United States Department of the Interior

Fish and Wildlife Service

Arizona Ecological Services Office
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Phoenix, Arizona 85051
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In Reply Refer to:
AESO/SE
02EAAZ00-2015-F-0347
R2/TE 2012-F-0005
R2/TE 2-22-03-F-366
Region 2/ES/SE-000087RO

April 13, 2017

Mr. Kerwin Dewberry
Forest Supervisor
Coronado National Forest
300 West Congress Street
Tucson, Arizona 85701

Dear Mr. Dewberry:

Thank you for your request for formal consultation and conference with the U.S. Fish and Wildlife Service (FWS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. § 1531-1544), as amended (Act). We received your letter and Biological Assessment (BA) dated May 6, 2015, on May 11, 2015. You corrected clerical errors and re-sent your revised request and BA on June 10, 2016; we received this on June 14, 2016. On December 20, 2016, we received your letter, BA Addendum, and Forest Plan Best Management Practices and Conservation Measures which included changes in species' status and additional species analyzed; a corrected/updated version of this was transmitted to us on January 30, 2017. At issue are impacts that may result from the proposed Coronado National Forest (CNF) Revised Land and Resource Management Plan (LRMP) located in Cochise, Graham, Pima, Pinal, and Santa Cruz Counties, Arizona, and Hidalgo County, New Mexico.

In your BA, CNF determined that the proposed action *may affect* and *is likely to adversely affect* the endangered jaguar (*Panthera onca*) and its critical habitat, the endangered ocelot (*Leopardus pardalis*), the endangered Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*) and its critical habitat, the endangered lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), the threatened Mexican spotted owl (*Strix occidentalis lucida*) and its critical habitat, the threatened western yellow-billed cuckoo (*Coccyzus americanus*), the endangered Sonoran tiger salamander (*Ambystoma mavortium stebbinsi*), the threatened Chiricahua leopard frog (*Lithobates chiricahuensis*) and its critical habitat, the threatened northern Mexican gartersnake (*Thamnophis eques megalops*), the threatened New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*), the endangered Gila chub (*Gila intermedia*) and its critical habitat, the endangered Yaqui chub (*Gila purpurea*), the endangered Gila topminnow (*Poeciliopsis occidentalis occidentalis*), the threatened Gila trout (*Oncorhynchus gilae gilae*), the threatened Apache trout (O*ncorhynchus gilae apache*), the endangered spikedace (*Meda fulgida*) and its critical habitat, the endangered loach minnow (*Tiaroga cobitis*) and its critical habitat, the threatened Sonora chub (*Gila ditaenia*) and its critical habitat, the endangered desert pupfish (*Cyprinodon macularius*), the threatened Yaqui catfish (*Ictalurus pricei*), the endangered Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*) and its critical habitat, and the endangered Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*). In addition, you made a determination that the proposed action *is not likely to jeopardize* the proposed roundtail chub (*Gila robusta*).

In your letter, you requested our concurrence that the proposed action *may affect, is not likely to adversely affect* the endangered Mexican long-nosed bat (*Leptonycteris nivalis*) and the endangered Canelo Hills ladies'-tresses (*Spiranthes delitescens*). Additionally, you asked us to concur with your determination that the proposed action *is not likely to jeopardize* the experimental non-essential population of Mexican gray wolf (*Canis lupus baileyi*) within the proposed 10(j) area and the experimental non-essential population of northern Aplomado falcon (*Falco femoralis septentrionalis*). You also requested our concurrence with your determination that the proposed action is *not likely to result in destruction or adverse modification* for the proposed critical habitat for the western yellow billed cuckoo and the northern Mexican gartersnake. We concur with your determinations; the basis for our concurrences is found in Appendix A of this programmatic biological and conference opinion (PBO/PCO).

Additionally, in your letters dated December 20, 2016 and January 30, 2017, you withdraw several candidate species from consultation. There is no legal requirement to consult on candidate species. Furthermore, we found that listing of these species as an endangered or threatened species is not warranted. These species include: the Sonoran desert tortoise (*Gopherus morafkai*), October 6, 2015 (USFWS 2015, 80 FR 60321); Huachuca springsnail (*Pyrgulopsis thompsoni*), September 21, 2016 (USFWS 2016, 81 FR 64843); Stephan's riffle beetle (*Heterelmis stephani*), October 6, 2016, (USFWS 2016, 81 FR 69425); and the Huachuca/Canelo distinct population segment of the Arizona treefrog (*Hyla wrightorum*), October 6, 2016 (USFWS 2016, 81 FR 69425).

This PBO/PCO is based on information provided in the June 2016 corrected Biological Assessment, the May 2015 original Biological Assessment, the December 2016 and January 2017 BA addendums, the October 2013 Draft Environmental Impact Statement, the October 2013 revised Draft LRMP, meetings, telephone conversations, field investigations, and other sources of information. Literature cited in this biological and conference opinion is not a complete bibliography of all literature available on the species of concern, forest management, and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Consultation History

December 6, 1985	FWS issued BO on the Coronado National Forest Plan
August 4, 1986	FS issued Coronado National Forest Plan
May 14, 1996	FWS issued BO on the 11 LRMPs within the Southwestern National Forests and Grasslands, which concluded jeopardy to the Mexican spotted owl.
May 15, 1996	FS requested formal consultation on the continued implementation of the LRMPs for 11 Southwestern National Forests and Grasslands

December 19, 1997	FWS issued BO/CO on the FS's 1996 Regional Amendment to the LRMPs for all federally listed species other than the Mexican spotted owl.
January 13, 2003	FWS issued final BO on the proposed rate of implementation of the grazing Standards and Guidelines in the 1996 Regional Amendment and its effect on the Mexican spotted owl.
June 10, 2005	FWS issued final programmatic BO/CO on the CNF LRMP
April 17, 2009	FS requested re-initiation of the 2005 LRMP BO/CO since the incidental take threshold for Mexican spotted owlwas close to being reached.
May 18, 2010	FS requested re-initiation of the 2005 LRMP BO/CO for all species addressed in the document
April 9, 2011	FS requested re-initiation of consultation on the continued implementation of the LRMPs for 11 Southwestern National Forests and Grasslands
April 30, 2012	FWS issued the BO for "Continued Implementation of the LRMP for the Coronado NF"
October 2013	Revised Draft CNF LRMP
February 23, 2015	Consultation Agreement between FWS and U.S. Forest Service (FS) to consult on the Revised CNF LRMP.
May 11, 2015	FWS received your May 6, 2015, request for formal consultation and the Final BA on the Revised CNF LRMP.
June 23, 2015	FWS stated we had reviewed final BA and all information required for formal consultation had been received.
August 13, 2015	FWS requested additional time to complete formal consultation.
June 22, 2016	FWS received your June 10, 2016, letter addressing the updates to the BA with corrected determinations for some species.
August 18, 2016	FWS met with FS to discuss BA determination discrepancies and additional species to add to BA
December 20, 2016	FWS received your December 20, 2016, letter and BA addendum addressing two additional species.
January 30, 2017	FWS received your revised version of your December 20, 2016, letter and BA addendum addressing two additional species.
February 1, 2017	FWS sent a draft PBO/PCO on the CNF Revised LRMP to the FS.
March 10, 2017	FWS received comments on the draft Revised LRMP PBO/PCO from FS.

Certain project activities may also affect species protected under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. sec. 703-712) and/or bald and golden eagles protected under the Bald and Golden Eagle Protection Act (Eagle Act). The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when authorized by the FWS. The Eagle Act prohibits anyone, without a FWS permit, from taking (including disturbing) eagles, and including their parts, nests, or eggs. If you think migratory birds and/or eagles will be affected by this project, we recommend seeking our Technical Assistance to identify available conservation measures that you may be able to incorporate into your project.

For more information regarding the MBTA and Eagle Act, please visit the following websites. More information on the MBTA and available permits can be retrieved from http://www.fws.gov/migratorybirds and http://www.fws.gov/migratorybirds/mbpermits.html.

For information on protections for bald eagles, please refer to the FWS's National Bald Eagle Management Guidelines (72 FR 31156) and regulatory definition of the term "disturb" (72 FR 31132) published in the Federal Register on June 5, 2007 (http://www.fws.gov/southwest/es/arizona/BaldEagle.htm), as well at the Conservation Assessment and Strategy for the Bald Eagle in Arizona (SWBEMC.org).

In keeping with our trust responsibilities to American Indian Tribes, we suggest you to coordinate this consultation with the tribes with cultural affiliaion encompassing the action area, including, but not limited to the Hopi, Tohono O'odham, San Carlos Apache, Pascua Yaqui, Gila River, White Mountain Apache, Ft. Sill Apache, and Mescalero Apache tribes, as well as Bureau of Indian Affairs (BIA) in Phoenix, Arizona, Albuquerque, New Mexico, and Anadarko, Oklahoma.

We are also increasing our efforts to coordinate endangered species issues with the Arizona Game and Fish Department (AGFD). We encourage you to provide a copy of this biological opinion to AGFD's Habitat Branch Chief, Arizona Game and Fish Department, 5000 West Carefree Highway, Phoenix, Arizona 85086-5000.

We appreciate the FS's efforts to identify and minimize effects to listed species from this project. Please refer to the consultation number, 02EAAZ00-2015-F-0347, in future correspondence concerning this project. Should you require further assistance or if you have any questions please contact Jason Douglas (520) 670-6150 (x226) or Scott Richardson (520) 670-6150 (x242).

Sincerely,

Steven L. Spangle
Field Supervisor

cc (hard copies):
Field Supervisor, U.S. Fish and Wildlife Service, Phoenix, Arizona (2 copies)
Assistant Field Supervisor, U.S. Fish and Wildlife Service, Tucson, AZ

cc (electronic copies):
Brenda Smith, Assistant Field Supervisor, U.S. Fish and Wildlife Service, Flagstaff, AZ
Bobbi Barrera, Deputy Director, Wildlife, Fish, and Rare Plants Program, U.S. Forest Service, Albuquerque, NM (blbarrera@fs.fed.us)
Angela Barclay, Forest Wildlife Biologist, Coronado National Forest, Tucson, AZ (abarclay@fs.fed.us)

filename: CNF LRMP Final BO.20170413.ml.docx

Kerwin Dewberry, Forest Supervisor

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BIOLOGICAL OPINION
CONFERENCE OPINION

for

Coronado National Forest
Land and Resource
Management Plan

Cochise, Graham, Pima, Pinal, and Santa

Cruz Counties, Arizona and

Hidalgo County, New Mexico

Southwestern Region U.S.D.A. Forest Service

Arizona Ecological Services, Region 2
U.S. Fish and Wildlife Service

Kerwin Dewberry, Forest Supervisor

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Kerwin Dewberry, Forest Supervisor

DESCRIPTION OF THE PROPOSED ACTION

The proposed action being analyzed in this PBO/PCO is the implementation of the CNF LRMP. The CNF is consulting on the LRMP's program administration (effects of recreation, engineering, range management, fire management, etc.), as well as "plan components" (desired conditions, objectives, guidelines, standards, management areas and special designations, and suitability; these are discussed in greater detail below). Most of the actions being consulted on are from program management activities and objectives, while standards, guidelines, and special designations tend to mitigate effects of the actions, and function as conservation measures (hence, together they result in net proposed actions). Many aspects of program management are similar to those in the previous (1986) LRMP, as amended, although there is a greater emphasis on vegetation and watershed restoration (which may have short-term effects while targeting long-term benefits).

Once finalized, the revised LRMP will replace the 1986 CNF LRMP and its amendments, and this PBO/PCO will replace the BO/CO issued on June 10, 2005, as well as the 2012 BO/CO, which addressed effects from continued implementation of the 1986 CNF LRMP. The planning period for the proposed revised LRMP is for 15 years immediately following LRMP approval or until the LRMP is again revised, whichever applies.

The proposed action described below is a "framework programmatic action" as defined in 50 CFR 402.02, where framework programmatic action only establishes a framework for the development of specific future action(s) but does not authorize any future action(s). Under those circumstances, the programmatic action in and of itself does not result in incidental take of listed species. Because a framework programmatic action does not itself authorize any action to proceed, no take is anticipated to result, and, therefore, does not require the provision of an incidental take statement (See 80 FR 26832- 26845 and 50 CFR 402.14(i)(6)).

The proposed LRMP (USFS 2013) includes the following types of direction (i.e., plan components and decisions):

- **Desired conditions** (DC) are goals that express an aspiration, often to achieve long-term ecosystem restoration and resiliency. They form the basis for projects, activities, and uses that will occur under the LRMP. Site-specific projects will be designed to maintain or move towards desired conditions over the long term. Desired conditions provided in the proposed LRMP include important ecosystem components including airsheds, watersheds, vegetation, aquatic and terrestrial wildlife, as well as social and cultural resources including recreation, wilderness, scenic beauty, open space, transportation system, and public access and use opportunities for the Forest. Desired conditions are incorporated by reference from the Biological Assessment.
- **Objectives** (O) are the short-term mechanisms to reach desired conditions over the long-term. Objectives are generally the actions proposed to reach certain short-term goals over the planning period. Objectives have two parts: a quantifiable outcome and a time in which to achieve the outcome. There is intent to meet the outcome of objectives during the planning period. Although they are considered realistic short-term goals, there may be unforeseen operational, logistical, environmental, political, or financial considerations that may influence the

outcome. To accommodate potential uncertainty, there is a stated or implied range of values for the outcome (e.g., acres treated during the proposed action period). Objectives are incorporated by reference from the Biological Assessment. Objectives applicable to this PBO/PCO are listed in Appendix C.

- **Standards (S)** set sideboards on the achievement of desired conditions and objectives by setting requirements to limit or guide Forest uses or activities that are expected to occur under the LRMP. Standards are activity or project design constraints that must be followed. Thus, standards are often mitigation measures placed on objectives or program activities. Standards are incorporated by reference from the Biological Assessment. Standards applicable to this PBO/PCO are listed in Appendix C.
- **Guidelines** (G) allow for some variance from the exact wording of objectives, as long as the intent of the guideline is met. Thus, guidelines are often mitigation measures placed on objectives or program activities. Guidelines are incorporated by reference from the Biological Assessment. Guidelines applicable to this PBO/PCO are listed in Appendix C.
- **Suitability** determinations identify areas of land as suitable or unsuitable for the specific uses of timber, livestock grazing, and recreation activities. These relay information about proposed land use activities.
- **Management area and special designations**, or recommendations for special designations, identify areas with differing desired conditions, uses, standards, and/or guidelines than Forest-wide plan direction. Examples include wilderness, botanical areas, and wild and scenic rivers. Management can occur in these areas, so consultation applies to management actions in these areas addressed in the LRMP and this BA.
- **Monitoring and evaluation** are not plan components, per se, but are requirements for LRMP implementation. They are used to determine the degree to which on-the-ground management is maintaining or making progress toward desired conditions, evaluate plan implementation effectiveness, and inform adaptive management. Required monitoring and evaluation are parts of the proposed actions being consulted on.

The LRMP does not make site-specific decisions about exactly how, when, and where these activities will be carried out. However, all site-specific activities must conform to the programmatic framework set up in the LRMP (they must include the standards and guidelines) and they must meet site-specific National Environmental Policy Act (NEPA) and ESA requirements. Implementation of ongoing projects and the issuance of incidental take associated with those projects are covered under this programmatic opinion since this consultation supersedes all previous CNF LRMP consultations.

Potential Natural Vegetation Types are coarse-scale groupings of ecosystem types that share similar geography, vegetation, and historical ecosystem disturbances, such as fire, drought, and grazing by native species. The potential natural vegetation types represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail.

The proposed action establishes forestwide management goals (desired conditions). The draft revised LRMP (forest plan) sets goals for the natural resource and social elements. For each resource element, general conditions necessary to support sustainable ecosystems, biodiversity, and sustainable social and economic interactions between the CNF and surrounding communities are described. It also describes desired outcomes for anticipated tradeoffs or conflicts among resources. In addition to resource and social elements, the draft revised plan defines desired conditions for specific places (i.e., management areas).

Also established in the revised plan are objectives, standards, and guidelines for management activities related to many (but not all) specific elements and/or management areas. There are also suggested management approaches for achieving desired conditions. This combination of direction is intended to give a complete picture of desired outcomes and the tools to attain them. It also provides direction for ways to address threats such as invasive species, excessive fuel loading, and climate change, within the authority of the Forest Service.

Management Areas

In the revised forest plan, management areas (MA) are assigned based on administrative and user needs, and comments received during the planning process. Table 1 reports the allocation of land by the proposed action for each management area. Detailed descriptions of each ecosystem management area are provided in the revised forest plan and Biological Assessment and are incorporated by reference.

Description of the Program Areas

The following is a summary of the proposed management on the CNF by program area. The standards and guidelines for each program also function as conservation measures for those programs. We will also work with CNF on design of future site-specific projects to determine whether additional conservation measures should be incorporated.

The programs analyzed are: Wildland-Urban Interface and Landscape-scale Fire, Biophysical Features, Water Resources – Natural, Water Resources – Constructed, Soil, Air, Animals and Rare Plants, Invasive Species, Forest Products, Minerals, Public Access, Motorized Transportation System, Recreation, Scenery, Special Uses, Cultural Resources, Tribal Relations, Range Management, and Land Ownership Adjustments and Boundary Management. Each program area is analyzed under each species to determine if that program will have any effect on the species. If the program area is determined to have no effect it will be dropped out of the discussion for that species.

Objectives, standards, and guidelines (which serve as conservation measures to offset impacts) are listed in Appendix A of the BA under each of the program areas.

Wildland-Urban Interface and Landscape-scale Fire

This program area represents all vegetation communities on the CNF, including areas of human populations and developments at imminent risk from wildfire. Prescribed fire and mechanical treatments are actions that are part of this program designed to protect communities, watersheds, and species at risk; and to restore and maintain resilient ecosystems. Wildland-urban interface (WUI) includes areas of resident populations at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

Use of wildland fire (primarily prescribed burning) is one of the methods for ecosystem restoration. The program combines elements of wildland fire prevention, response, and management; post-fire area stabilization and rehabilitation; and hazardous fuels planning, implementation, and monitoring.

Wildland fire is defined as any non-structural fire that occurs in vegetation or natural fuels, and it is further categorized as either wildfire or prescribed fire. Wildfires are fires with unplanned ignitions including lightning or unauthorized and accidental human-caused actions. Prescribed fires are intentionally ignited by the Forest Service (FS) under an approved plan to meet specific objectives.

Management actions taken in response to wildfires are not planned, so they are covered under ESA § 7(a)(2) emergency procedures. Therefore, they are not included as part of the proposed action for this consultation. However, the FS expects to work closely with the FWS on management responses and emergency consultation procedures as wildfires occur during the life of the LRMP.

Desired conditions (DC) for this program provide for the natural fire regime within potential natural vegetation types and public and firefighter safety. This program would reduce the risk of overall uncharacteristic fire impacts.

The objective of this program is to treat 5,000 to 10,000 acres every year in the Wildland-Urban Interface (WUI). Additional objectives include wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication treatments to reduce fire hazard and risk to communities and the forest throughout the vegetation communities and Ecosystem Management Areas to create resiliency to disturbances.

Biophysical Features (Caves/Mines, Rocky features, Talus slopes)
Biophysical features include geological features such as caves, cliffs, and talus slopes. Methods used to meet the overall desired conditions of these features include: coordinate with partners, State and Federal agencies; educate the public; monitor significant features; and foster collaboration with Arizona Game & Fish Department (AGFD), FWS, Bat Conservation International and other stakeholders and researchers to address conservation. Future projects would be designed to protect and improve these features and would employ standards, guidelines, and mitigation measures to protect these resources.

The CNF contains many significant caves and karst resources. The National Caves Resources Management and Protection Act (P.L. 110-691) defines a significant cave as a cave located on National Forest System lands that has been evaluated and shown to possess features, characteristics, values, or opportunities in one or more of the following resource areas: biota; cultural; geologic-mineralogic-paleontologic; hydrologic; recreational; or educational-scientific for scientific, educational or recreational purposes; and which has been designated “significant” by the forest supervisor.

Biophysical features occur in all vegetation types and at all elevations throughout the CNF. These features provide specialized seasonal and year-round habitats for a variety of wildlife species including bats, cliff-nesting birds, talussnails, and several unique montane reptiles and amphibians. Several species of rare plants are adapted for growth on rocky sites and cliff faces. Underground features such as caves often contain unique geological, archaeological, and biological resources. Animal species found in caves and mines range from cave-obligate pseudo-scorpions to many species of bats to opportunistic users like black bear, ringtail, and black-tailed rattlesnake. Species associated with rocky areas and cliffs include desert bighorn sheep, peregrine falcon, Yarrow's spiny lizard, rock rattlesnake, barking frog, and talussnails. Rare plant species found in rocky sites include Bartram's stonecrop, Catalina beardtongue, and many others.

Desired conditions provide for the protection of natural features such as cliffs and rock outcrops, and caves. These features will support nesting, roosting, and feeding habitats of birds of prey, desert bighorn sheep, bats, snails, western barking frogs, and other species. Cave features are not disturbed by visitors, and are protected for use by wildlife and people. These features are allowed to develop under natural conditions.

The objective of this program is to install wildlife-friendly closures at mines, caves, or adits (horizontal passages into mines). This objective would protect these natural features as well as the species that use these them from human disturbance and disease, including but not limited to lesser long-nosed bat and Mexican long-nosed bat.

Water Resources -Natural Water Sources
There are approximately 100 miles of perennial streams and 400 springs and seeps on the CNF. All streams, springs, and seeps are small, with a low volume of surface water generally present. Many springs and seeps are developed in a manner that diverts water from the natural source for uses such as livestock and wildlife watering and domestic use. Most species of animals need water to drink. Species that need it for other critical life history components (e.g., food, shelter, and reproduction) include Chiricahua leopard frogs, Arizona treefrog, Sonoran tiger salamander, northern Mexican gartersnake, Gila chub, Gila topminnow, Huachuca springsnail, and Stephan's riffle beetle.

Based on projections of future climate change for the region, natural water sources are susceptible to increased evaporation from warmer temperatures, and altered frequency and severity of both droughts and flash floods. Water resources are also at risk due to competing demands for multiple uses. These conditions place additional stress on native species that depend on surface water for their life histories, especially if these species also rely on a narrow range of water temperatures.

These desired conditions provide for water quality, adequate instream flows, and sediment balance for riparian vegetation, wildlife and fish habitat. Objectives include applying for instream flow water rights, reconstructing developed springs, and stream restoration/development projects to provide aquatic habitat.

Water Resources -Constructed Waters
There are approximately 400 developed springs, 300 wells, and 1,100 stock ponds on the CNF. These constructed water features provide surface water resources, in many cases perennial

sources, which augment natural water resources. Structures include earthen stockponds and reservoirs, such as tanks, wildlife drinkers, and concrete or steel storage tanks, or watering troughs fed by a natural spring, groundwater well, or stream diversion. These facilities can often provide valuable habitat features for native wildlife such as Sonoran tiger salamander, but can also harbor invasive aquatic species such as American bullfrogs, crayfish, and green sunfish that prey on or compete with native wildlife. Poorly designed waters can entrap native wildlife or be inaccessible. The Sonoran mud turtle is a management indicator species for constructed waters and can be found in the grasslands, Madrean encinal woodlands, and Madrean pine-oak woodlands vegetation communities. Based on projections of future climate change for the region, constructed water sources are susceptible to increased evaporation from warmer temperatures and altered frequency and severity of both droughts and flash floods. Water resources are also at risk due to competing demands for multiple uses. These conditions place additional stress on native animal species that depend on surface water as a water source. However, a reduction in water availability could lead to a reduction in or slowing of non-native aquatic species invasions.

These desired conditions provide aquatic environments and important refugia for native plants and animals. Water resources are high quality, and diseases and invasive species are controlled.

The objective of this program provides for wildlife escape ramps in all above-ground constructed waters. This objective would benefit species that utilize constructed water sources across the landscape.

Soil Management

This program area covers the mineral and organic matter that occurs on the land surface throughout all vegetation types known as soil. It is characterized by horizons or layers that are distinguishable from the parent material beneath as a result of weathering of that parent material, additions of organic matter, and chemical and physical processes. It is the transition area between air and the parent material beneath, and makes a site capable of supporting vegetation (USFS 2013).

Based on projections of future climate change for the region, soils are vulnerable to having decreased water available for plant growth, groundwater recharge, and stream recharge due to increases in evaporation and decreases in precipitation. Longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, windstorms, and ice storms) could make soils more susceptible to erosion (USFS 2013).

The desired condition provides for good soil conditions that promote nutrient cycling and water infiltration, reduce the risk of overall soil compaction and loss, and enhance carbon sequestration.

The objectives of this program aim to enhance or restore uplands using vegetation, soil, and watershed restoration treatments to attain necessary ground cover and maintain watershed stability. Implementing these treatments will improve the structure and function of streams, floodplains, and riparian vegetation.

Air Management

Management of air quality above the CNF is divided into five airsheds, four in Arizona, and one in New Mexico. Airsheds are used to describe air quality-related values and impairment by pollutants, including smoke and emissions from permitted activities. The Clean Air Act as amended assigns Federal land managers the responsibility to protect air quality-related values in Class I airsheds, and to protect human health, plant and animal health, and visual quality in all areas. There are two Class I airsheds within the CNF: the Chiricahua Wilderness and Galiuro Wilderness.

Based on projections of future climate change for the region, airsheds are susceptible to increased levels of pollutants (particulates and aerosols) resulting from longer, more severe fire seasons, increased occurrence of warmer air masses that can suspend higher concentrations of pollutants, and frequent or intense windstorms that can transport pollutants and fugitive dust short and long distances.

The desired condition ensures that air quality standards are met. This program would reduce the risk of air quality related issues to plant and animal health.

Animal and Rare Plants Program

The CNF has the highest biological diversity of any national forest in the western United States. This is because it is situated at a convergence zone of ecological regions, including those extending into Mexico, and has a wide variety of vegetation communities and steep elevation gradients. Biological diversity is further enhanced by a long growing season, bimodal precipitation, and the evolutionary consequences of isolation in the sky island mountain ranges.

The number of species inhabiting the CNF and adjoining lands is not precisely known, and new species are periodically described. Conservative estimates include about 2,100 species of plants, 466 species of birds, 110 species of mammals, 91 species of reptiles, over 240 species of butterflies, and nearly 200 species of mollusks.

The Animal and Rare Plants program involves a variety of activities conducted by the FS and its partners, including inventory and monitoring, habitat assessments, habitat improvements through land treatments and structures, species reintroductions, development of conservation strategies, administrative studies, collaboration with research, and information and education.

The Animal and Rare Plants program manages habitats for all existing native and desired non-native wildlife, fish, and plant species in order to maintain viable populations. Habitat planning and evaluation are integral to meeting the goals for ensuring the continued existence of wildlife, fish, and plants generally throughout their geographic range. Much of this habitat enhancement is accomplished by the involvement of fisheries biologists, wildlife biologists, and botanists in project planning and implementation.

Based on projected future climate change, terrestrial wildlife species are susceptible to habitat loss and fragmentation resulting from more frequent or extreme disturbance events, including wildfires, droughts, flash floods, landslides, and windstorms. Wildlife species are also susceptible to alterations in the timing of plant phenology events (greenup, flowering, pollination, and fruit ripening), especially those that influence critical life behaviors (migration, breeding, and dispersal).

Future climate change projections further suggest that aquatic species may likely be subjected to increased water temperatures, altered seasonal discharge events, increases in drought severity during summer flows, and increased predation pressure. There may be decreases in waterflow and, possibly, a shorter period of sustained flows in the spring due to reduced winter snowpack. Sustained flows and desired temperatures in the spring are needed for successful spawning. There also may be the potential for fragmentation of habitat, with resulting increases in competition and predation in pools due to little or no waterflow in some stream segments.

The desired conditions ensure that all species and naturally occurring native ecosystems are present and sustainable across the CNF, providing habitat to support a full complement of plants and animals. Conservation strategies, research or studies, and public education are additional important components of this program that are often conducted in collaboration with other resource areas and agencies.

Invasive Species Management
Invasive species are defined as "alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13112). Alien refers to species that are non-native to the ecosystem they have infested. Both terrestrial and aquatic invasive species are a growing threat to native species, ecosystem function, and the quantity of forest goods and services. Invasive plants, such as buffelgrass, threaten native plant communities by competing for resources and increasing the frequency and intensity of fire regimes. Even though complete eradication of invasive species is not always possible, aggressive control of existing populations is important to protect native ecosystem diversity.

Invasive species pose an increasing threat to the integrity of ecosystems by decreasing native plant and animal diversity, increasing soil erosion and sedimentation, and interfering with natural fire regimes. Reducing the threat of aquatic and terrestrial invasive species will allow the CNF to better manage for resilient landscapes and species populations that have a greater capacity to survive natural disturbances and uncertain future environmental conditions, such as those driven by climate change and increasing human uses. Methods used to meet the overall desired conditions and objectives of the program include: assessing and eradicating priority infestations or populations; monitoring, preventing, and controling infestations; coordinating with other Federal, and State agencies; and planning and implementing burned area emergency response activities. Future projects would be designed to restore and improve watershed conditions and maintain ecosystem function, and would employ best management practices, guidelines, and mitigation measures to protect watershed resources.

Based on projections of future climate change for the region, conditions could favor the spread and establishment of invasive species, which are typically better adapted to a range of climates and often are early colonizers following disturbances. For example, to control invasive grasses that alter fire regimes and compete with native plants, the CNF has an objective to suppress or eradicate buffelgrass within the desert community using herbicides and manual methods.

Forest Products
Forest products are often associated with thinning and fuels reduction projects or silvicultural treatments. This program maintains a sustainable supply of wood and other products, provided within the capacity of the land. Forest products are made available as part of fuel treatment projects and restoration activities. In most cases, projects would be limited in extent and amount

of ground disturbance. Common forest products available from the CNF include sawlogs, fuelwood, cactus, and beargrass. Sawlogs and fuelwood are generally available as byproducts of forest restoration or forest fuels reduction projects. Other less common forest products include manzanita, ferns, and mushrooms. A sustainable supply of these products is desired.

It is unclear how a changing climate may alter the availability of forest products in the future. Some species that are more adapted to drier climates may be more abundant, while others may become less abundant. An increased need for fuels reduction and restoration projects to restore ecosystem resilience may increase the availability of sawlogs and fuelwood during some periods.

Minerals Management

Three categories of minerals potentially found on the CNF include locatable, leasable, and salable minerals; each is subject to different laws and implementing regulations. Locatable minerals are subject to the General Mining Law of May 10, 1872, as amended, and for the most part are outside the scope of the LRMP. The FS's role in managing such resources is to provide reasonable protection of surface resources. Leasable minerals include oil and gas, coal, and certain other commodities such as potash, which is a solid leasable mineral. The FS's role in managing such resources is to recommend or consent to the Department of the Interior, BLM whether leases for these commodities should be issued, and specify any surface resource protections that may be needed. Salable minerals, applies to mineral materials such as sand and gravel for which the FS has total discretion to manage. It is FS policy to support responsible, environmentally sound energy and mineral development and reclamation on the CNF.

The potential for locatable minerals within the boundaries of the CNF is high and resources occur on all ranger districts on the CNF. There are numerous active mining claims throughout the CNF, but most prominently within the Sierra Vista and Nogales Ranger Districts. The FS must determine whether to approve the preliminary plan of operations submitted, or to require changes or additions deemed necessary to meet the requirement of the regulations for environmental protection. All proposals must comply with Federal and State laws and regulations, and should be managed to reduce adverse environmental impacts to the extent practicable on National Forest System lands.

The potential for leasable minerals such as oil or gas is low. However, there is potential for leasable potash minerals bearing the commodity of potassium on the CNF. The FS would make a recommendation for a lease to the BLM, which is the lead agency for solid leasable potash minerals. Stipulations to protect surface resources would be made for exploration or mining.

Common variety, or salable, minerals have never been a significant component of minerals operations on the CNF, and there is only one salable mineral operation in 2013. The forest has a handful of active rock pits used for aggregate road base and fill.

Methods used to meet the overall desired conditions of the program include: incorporating best management practices into future leases as appropriate; considering withdrawal from locatable minerals entry and operations for congressionally designated areas; and coordinating with other Federal and State agencies. Future projects would be designed to incorporate opportunities for environmentally sound minerals development to protect social, cultural, and ecological values and would employ best management practices, standards, guidelines, and mitigation measures to protect these resources.

The CNF is currently aware of approximately 37 mineral projects (see Table 2). These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Actual mining infrastructure and disturbance would be impossible to predict at the time of this document. Eighteen of these projects are active and currently in place, while one project is inactive, four are completed, one project is unknown, one project is not applicable, and twelve are withdrawn from consideration at the point.

Public Access

Public access to the CNF is provided through a system of arterial, collector, and local roads and trails, which are interconnected with public roads, highways, and trails (local, county, State, and other Federal) within, adjacent to, and adjoining the national forest. Within the CNF boundary, there are numerous scattered private inholdings with roads and trails often crossing these inholdings to access National Forest System lands adjacent to and adjoining them. At the national forest boundary, there are about 300 motorized access points; less than one-third of these provide permanent legal access. A number of trailheads located at the national forest boundary provide non-motorized access to wilderness and National Forest System lands. Many private roads and trails that provide access to National Forest System lands across non-Federal lands (State, county, private, and other ownerships) within and adjacent to the CNF have no legal right of public access (written and unwritten title) and may be closed without notice.

The objective of the program is to increase the number of permanent legal access routes to and within the CNF by resolving the legal status deficiencies of existing and proposed National Forest System roads and trails, using a variety of methods. This will help maintain the integrity or watersheds and species habitats by reducing poorly located, illegal access routes which traverse through riparian areas and critical habitats.

Motorized Transportation System

The motorized transportation system available for public use is displayed on motor vehicle use maps. The motor vehicle use maps include designated roads, trails, and areas for each ecosystem management area. The designations include vehicle class, time of year of use, and any designations for motorized use associated with dispersed camping or game retrieval. The CNF motorized transportation system also includes National Forest System roads that are only available for administrative and permitted use.

The CNF provides management of the transportation system including conducting inventories, surveys, and analyses; formulating plans; and executing reconstruction, maintenance, and obliteration operations.

The miles of road open to motorized use include roads where access may be restricted on a seasonal basis. Any road, regardless of maintenance level, may be closed during extreme weather conditions for public safety or to minimize resource damage. Motor vehicle use off of the designated system of roads, trails, and areas is prohibited except as identified on the motor vehicle use map and as authorized by law, permits, and orders in connection with resource management and public safety. The motor vehicle use map for all districts identifies a 300 foot buffer on each side of system roads that allows cross country travel for the purposes of camping.

Methods used to meet the overall objective of the program include assessing the transportation system to create a more effective road system; restoration of natural resources that have been impacted; and coordinating with other partners, Federal, and State agencies. Future projects would be designed to restore and improve watershed conditions and would employ best management practices, guidelines, and mitigation measures to protect watershed resources.

Based on projections of future climate change for the region, roads are susceptible to the altered frequency, severity, timing, and spatial extent of disturbance events (e.g., flash floods and landslides). Increased recreational use to escape summer heat could lead to additional wear and tear and heavy use of roads in some areas.

The objectives of the program are to reduce impacts to wildlife habitat, prevent downstream impacts, and preserve wetlands and meadows. This will be done by: maintenance of high-clearance and passenger car level roads (based on a safety prioritization); decommission of unneeded non-system roads; and closure of hardened road surface at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are creating negative affects to habitat and watersheds.

Recreation Management
The CNF offers a rich variety of year-round recreational opportunities in myriad settings. Recreational options in the CNF range from a very high probability of solitude, self-reliance, challenge, and risk (primitive) to very social experiences where self-reliance, challenge, and risk are relatively low (rural or urban).

The Recreation program provides a wide range of recreation settings, opportunities, and services. Program components include administration and management of resources and visitors at developed recreation sites, dispersed recreation settings, partnerships and tourism, interpretive services, recreation special use permits, congressionally designated areas, visual quality management, trail management, and scenic byways.

Based on projections of future climate change, recreation and transportation sites are susceptible to increased use for relief from increased temperatures in urban areas, and to damage from altered frequency, severity, timing, and spatial extent of disturbance events (e.g., fires, droughts, flash floods, landslides, and windstorms). Winter activities, such as skiing, may be reduced due to a reduction in snowpack under higher temperatures.

The objectives of this program are to: reduce the backlog of recreation deferred maintenance in developed sites, retrofit or install wildlife-resistant trash cans at all developed recreation areas, and provide wildlife-resistant food storage boxes at all developed campgrounds within 10 years of plan approval.

Scenery Management
The CNF sky islands are unique among the lands in southeastern Arizona. The mountains provide a spectacular backdrop for residents living in desert cities, and visitors travel into the CNF to enjoy the natural beauty of these special places year-round.

The CNF scenic management program is responsible for activities such as desired landscape character. Some areas of the forest may require restoration in order to move toward the conditions described in the desired landscape character. The effects of future projects would contribute to the scenic integrity of the desired landscape character. Scenic integrity would be addressed on a site specific basis and mitigated individually following scenic integrity objectives and FS policy.

Vegetation treatments contribute to the scenic integrity of the desired landscape character. Long term soil and plant productivity, proper functioning ecosystems, and clean water are considered important components of scenic quality.

Based on projections of future climate change, scenic landscapes are susceptible to increased use for relief from increased temperatures in urban areas and to damage from altered frequency, severity, timing, and spatial extent of disturbance events (e.g., fires, droughts, flash floods, landslides, and windstorms).

Special Uses

The CNF administers over 620 special use authorizations. These uses include such activities as outfitting and guiding, research, various types of utility lines, communications sites, road permits and easements, and recreation residences. Also included are permits for campground, marina, and store facilities; filming; and numerous recreation events. The CNF also supports, through the permitting process, military, local law enforcement, and Department of Homeland Security activities.

Cultural Resources

CNF heritage resources provide the public with opportunities to gain a broader understanding of the 12,000-year history of human habitation in southeastern Arizona. Cultural resources help people connect with the past, not only to enhance their sense of time and place, but also to illuminate aspects of Arizona history that are relevant to modern life and land use decisions. The unique geographical configuration of the CNF, with its relatively small isolated mountain ranges, has strongly influenced the patterns of human use throughout the region. Major occupation sites by Native American peoples are concentrated in the lower elevations of the ranges in adjacent valleys, while the mountainous portions of the ranges are the focus of more limited activities such as resource gathering. The CNF also has a rich historic period record of mining, ranching, and FS administration.

The objectives include: non-project inventory each year; stabilization or preservation activities at one or more priority heritage; provision of opportunities for volunteers to participate in heritage resource conservation activities; inclusion of historic sites in the cabin rental program; nomination of sites to the National Register of Historic Places; completion of Native American Graves Protection and Repatriation Act (NAGPRA) repatriations; participation in interpretive events for the public; and provision of opportunities for volunteers to participate in heritage resource conservation activities.

Tribal Relations

Federally recognized American Indian tribes are sovereign nations; therefore, the FS strives to establish and maintain government-to-government relationships with each tribe. The FS has Federal trust responsibilities to American Indian tribes. In meeting these responsibilities, CNF managers consult with tribes when proposed policies or management actions may affect their interests. The FS recognizes that tribes have cultural ties and knowledge about the lands currently managed by CNF staff. Many tribal members regularly visit these lands to gather traditional resources and to visit traditional cultural properties and sacred sites. Therefore, tribes share an interest in protecting important natural and cultural resources.

Tribes with cultural ties to the land now administered by the CNF include the Ak-Chin Indian Community, Fort Sill Apache Tribe, Gila River Indian Community, Hopi Tribe, Mescalero Apache Tribe, Pascua Yaqui, Pueblo of Zuni, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe, Tohono O'odham Nation, White Mountain Apache Tribe, and Yavapai-Apache Nation. All tribes with traditional connections to lands that are now part of the CNF are recognized as having roles in the stewardship of the land.

Under a changing climate, some forest products for traditional tribal uses may be vulnerable to more frequent or extreme disturbance events, including wildfires, droughts, flash floods, landslides, and windstorms.

Range Management

The focus of range management on the CNF is the production of a diverse array of tangible and intangible products. Tangible products include forage for grazing and browsing livestock and wildlife. Intangible products include natural beauty and quiet places. Livestock grazing is permitted on about 90 percent of the CNF. Grazing use is administered through a grazing permit system on designated livestock grazing allotments.

Allotments are managed using an adaptive management strategy whereby results from long and short term monitoring are used to guide managers concerning yearly stocking rates, pasture rotations, and whether other adjustments are needed in order to meet desired conditions for rangelands. Periodic review of allotment management plans also results in decisions to exclude livestock grazing on individual allotments in response to drought, wildfire, and other factors that influence range conditions.

Based on projections of future climate change, conditions may be preferable for grassland habitat. However, suitable forage for grazing or browsing and availability of water for livestock may be reduced during extended drought periods, and increased disturbances could favor non-native species that are unsuitable for grazing.

Land Ownership Adjustments and Boundary Management

The sky islands nature of the CNF combined with the current complex land ownership pattern within and next to the CNF leads to the need for an intensive and extensive land ownership adjustment and boundary management program. This program includes: land ownership adjustments (donation, purchase, land exchange, and limited sales), withdrawals, right-of-way acquisition, landline location, and boundary modifications. Landline location surveys ensure that boundary lines are accurate. All of these programs ensure that public access, watershed protection, wildlife habitat, recreation, open space, and scenic resources continue to flourish on the CNF.

The effects of future development projects, such as those for utilities and transportation systems, would be addressed on a site specific basis and mitigated individually following the FS policy regarding special uses. Mitigations are typically accomplished by consolidation of new developments along existing routes and corridors or by construction techniques that disturb less land and improve reclamation success.

Conservation Measures

Conservation Measures are considered part of the proposed action and are analyzed as such. A series of standards and guidelines for each program are described in Appendix A of the BA; these serve as Conservation Measures, providing some offset to impacts, and are incorporated herein by reference. In addition, one set of species-specific Conservation Measures, for the Chiricahua leopard frog, is included in the BA based on past and ongoing concerns over the species' status. The Chiricahua leopard frog Conservation Measures represent the continued implementation of proposed measures first analyzed in the June 10, 2005, BO and carried forward into the April 30, 2012, BO. The FS has agreed to continue implementing the following conservation measures for the Chiricahua leopard frog.

Chiricahua leopard frog

- **Conservation Measure #1**: Design projects in occupied Chiricahua leopard frog habitat on National Forest System (NFS) lands which address the appropriate components of the recovery plan, with the goal of beneficial, insignificant, or discountable effects to Chiricahua leopard frog.
- **Conservation Measure #2**: Cooperate with state game and fish agencies, other federal agencies, FS research stations, USFWS, and others to assess and prioritize habitat for potential Chiricahua leopard frog re-introduction; results will be reported to USFWS. To the extent feasible within the mission and capabilities of the FS, assist with any Chiricahua leopard frog re-introduction efforts.
- **Conservation Measure #3**: Implement the recommendations to minimize the effects of stock pond management and maintenance identified in the final recovery plan for the Chiricahua leopard frog.
- **Conservation Measure #4**: Continue to implement the standardized interagency monitoring protocol for Chiricahua leopard frogs.
- **Conservation Measure #5**: FS agrees to the following:
  - Pre-ignition Planning: Maintain current distributions of threatened, endangered, proposed, and candidate species in GIS layers on each NF in the Southwestern Region and these GIS layers will be provided to the Line Officer, Fire Management staff, and/or incident commander for each species occurring in the watershed of the ignition as well as surrounding watersheds. Identify watersheds that are particularly susceptible to ash flow and sediment following high intensity fires.
  - A FS biologist will be assigned and consulted during fire management activities to ensure that concerns for threatened and endangered species are addressed: for example, spawning season restrictions to protect breeding activities, appropriate buffers to filter ash and sediment, avoiding mechanical and chemical measures within the riparian corridor, etc. During development and implementation of operational management plans, identify potential threats to listed species and designated critical habitat and develop mitigation actions to eliminate threats.
  - Develop contingency plans in cooperation with USFWS, other federal agencies, state agencies, universities/colleges, and others to preserve, rescue and secure a population in imminent danger of localized extirpation due to fire use for resource benefits.

ACTION AREA

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR § 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The action area addressed in this PBO/PCO includes all lands under the jurisdiction of the Coronado National Forest (CNF) (Figure 1) and all adjacent lands that could be directly or indirectly affected by decisions or actions implemented under the direction of the revised LRMP. The southernmost portion of the CNF shares a contiguous international border with the Republic of Mexico. Adjacent lands include: the Chiricahua National Monument and Saguaro National Park managed by the National Park Service (NPS); various wildernesses administered by the BLM; Arizona State Trust lands; Buenos Aires National Wildlife Refuge managed by the FWS; San Carlos Indian Reservation; Fort Huachuca Military Reservation; and several communities including Tucson, Safford, Sierra Vista, and Nogales. The CNF is divided into five ranger districts (Douglas, Nogales, Safford, Sierra Vista, and Santa Catalina) with a total of 12 Ecosystem Management Areas: Peloncillo, Chiricahua, Dragoon, Tumacocari, Santa Rita, Huachuca, Whetstone, Pinaleno, Winchester, Galiuro, Santa Teresa, and Santa Catalina Mountains. These Ecosystem Management Areas are described in the BA. The CNF ecology is further described in the BA in terms of vegetation types and ecological communities. See the BA for the full description of Ecosystem Management Areas and vegetation types.

The proposed LRMP provides Forest-level direction to meet the FS's mission for program management activities. It is largely strategic in nature, but does address types of activities to be conducted on the CNF.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this PBO/PCO relies on four components in our evaluation for each species: (1) the *Status of the Species*, which evaluates the species' range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and, (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The jeopardy analysis in this PBO/PCO considers the range-wide survival and recovery needs of the species and the role of the action area in the survival and recovery as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This Biological Opinion relies on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02[1]. In accordance with policy and regulation, the adverse modification analysis in this Biological Opinion relies on four components: 1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the species in terms of physical and biological features[2], the factors responsible for that condition, and the intended value of the critical habitat for conservation of the species; 2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat for conservation of the species in the action area; 3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the physical and biological features and how that will influence the value of affected critical habitat units for conservation of the species; and 4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the physical and biological features and how that will influence the value of affected critical habitat units for conservation of the species.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the species' critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would not preclude or significantly delay the current ability for the physical and biological features to be functionally established in areas of currently unsuitable but capable habitat) such that the value of critical habitat for the conservation of the species is not appreciably diminished.

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[1] See 81 FR 7214

[2] The term "primary constituent elements" was introduced in critical habitat designation regulations (50 CFR 424.12) to describe aspects of "physical or biological features", which are referenced in the statutory definition of critical habitat. The Services have removed the term "primary constituent elements" and returned to using the statutory term "physical or biological features" (81 FR 7414). Existing critical habitat designations will not be republished to reflect this change; however, in future rules we will discontinue using the term "primary constituent elements" and instead will use "physical and biological features".

STATUS OF THE SPECIES AND CRITICAL HABITAT

The information in this section summarizes the range-wide status of each species that is considered in this PBO/PCO. Further information on the status of these species can be found in documents on our web page (www.fws.gov/southwest/es/arizona) under Document Library, Document by Species, and in other references cited in each summary below.

Jaguar

Description and Legal Status

The jaguar (*Panthera onca*), a large member of the cat family (Felidae), is a muscular cat with relatively short, massive limbs and a deep-chested body. They are cinnamon-buff in color with many black spots; melanistic (dark coloration) forms are also known, primarily from the southern part of the range.

In 1972, the jaguar was listed as endangered (USFWS 1972, 37 FR 6476) in accordance with the Endangered Species Conservation Act of 1969 (ESCA), a precursor to the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 et seq.). Under the ESCA, the FWS maintained separate listings for foreign species and species native to the U.S. At that time, the jaguar was believed to be extinct in the U.S.; thus, the jaguar was included only on the foreign species list. On July 25, 1979, the FWS published a notice (USFWS 1979, 44 FR 43705) stating that, through an oversight in the listing of the jaguar and six other endangered species, the U.S. populations of these species were not protected by the Act. The notice asserted that it was always the intent of the FWS that all populations of these species, including the jaguar, deserved to be listed as endangered, whether they occurred in the U.S. or in foreign countries. Therefore, the notice stated that the FWS intended to take action as quickly as possible to propose the U.S. populations of these species (including the jaguar) for listing. On July 25, 1980, the FWS published a proposed rule (USFWS 1980, 45 FR 49844) to list the jaguar and four of the other species referred to above in the U.S. The proposal for listing the jaguar and three other species was withdrawn on September 17, 1982 (USFWS 1982, 47 FR 41145) stating that the Act mandated withdrawal of proposed rules to list species which have not been finalized within 2 years of the proposal. On July 22, 1997, the FWS published a final rule clarifying that endangered status for the jaguar extended into the United States (USFWS 1997, 62 FR 39147). The jaguar is listed as endangered under Mexican law in Mexico (SEMARNAT 2010).

Life History and Habitat

The life history of the jaguar has been summarized by Seymour (1989) and Brown and López-González (2001), among others. Jaguars may breed year-round range-wide, but tend to breed seasonally at the southern and northern ends of their range (Seymour 1989). On average, gestation is 101 days with cubs being born in a sheltered place (Seymour 1989). Litters range from one to four but usually consist of two cubs (Seymour 1989). Cubs remain with their mother for 1.5 to 2 years (Seymour 1989). Sexual maturity ranges from 2 to just over 3 years for females and 3 to 4 years for males (Seymour 1989). According to Seymour (1989), in Belize, Rabinowitz (1986) found few wild jaguars over 11 years of age. Jaguar populations of northern Mexico have a high individual turnover rate (Rosas-Rosas and Bender 2012) with a maximum permanency of 8 years in the area for a female and 5 years for a male (Gutiérrez-González et al. 2015). A wild male jaguar in Arizona was documented to be at least 15 years of age (Johnson et al. 2011). In Jalisco, two wild females were documented to be at least 12 and 13 (Núñez-Pérez, pers. comm. 2011). Therefore, the lifespan of the jaguar in the wild is estimated to be approximately 10-15 years.

Cats are specialized ambush hunters with the stalk being the most important and least variable part of the prey capture sequence (Kitchener 1991, as cited by Cavalcanti 2008). Like other large cats, jaguars rely on a combination of cover, surprise, acceleration, and body weight to capture their prey (Schaller 1972 and Hopcraft *et al*. 2005, as cited by Cavalcanti 2008). Jaguars usually catch and kill their prey by stalking or ambush and biting through the nape as do most Felidae; however, sometimes they bite through the skull or occasionally through the neck vertebrae of large prey (Seymour 1989). The list of prey taken by jaguars throughout their range includes more than 85 species (Seymour 1989). Known prey include, but are not limited to, collared peccaries (javelina (*Pecari tajacu*)), white-lipped peccaries (*Tayassu pecari*), capybaras (*Hydrochoerus* spp.), pacas (*Agouti paca*), agoutis (*Dasyprocta* spp.), deer (*Odocoileus* and *Mazama* spp., *Blastocerus dichotomus*), opossum (*Didelphis* spp.), rabbits (Leporidae), armadillos (*Dasypus* spp.), caimans (*Caiman* spp.), turtles (*Podocnemis* spp.), livestock, and various other reptiles, birds, and fish (Seymour 1989; Núñez *et al*. 2000; Rosas-Rosas 2006; Rosas-Rosas *et al*. 2008, Figueroa 2013, Hernández-SaintMartín *et al*. 2015). Jaguars are considered opportunistic feeders, especially in rainforests, and their diet varies according to prey density and ease of prey capture (Seymour 1989). Jaguars use medium- and large-size prey, with a trend toward use of larger prey as distance increases from the equator (López-González and Miller 2002). Javelina and white-tailed deer are thought to be the mainstays in the diet of jaguars in the U.S. and Mexico borderlands (Brown and López-González 2001).

Like most large carnivores, jaguars have relatively large home ranges. According to Brown and López-González (2001), their home ranges are highly variable and depend on sex, topography, available prey, and population dynamics. However, little information is available on this subject outside tropical America, where several studies of jaguar ecology have been conducted. Data compiled from studies in Brazil, Venezuela, and Belize found mean home range areas for males to vary from 5 to 52 square miles (mi^2) during the wet season and 11 to 64 mi^2 during the dry season. For females, the ranges were smaller, with less variation between seasons (Rabinowitz and Nottingham, Jr. 1986, Crawshaw and Quigley 1991, Brown and López-González 2001, Cavalcanti and Gese 2009).

A small number of home range studies have been conducted in the Northwestern Recovery Unit (see description below). In the tropical deciduous forest of Jalisco, Mexico, mean home range size for two males was 38.7 ± 5.8 mi^2 and four females was 16.4 ± 6.2 mi^2 (Nuñez Perez 2006). Only one limited home range study using standard radio-telemetry techniques has been conducted for jaguars in northwestern Mexico. One adult female that tracked for four months during the dry season in the municipality of Sahuaripa, Sonora, had a home range size of 39 mi^2 (López-González, pers. comm. 2011b). Additionally, in the same area, camera trap data indicated that one male had a home range of 32 mi^2 (López-González, pers. comm. 2011b), and another male had a home range of 63.2 mi^2 (Gutiérrez-González *et al*. 2015). Also using camera traps, in Nacori Chico, Sonora, Rosas-Rosas and Bender (2012) estimated the home range for one adult male jaguar encompasses about 77 mi^2.

No home range studies have been conducted for jaguars in southwestern U.S. using standard radio-telemetry techniques. Culver (2016) used camera traps to estimate a 35 mi^2 minimum home range for one male jaguar in the Santa Rita Mountains in Arizona; however, this estimate should be used with caution, considering the small sample size and that the study was not designed to determine home range size. The home ranges of borderland jaguars are presumably as large or larger than the home ranges of tropical jaguars (Brown and López-González 2001), as jaguars in this area are at the northern limit of their range and the arid environment contains resources and environmental conditions that are more variable than those in the tropics (Hass 2002, as cited in McCain and Childs 2008). Therefore, jaguars require more space in arid areas to obtain essential resources such as food, water, and cover.

Jaguars move regularly throughout their home ranges, with mean daily movements ranging from 1.1 ± 1.6 miles (Crawshaw and Quigley 1991) to 6.13 miles (Moreira *et al*. 2011) using a variety of methods. Males generally move longer distances than females (Crawshaw and Quigley 1991, Hernandez-Santin 2007), and movements during wet seasons are generally shorter than during dry seasons (Crawshaw and Quigley 1991, Figueroa 2013). Hernandez-Santin (2007) states the maximum distance traveled in one day by a male jaguar was 24 miles and 19 miles by a female.

Few studies have been conducted on jaguar movements in the northwestern recovery unit. Núñez-Pérez (2006) states that in the forests of Jalisco, jaguars can move up to 12 miles in a single night, frequently finishing very close to where they started. Additionally, Rosas-Rosas and Bender (2012) state that in Nácori Chico, Sonora, female jaguars returned to a given location approximately every 20 days and males every 30 days.

Jaguars can disperse long distances from their natal home range, and males disperse farther than females, but little data exist on jaguar dispersal, including dispersal distance and duration. In the northwestern recovery unit, one juvenile male dispersed about 43.5 miles to the north in coastal Jalisco (Núñez *et al*. 2002). Throughout the rest of the jaguar's range, Crawshaw and Quigley (1991) documented dispersal of two subadult males in Brazil, one of which was killed before establishing a home range, the other of which dispersed in a series of movements over time, the longest of which was 39.8 miles from his presumed natal area. Rabinowitz and Zeller (2010) note that Leopold (1959) speculated that a jaguar killed in California in the 1950s had traveled more than 497 miles from its point of origin.

Jaguars are known from a variety of vegetation communities (Seymour 1989). At middle latitudes, they show a high affinity for lowland wet communities, including swampy savannas or tropical rain forests (sources as cited in Seymour 1989). Swank and Teer (1989) stated that jaguars prefer a warm, tropical climate, usually associated with water, and are rarely found in extensive arid areas. Jaguars may use dense vegetative cover, canyons, ridges, and rocky hills for denning and resting (USFWS 2016a). However, jaguars have been documented in arid areas, including thornscrub, desertscrub, lowland desert, mesquite grassland, Madrean oak woodland, and pine-oak woodland communities of northwestern Mexico and southwestern U.S. (Boydston and López-González 2005, McCain and Childs 2008, López-González and Brown 2002). The more open, dry habitat of southwestern U.S. has been characterized as marginal in terms of water, cover, and prey densities (Rabinowitz 1999). Jaguars rarely occur above 8,500 feet (Brown and López- González 2001). In Arizona they have been found using areas from rugged mountains at 5,174 feet to flat lowland desert floor at 2,877 feet (McCain and Childs 2008).

No formal habitat use studies have been conducted (with the exception of Núñez *et al.'s* (2002) examination of arroyo use) in the northwestern recovery unit. However, results of a study in the municipality of Nácori Chico, Sonora, showed that jaguar kill sites of wild prey (i.e., white-tailed deer and peccary) (Rosas-Rosas, pers. comm. 2011) and cattle were positively associated with oak forest and semi-tropical thornscrub vegetation types, whereas they were negatively associated with upland mesquite (Rosas-Rosas *et al*. 2010). Sites of cattle kills were also positively associated with proximity to permanent water sources and roads (Rosas-Rosas *et al*. 2010). In the tropical dry forest of coastal Jalisco, jaguars use arroyos in greater proportion to their availability (Núñez *et al.* 2002).

General jaguar habitat associations have been described in the northwestern recovery unit by various authors. In western Mexico, including Nayarit and Jalisco, jaguars primarily occur in tropical deciduous forest, although other formerly important habitats are the mangrove forests and swamps of the Agua Bravo and Marismas Nacionales straddling the borders of Nayarit and Sinaloa (Brown and López-González 2001). In Jalisco, oak and pine forest are also used by jaguars, some of them located between 8,858 feet and 9,186 feet in elevation (Núñez-Pérez, pers. comm. 2011). Although jaguars are not primarily associated with these vegetation communities, it is important to consider oak woodlands and pine forests as potential jaguar corridors (Núñez-Pérez, pers. comm. 2011). Jaguars also occur in tropical deciduous forest in southern Sonora and Sinaloa (Brown and López-González 2001, Navarro-Serment *et al*. 2005). According to Brown and López-González (2001), the most important biotic community for jaguars in the southwestern borderlands (Arizona, New Mexico, Sonora, Chihuahua) is Sinaloan thornscrub, which inhabits the lower bajadas and basins between 1,500 and 3,100 feet in elevation. Based on records obtained through interviews, they report that nearly 80% of the jaguars killed in the state of Sonora were documented in Sinaloan thornscrub. Madrean evergreen woodland is also important for borderlands jaguars; nearly 30% of jaguars killed in the borderlands region were documented in this biotic community (Brown and López-González 2001). Brown and López-González (2000) indicate jaguars in Arizona and New Mexico predominantly use montane environments, probably because of more amiable temperatures and prey availability. A smaller, but still notable, number of jaguars were killed in chaparral and shrub-invaded semi-desert grasslands (Brown and López-González 2001). In Arizona, approximately 15 percent of the jaguars taken within the State between the years 1900 and 2000 were in semi-desert grasslands (Brown and López-González 2001).

Sanderson and Fisher (2013) created a jaguar habitat model for the northwestern recovery unit using the methodology described in Hatten *et al*. (2005), but with some modifications, and using a larger number of jaguar observations. They found that jaguars in the Jalisco Core Area appeared to use areas of higher human influence (HII < 30 on a scale of 0-64) and higher tree cover (> 1 and ≤ 100%) compared to jaguars in the northern three Areas of the northwestern recovery unit (including the U.S.; HII < 20; tree cover > 1 and ≤ 50%). However, throughout the entire northwestern recovery unit jaguars used areas of similar ruggedness (intermediately, moderately, and highly rugged), elevation (< 6,562 feet), and distance from water (≤ 6.2 miles). Using these habitat features, they determined the amount of jaguar habitat available in each of the Areas within the northwestern recovery unit, as shown in Table J-1. Additionally, they weighted the amount of available habitat by ecoregion, and using 12 jaguar density estimates from throughout the northwestern recovery unit, suggest a potential carrying capacity of 3,414 jaguars over the total area of over 87,578 mi^2. They further break this capacity down into smaller areas of the northwestern recovery unit which, from south to north, they suggest may have the potential to contain: approximately 1,318 jaguars in the Jalisco Core Area, approximately 929 jaguars in the Sinaloa Secondary Area, approximately 1,124 jaguars in the Sonora Core Area, and approximately 42 jaguars in the Borderlands Secondary Area (37 in the Mexico portion and five in the U.S. portion) (Table J-1). The current populations are substantially below these carrying capacities, but are not zero according to recent observations in all four subunits (Sanderson and Fisher 2013).

Distribution, Abundance, Population Trends

Jaguars historically ranged from southern U.S. to central Argentina (Swank and Teer 1989, Caso *et al*. 2008). Currently, they range from the southwestern U.S. to northern Argentina, and are found in all countries except for El Salvador and Uruguay (Zeller 2007), but no range-wide population estimates exist. According to the International Union for Conservation of Nature (IUCN), the population trend of jaguars is decreasing (Caso *et al*. 2008), although the rate of decline is unknown and likely highly variable throughout the jaguar range. Tobler *et al*. (2013) estimate that more than 80% of the currently occupied range lies in the Amazon. Sanderson *et al*. (2002) found that the jaguar is thought to be extant (based on expert opinion) in about 3.4 million mi^2, which represents 46% of its historical global range. Jaguars are thought to be extirpated in 37% of their historical range, and their status in another 18% is unknown (Sanderson *et al*. 2002). The probability of long-term survival of the jaguar is considered high in 70% of the currently occupied range (over 2.3 million mi^2) (Sanderson *et al*. 2002). Zeller (2007) updated Sanderson *et al*.'s (2002) work and found that the jaguar is thought to be extant (based on expert opinion) in about 4,517,395 mi^2, which represents 61% of its historical range, likely reflecting improved knowledge rather than range expansion.

In northwestern and western Mexico, jaguars occur from the border of Colima and Jalisco north through Nayarit, Sinaloa, southwestern Chihuahua, and Sonora to the border with the U.S. Until recently, Colima had not had any verified jaguar sightings for more than 50 years (López González, pers. comm. 2011a), although credible jaguar reports from the state have been reported in the last decade, mainly near the border with Jalisco (Núñez Pérez, pers. comm. 2011). Breeding populations currently occur in Jalisco, Nayarit, Sinaloa, and Sonora. The most northern recently documented breeding population of jaguars occurs in Sonora near the towns of Huasabas and Sahuaripa, about 130 miles south of the U.S.-Mexico international border (Valdez *et al*. 2002, Brown and López-González 2001). Since 2009, two jaguars have been documented at Rancho El Aribabi, Sonora, about 30 miles southeast of Nogales, and one jaguar has been documented in the Sierra Los Ajos within the Reserva Forestal Nacional y Refugio de Fauna Silvestre Ajos-Bavispe, about 30 miles south of the U.S. border near Naco, Mexico. Population estimates in the core areas of Sonora and Jalisco (called Jaguar Conservation Units) were 50-100 and >500, respectively (Zeller 2007). The Mexican National Jaguar Census estimated there are 271 jaguars in Sonora, 211 in Sinaloa, 92 in Nayarit, and 176 in Jalisco (Manrequez Martinez, pers. comm. 2011).

In the U.S., jaguars historically occurred in California, Arizona, New Mexico, Texas, and possibly Louisiana (USFWS 1997, 62 FR 39147). The last jaguar sightings in California, Texas, and Louisiana were documented in the late 1800s into the early 1900s, with the last confirmed jaguar killed in Texas in 1948 (Nowak 1975). Jaguars have been documented as far north as the Grand Canyon, Arizona; however, occurrences in the U.S. since 1963 have been limited to south-central Arizona and extreme southwestern New Mexico. Three records of females with cubs have been documented in the U.S. (all in Arizona), the last in 1910 (Lange 1960, Nowak

1975, Brown 1989), and no females have been confirmed in the U.S. since 1963 (Brown and López-González 2000, Johnson *et al*. 2011; note the validity of the 1963 record [a female jaguar killed in the White Mountains of Arizona] has been disputed—see Johnson *et al*. 2011 for further information). As a result, jaguars in the U.S. are thought to be part of a population, or populations, that occur largely in Mexico.

From 1996 through February 2017, seven, possibly eight (see end of paragraph, below), individual jaguars have been documented in the U.S. (79 FR 12571, AGFD 2016, AGFD 2017). One adult male was observed and photographed on March 7, 1996, in the Peloncillo Mountains in New Mexico near the Arizona border (Glenn 1996, Brown and López-González 2001, 79 FR 12571). The Peloncillo Mountains run north-south to the Mexican border, where they join the foothills of the Sierra San Luis and other mountain ranges connecting to the Sierra Madre Occidental. A second adult male (later referred to as "Macho B") was observed and photographed on August 31, 1996, in the Baboquivari Mountains of southern Arizona (Childs 1998, Brown and López-González 2001, 79 FR 12571). In February 2006, a third adult male jaguar was observed and photographed in the northern part of the San Luis Mountains in Hidalgo County, New Mexico (79 FR 12571). From 2001 to 2009, a fourth adult male jaguar (referred to as "Macho A") and the jaguar observed and photographed in 1996 in the Baboquivari Mountains (referred to as "Macho B") were photographed (one repeatedly) using infra-red camera traps in south-central Arizona, near the Mexico border (79 FR 12571). More specifically, these two jaguars were documented in three different mountain range complexes in southeastern Arizona, over an area extending 47 miles north from the U.S.-Mexico international border and 39 miles east to west (McCain and Childs 2008). Furthermore, they were found using areas from rugged mountains at 5,174 feet to flat lowland desert floor at 2,877 feet (McCain and Childs 2008). A fifth adult male jaguar was observed and photographed in November 2011 in the Whetstone Mountains in 2011 (79 FR 12571). This same jaguar, named El Jefe by Tucson-area school children in late 2015, has been repeatedly photographed (2012 to 2015) in the Santa Rita Mountains, within the CNF, as recently as September 2015 (https://www.flickr.com/photos/usfws_southwest/sets/72157632294203147/with/22354277201/; see Environmental Baseline section below). The rugged and arid conditions at the northern limit of this distribution contrast sharply to lush tropical forests to the south (Boydston and López-González 2005); however, based on detections by Culver (2016) between September 2012 and June 2015, this male is considered to be a resident in the Santa Rita Mountains. A sixth adult male jaguar was observed and photographed in the Huachuca Mountains on December 1, 2016 (AGFD 2016), and again on January 17, 2017 (https://www.flickr.com/photos/usfws_southwest/32161863720/in/album-72157632294203147/). A seventh jaguar was photographed on November 16, 2016, in the Dos Cabezas Mountains (AGFD 2017). The sex of this individual could not be determined from the photograph. A possible eighth jaguar was photographed in 2004; however, it could not be determined if the animal was a unique individual or was "Macho A" (the photo was of the animal's right side and only photos of "Macho A's" left side were available for comparison) (79 FR 12571).

Boydston and López-González (2005) estimated the potential geographic distribution of jaguars in the southwestern U.S. and northwestern Mexico by modeling the jaguar ecological niche from occurrence records [100 male records from Arizona (47), New Mexico (6), Chihuahua (8), and Sonora (39) and 42 female records from Arizona (6) and Sonora (36)]. They report that eastern

Sonora appeared capable of supporting male and female jaguars with potential range expansion into southeastern Arizona, while New Mexico and Chihuahua contained environmental characteristics primarily limited to the male niche and thus may be areas into which males occasionally disperse. They found significant differences between land cover within the female distribution and the available landscape. The predicted distribution of female jaguars was mainly across areas of shrubland, deciduous broadleaf forest, and grassland, but deciduous broadleaf forest and mixed forest composed more of the female distribution than expected by chance when compared to the available land cover for the study area. Shrubland was a smaller proportion of the female distribution than expected, and grassland and needleleaf forest were present in proportion to their availability. Boydston and López-González‘s (2005) results indicated that the availability of areas meeting females’ environmental requirements may be an important factor limiting the distribution of northern jaguars.

Grigione *et al*. (2009) conducted a mapping study to construct a blueprint of priority conservation areas for jaguars, as well as ocelots and jaguarundis, in the U.S.-Mexico border region. For the jaguar in the western bioregion of the study area (including Arizona, New Mexico, Sonora, Chihuahua, and Sinaloa), four units were identified (two very high priority, one high priority, and one low priority), including two in the U.S. and two in Mexico (totaling 39,587mi^2). Within these four units, currently 19.8 percent of the area has any form of protection (Grigione *et al*. 2009). A very high priority corridor was identified between the two Mexican units; otherwise the connections between the units are poorly understood and consequently two corridors needing further study were identified. Two underpasses were identified as being needed in northern Sonora, where jaguars are believed to be crossing roads as they disperse north. The authors conclude that the region to the south of Arizona and New Mexico is especially critical for the recovery of the jaguar in the southwestern U.S. because the source population is likely in central Sonora. Citing Brown and López-González (2001) and List (2007), Grigione *et al*. (2009) explain that to reach the U.S., jaguars need to travel through Sonora and Chihuahua, where there are many challenges to jaguar survival and movement, including the U.S.-Mexico border fence. The Sky Islands Unit was ranked as “very high priority” for a conservation area for jaguars (Grigione *et al*. 2009).

Threats

In addition to the numerous anthropogenic threats affecting jaguars, the species has a number of intrinsic biological factors that limit its recovery, including being a K-selected species (i.e., species with large body size, long life expectancy, and the production of fewer offspring, which often require extensive parental care until they mature) and having large spatial requirements. Small and isolated jaguar populations do not appear to be highly persistent (Haag *et al*. 2010, Rabinowitz and Zeller 2010). However, persistence of relatively small populations appears to increase with connectivity to other populations and reduction of threats within a corridor (Rabinowitz and Zeller 2010). The prospects for the jaguar being self-sustaining in the wild are favorable; however conservation of key jaguar habitats and populations is critical to this sustainability (USFWS 2012b). Primary threats to jaguars are summarized below.

Illegal killing

Illegal killing of jaguars is one of the two most significant threats to the jaguar (Nowell and Jackson 1996, Medellín *et al*. 2002, Núñez *et al*. 2002, Chávez and Ceballos 2006, Medellín 2009) and, to recover jaguars, likely requires the most immediate response. Commercial hunting and trapping of jaguars for their pelts has declined drastically since the mid-1970s, when anti-fur campaigns and CITES controls progressively shut down international markets (Nowell and Jackson 1996). However, although hunting (for pelts) has decreased, there is still demand for jaguar paws, teeth, and other products (Nowell and Jackson 1996, CITES trade database 2014). Additionally, illegal killing of jaguars due to conflicts with humans is a major threat to jaguars. Jaguars are known to kill cattle and are killed by ranchers as pest species (Nowell and Jackson 1996). People compete with jaguars for prey and jaguars are frequently shot on sight, despite protective legislation (Nowell and Jackson 1996). Continuing deforestation in Latin America and fragmentation of forest habitat isolates jaguar populations so that they are more vulnerable to human persecution (Nowell and Jackson 1996). Experts from throughout the jaguar range agree that one of the most severe causes of mortality is the direct hunting of jaguars, either because jaguars have caused some conflict by killing livestock or to sell the jaguar as a trophy or its skin or teeth (Medellín 2009). This illegal and indiscriminate killing eliminates hundreds or even thousands of jaguars each year in Latin America and must be controlled to reduce the risk of extinction (Medellín 2009).

Habitat loss
Range wide habitat destruction, modification, and fragmentation form the other of the two most significant threats to the jaguar (Nowell and Jackson 1996, Medellín *et al*. 2002, Núñez *et al*. 2002, Chávez and Ceballos 2006, Medellín 2009, Rodriguez-Soto *et al.* 2013). To recover jaguars, addressing this threat of habitat loss requires immediate response. The jaguar is classified as "Near Threatened" on the Red List of the International Union for the Conservation of Nature (IUCN) due to a number of factors, including habitat loss and fragmentation of populations across portions of the range (Caso *et al*. 2008). Various factors, particularly habitat loss, have caused a considerable reduction in the historical range of the jaguar (Sanderson *et al*. 2002, Zeller 2007, Rabinowitz and Zeller 2010). Most loss of occupied range has occurred in the southern U.S., northeastern Mexico, northern Brazil, and southern Argentina (Sanderson *et al*. 2002). Deforestation rates are high in Latin America and fragmentation of forest habitat isolates jaguar populations so that jaguars are more vulnerable to human persecution (Nowell and Jackson 1996). Medellín *et al.* (2002) report that loss, fragmentation, and modification of jaguar habitat have contributed to population declines throughout much of the species' range, including northern Mexico. The main threats for jaguars in habitat corridors in Mexico are habitat fragmentation, roads and highways, and possible human-wildlife conflicts (livestock predation) (Rodriguez-Soto *et al.* 2013). Faller Menéndez (2009) reported that, in addition to habitat loss, fires are causing abnormal concentrations of wildlife in the remaining available habitat in southern Mexico, which provides a possible explanation for the relatively high densities reported in southern Mexico.

Chávez and Ceballos (2006) reported that deforestation was one of the two most important threats to jaguars in Mexico; 60% of the jaguar's historical range in Mexico has been lost; the nationwide population was fewer than 5,000 individuals; and a variety of threats suggested that, absent effective conservation efforts, jaguar imperilment in Mexico would only worsen. Rosas-Rosas and Valdez (2010) reported that jaguar habitats were degraded and conflicts between jaguars and human interests were common in Sonora. Furthermore, they reported that habitat fragmentation and illegal hunting of jaguars and their potential prey species are probably the main threats to long-term conservation of jaguars in their northernmost western range. Increased illegal activities and responsive law enforcement actions, including construction and maintenance of the border fence along the U.S.-Mexico international border, may be limiting jaguar movement across the border, but it is uncertain if and how much this is affecting that movement.

Human population growth has both direct and indirect impacts on jaguar survival and mortality. For example, human growth and development tend to fragment habitat and isolate populations of jaguars and other wildlife. For carnivores in general, the impacts of high road density have been well documented and thoroughly reviewed (e.g., Noss *et al*. 1996, Carroll *et al*. 2001, as cited by Menke and Hayes 2003). Carnivores are particularly vulnerable to extinction in fragmented landscapes, owing to intrinsic biological traits, such as large body sizes, large area requirements, low densities, and slow population growth rates, as well as external anthropogenic threats, including hunting and other forms of direct mortality (sources as cited in Matthews *et al*. 2014). Roads may have direct impacts to carnivores and carnivore habitats, including mortality caused by vehicles, disturbance, habitat fragmentation, changes in prey numbers or distribution, and provision of increased access for legal or illegal harvest (Menke and Hayes 2003, Colchero *et al*. 2010, Matthews *et al*. 2014). Roads are among the most widespread and impose some of the most lasting impacts on ecosystems of all human-made linear infrastructures (sources as cited in Matthews *et al*. 2014). In the U.S. alone, roads and roadsides cover over 1% of the land, equivalent in area to the state of South Carolina, and influence the ecology of at least one-fifth of the land area of the entire country (Forman 2000, Cerulean 2002, as cited by Matthews *et al*. 2014). Núñez Pérez (2007) considered habitat fragmentation a risk to the long-term conservation of jaguars in western Mexico. In some areas, like Colima, connectivity is being lost due to four-lane road construction and forest destruction (Núñez Pérez 2014). In the Mayan forest, Conde *et al.* (2010) found that male jaguar movements were not influenced by road presence, but that females showed strong road avoidance. Males also used agricultural and livestock areas more often than females. These threats are relevant to jaguars throughout most of their range; however, no jaguars have been documented in collisions with vehicles in the U.S. despite the fact that they have been documented to cross roads, including two lane highways in Arizona. For example, the same male jaguar has been photo-documented in both the Whetstone and Santa Rita mountains. This jaguar would have had to cross over or through a passage beneath State Route 82 or 83 to move between the mountain ranges.

Loss of gene flow

Habitat fragmentation may disrupt original patterns of gene flow and lead to drift-induced differentiation among local population units and top predators, such as the jaguar, may be particularly susceptible to this effect, given their low population densities, leading to small effective sizes in local fragments (Haag *et al*. 2010). Large-scale habitat removal and fragmentation of once-contiguous habitat can cause the reduction of genetic diversity in jaguar populations (Haag *et al*. 2010). To avoid the negative demographic and genetic consequences of small population size caused by habitat fragmentation, connectivity should be restored to ensure gene flow is maintained (Haag *et al*. 2010). Citing a number of sources, Rabinowitz and Zeller (2010) explain that reduction or loss of genetic exchange leads to smaller effective population sizes, increased levels of genetic drift and inbreeding, and potential deleterious effects on sperm production, mating ability, female fecundity, and juvenile survival. Furthermore, they state that such effects eventually compromise adaptive potential, reduce fitness, and contribute to extinction risk for a population and, ultimately, for the species. To ensure genetic health and long-term viability of jaguars range-wide, it is critical to maintain gene flow among populations through maintaining and restoring connectivity. Corridors can provide one of the most basic requirements for species persistence and genetic exchange (Rabinowitz and Zeller 2010). Boydston and López- González (2005) suggest that range expansion to the north of eastern Sonora could help prevent genetic isolation and extinction of the northern jaguars and also increase chances for long-term survival of this species in the face of global anthropogenic changes.

Illegal killing of prey species
The jaguar is classified as "Near Threatened" on the IUCN Red List in part due to poaching of prey (Caso *et al*. 2008). According to experts across the jaguar range, hunting of the most important prey, such as peccaries and deer, is one of the primary factors negatively affecting the jaguar (Medellín 2009). An estimated 27 percent of jaguar range has a depleted wild prey base (WCS 2008 as cited by Caso *et al*. 2008). Illegal hunting of potential jaguar prey species is one of the main threats to long-term conservation of jaguars in northwestern Mexico (Rosas-Rosas 2006). Human population growth can put pressure on game populations that are used for human consumption. These same game populations are often prey for jaguars. Furthermore, overhunting of natural prey may cause an increase in jaguar predation on livestock and consequently increase human-jaguar conflicts, including continued negative attitudes toward jaguars and illegal killing of jaguars.

Conservation, Consultation and Recovery Planning
Among significant conservation efforts for the jaguar throughout its range, including in Mexico, efforts in the U.S. include the Jaguar Conservation Agreement, which is an agreement entered into in 1997 by AGFD and NMDGF with other State, local, and Federal cooperators, as well as voluntary participation by many private individuals. They formed the Jaguar Conservation Team, the purpose of which is to contribute to conserving the jaguar in Arizona and New Mexico and to encourage parallel efforts in Mexico. In 2010, the FWS convened the binational Jaguar Recovery Team to develop a Jaguar Recovery Plan and to guide and implement jaguar recovery. The Jaguar Recovery Team was instrumental in developing the Recovery Outline for the Jaguar (USFWS 2012a) and the Jaguar Draft Recovery Plan (USFWS 2016), as well as in guiding and implementing jaguar recovery actions within the U.S. and northwestern recovery unit, including the monitoring and recovery efforts described below. The final Jaguar Recovery Plan is expected to be completed within 1-2 years.

Several formal consultations (pursuant to section 7 of the ESA) have been completed by the FWS that analyzed the effects of various actions on jaguars. As a result of these consultations, a number of conservation measures were identified, including support and funding of jaguar survey, monitoring, and recovery efforts; and closure and restoration of an unauthorized road in jaguar habitat. To implement one of these conservation measures, in 2011, U.S. Customs and Border Protection provided funding to the FWS to implement jaguar monitoring and recovery efforts in the U.S. to help offset effects of border security activities on the jaguar.

In December 2016, the Jaguar Draft Recovery Plan was published by the FWS (USFWS 2016). The goal of the Jaguar Draft Recovery Plan is to conserve and protect the jaguar and its habitat so that its long-term survival is secured and it can be considered for removal from the list of threatened and endangered species (delisted). To accomplish this goal, the Jaguar Draft Recovery Plan describes the recovery strategy and objective, measurable criteria that, if met, provide a basis for determining whether a species can be considered for reclassification (downlisting to threatened status, or removing it from the list of threatened and endangered species (delisted)). Detailed information about the recovery strategy, goals, objectives, and criteria is available here: https://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/Jaguar/Jaguar_Draft_Recovery_Plan_20_Dec_2016.pdf.

The 2016 Jaguar Draft Recovery Plan describes two recovery units for the jaguar across its range, the Northwestern Recovery Unit (northwestern recovery unit; 87,578 mi^2) (Figure J-1) and the Pan American Recovery Unit (PARU; 2.60 million mi^2) (USFWS 2016). The analyses in this BO largely focus on the northwestern recovery unit. Recovery units for the jaguar are further divided into core, secondary, and peripheral areas (USFWS 2016). Core areas have both persistent verified records of jaguar occurrence over time and recent evidence of reproduction. Secondary areas are those that contain jaguar habitat with either or both historical or recent records of jaguar presence with no recent record or very few records of reproduction. In peripheral areas, most historical jaguar records are sporadic, and there is no or minimal evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by jaguars.

<u>Northwestern Recovery Unit</u>
The northwestern recovery unit is about 85,578 mi^2; with 11,205 mi^2 in the U.S. and 76,373 mi^2 in Mexico (USFWS 2016). Table J-1 describes the subdivisions within the northwestern recovery unit. The Borderlands Secondary Area lies within the northwestern recovery unit and is about 24,315 mi^2; with 11,205 mi^2 in the U.S. and 13,110 mi^2 in Mexico (Table J-1 and Figure J-1).

Within the U.S., jaguar habitat in the northwestern recovery unit primarily occurs on tribal (Tohono O'odham Nation) lands and federally and state owned lands, including those managed by the U.S. FS (CNF), BLM, NPS, FWS, and Arizona State Land Department. The remaining lands within the U.S. portion of the northwestern recovery unit are privately owned. Within Mexico, jaguar habitat within the northwestern recovery unit primarily occurs on privately owned, ejido (communal), and indigenous community (e.g., Yaqui) lands. Although there are natural protected areas (ANP) designated by the Comisión Nacional de Áreas Naturales Protegidas (CONANP [National Commission for Natural Protected Areas]) within the northwestern recovery unit, they overlap privately-owned and communal lands. The protected status of these ANPs does not change the land ownership status but instead imposes use restrictions on the lands. Within the northwestern recovery unit in Mexico, there are at least 17 federally-recognized protected areas that provide for the conservation of the jaguar (CONANP 2014).

Critical Habitat
Critical habitat (as defined under the Act) for the jaguar is designated in the United States for approximately 764,207 acres in Pima, Santa Cruz, and Cochise counties, Arizona, and Hidalgo County, New Mexico in six critical habitat units (USFWS 2014, 79 FR 12571; Figure J-2):

- Baboquivari Unit, approximately 63,134 acres in the Baboquivari, Saucito, Quinlan, and Coyote Mountains, Arizona;

- Atascosa Unit, approximately 144,865 acres in the Tumacacori, Atascosa, and Pajarito Mountains, Arizona;
- Patagonia Unit, approximately 351,501 acres in the Patagonia, Santa Rita, Empire, and Huachuca Mountains, and the Canelo and Grosvenor Hills, Arizona;
- Whetstone Unit, approximately 94,269 acres in the Whetstone Mountains, including connections to the Santa Rita and Huachuca Mountains, Arizona;
- Peloncillo Unit, approximately 102,724 acres in the Peloncillo Mountains, Arizona and New Mexico; and
- San Luis Unit, approximately 7,714 acres in the northern extent of the San Luis Mountains at the U.S.-Mexico border, New Mexico.

For a complete description of all units, see the final designation for jaguar critical habitat (79 FR 12571), available here: http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/Jaguar/2014-03485_Fed_Reg_Jag_fCH_2014-3-5.pdf.

Primary Constituent Elements (PCE) of Critical Habitat
There are seven primary constituent elements of critical habitat, which include those habitat features required for the following physical and biological feature that provides for the physiological, behavioral, and ecological needs of the species. The physical and biological feature including these seven elements is:
Expansive open spaces in the southwestern United States at least 38.6 mi^2 in size which:

- PCE 1: Provide connectivity to Mexico;
- PCE 2: Contain adequate levels of native prey species, including deer and javelina, as well as medium sized prey such as coatis, skunks, raccoons, or jackrabbits;
- PCE 3: Include surface water sources available within 12.4 miles of each other;
- PCE 4: Contain greater than 1 to 50 percent canopy cover within Madrean evergreen woodland, generally recognized by a mixture of oak, juniper, and pine trees on the landscape, or semidesert grassland vegetation communities, usually characterized by *Pleuraphis mutica* (tobosagrass) or *Bouteloua eriopoda* (black grama) along with other grasses;
- PCE 5: Are characterized by intermediately, moderately, or highly rugged terrain;
- PCE 6: Are below 6,562 feet in elevation; and
- PCE 7: Are characterized by minimal to no human population density, no major roads, or no stable nighttime lighting over any 0.4- mi^2 area.

Ocelot

Description and Legal Status

The ocelot (*Leopardus pardalis*), a medium-sized spotted cat, belongs to the genus *Leopardus* which also includes the margay (*Leopardus wiedii*) and the oncilla (*Leopardus tigrinus*). The ocelot has been divided into as many as 11 subspecies that ranged from the southwestern U.S. to northern Argentina (USFWS 2016). Two subspecies occur in the United States: the Texas ocelot (*L. pardalis albescens*) and the Sonora ocelot (*L. p. sonoriensis*) (USFWS 2016). The ocelot weighs from 15-35 lbs, with males weighing more than females (USFWS 2016). The coloration of the upper parts of the body is pale gray to cinnamon. There are spots on the head, two black stripes on the cheeks and four to five longitudinal black stripes on the neck. The body shows elongated black-edged spots arranged in chain-like bands. The rounded ears are black dorsally, with a conspicuous white spot. The underparts are whitish, spotted with black. The tail is marked with dark bars or incomplete rings (Hall 1981).

The ocelot was listed as endangered in 1972 under the authority of the Endangered Species Conservation Act of 1969 (USFWS 1972). The 1969 Act maintained separate lists for foreign and native wildlife. The ocelot appeared on the foreign list, but due to an oversight, not on the native list. Following passage of the ESA in 1973, the ocelot was included on the January 4, 1974, list of "Endangered Foreign Wildlife" that "grandfathered" species from the lists under the 1969 Act into a new list under the ESA (USFWS 1974). The entry for the ocelot included "Central and South America" under the "Where found" column in the new ESA list. Endangered status was extended to the U.S. portion of the ocelot's range with a final rule published July 21, 1982 (USFWS 1982). The "Historic range" column for the ocelot's entry in the rule reads, "U.S.A. (TX, AZ) south through Central America to South America." The entry on the current list (USFWS 2013) is essentially the same, and reads, "U.S.A. (TX, AZ) to Central and South America." The ocelot was upgraded to CITES Appendix I in 1986 (Nowell and Jackson 1996) and is considered endangered in Mexico under Mexican law (SEMARNAT 2010).

Life History and Habitat

The life history of the ocelot has been summarized by Laack (1991), Laack *et al*. (1991 and 2005), Tewes and Schmidly (1987), and others. Ocelots may live greater than 10 years in the wild and can live longer (18 years plus) in captivity (Murray and Gardner 1997). Gestation lasts about 70-80 days, and breeding reaches a peak during fall in Texas (Tewes and Schmidly 1987); however breeding peaks may vary throughout the ocelot range. Wild ocelots probably first produce young at about 18 to 30 months-of-age (Eaton 1977, Tewes and Schmidly 1987), although Laack (1991) observed first reproduction in wild female ocelots between 30 and 45 months-of-age. Average litter size is about 1 to 1.5 kittens per litter (Laack *et al*. 2005, Mora *et al*. 2000, Murray and Gardner 1997). Males are believed to contribute little to direct parental care (Tewes 1986, Laack 1991) and young may become independent at one year of age (Murray and Gardner 1997). There is little information on the interval between successive litters in the wild, but it is likely two years (Murray and Gardner 1997, USFWS 2016).

Ocelots are generally active for more than half of each 24-hour period and are typically most active at night and during crepuscular periods with more limited diurnal activity (Ludlow and Sunquist 1987, Crawshaw and Quigley 1989, Fernandez 2002, Avila-Villegas and Jessica Lamberton-Moreno 2012). Ocelots are likely generally nocturnal because they follow the nocturnal habits of their primary prey, small mammals (Ludlow and Sunquist 1987, Emmons 1988, and Crawshaw and Quigley 1989).

Ocelots are solitary hunters and eat a wide variety of prey, but small mammals, especially rodents, comprise most of their diet (Emmons 1987, Ludlow and Sunquist 1987, Crawshaw 1995, de Villa Meza *et al.* 2002, Fernandez 2002). Ocelot diets, however, also include medium to large mammals, reptiles, amphibians, birds, fishes, and insects (Emmons 1987, de Villa Meza *et al.* 2002, Fernandez 2002). Based on these results some authors have suggested that ocelots are opportunistic feeders (Bisbal 1986, Emmons 1987; as cited by de Villa Meza 2002).

Although ocelots usually disperse from the natal range, sometimes females may remain in their natal range (Laack 1991). The age at which subadult ocelots disperse from the natal range varies, but is about two years of age (Ludlow and Sunquist 1987, Laack 1991). Laack (1991) found that there was no obvious sex difference in age at dispersal and that duration of successful dispersal (time elapsed between leaving natal range and establishing an independent home range) was 7 to 9.5 months. Studies have shown that dispersal distance varies considerably, for example, in Texas, dispersal distances have been documented between 1.5 miles and 26.4 miles (Navarro-Lopez 1985, Tewes 1986, Laack 1991, USFWS 2016). The longest documented dispersal distance (31 miles) that we are aware of was of a male ocelot in Tamaulipas, Mexico (Booth-Binczik 2007).

Ocelots inhabit a wide variety of densely vegetated habitat types, including, but not limited to, thorn scrub, semi-arid woodland, tropical deciduous and semi-deciduous forest, subtropical forest, lowland rainforest, palm savanna, and seasonally flooded savanna woodland (Tewes 1986, Ludlow and Sunquist 1987, Crawshaw and Quigley 1989, Crawshaw 1995, Fernandez 2002, Laack *et al.* 2005). In south Texas, ocelots occur predominantly in dense thornscrub communities (Navarro- Lopez 1985, Tewes 1986, Laack 1991). Laack (1991) also documented minimal use of Johnsongrass (*Sorghum halepense*) by ocelots. Caso (1994) found ocelots used primarily forest or woody communities in Tamaulipas, Mexico, and used the open pastures much less often.

In Sonora, López-González *et al.* (2003) reported 27 of 36 (75%) of verified ocelot records in Sonora were associated with tropical or subtropical habitats, namely subtropical thornscrub, tropical deciduous forest and tropical thornscrub; a few ocelots were recorded in oak woodlands, but were all males. The mean elevation of the 33 records located with precision was 2,297 +/- 1,476 feet, at which altitudes subtropical thornscrub is the main habitat (López-González *et al.* 2003). They report that ocelots were associated largely with the mountainous Sierra region of eastern Sonora and that records closer to the Sonoran desert biome were mainly associated with riparian areas, where the shrub cover is relatively thicker than the surrounding areas. Avila-Villegas and Jessica Lamberton-Moreno (2012) collected 68 camera photographs of ocelots in the Sierra Azul in northern Sonora, all of which were taken at elevation ranges between 4,183 and 5,331 feet in Madrean evergreen woodland.

Of the five ocelots recently recorded in Arizona, the one in the Whetstone Mountains was documented (via remote camera) in Madrean evergreen woodland (Avila-Villegas and Jessica Lamberton-Moreno 2012). A male ocelot that was killed by a vehicle west of Globe, Arizona, in 2010 (Holbrook *et al*. 2011) was in the interior chaparral vegetation community, at an elevation of 1,377 feet within the Greater Oak Flat Watershed (AGFD as cited by Featherstone *et al*. 2013). Recent detections of three other ocelots in Arizona (in the Huachuca and Santa Rita Mountains) were located in the semidesert grassland (46%), Madrean evergreen woodland (46%), and Great Basin grassland (8%) biotic communities (Culver 2016). On average, all ocelot locations had 23% tree cover and were found at an elevation of 6,010 feet. Additionally, on average, they were 7,660 feet from perennial water sites and 20,790 feet from major roads (Culver 2016).

Despite the variation in habitat use, the species does not appear to be a habitat generalist. Ocelot spatial patterns are strongly linked to dense cover or vegetation, suggesting it uses a fairly narrow range of microhabitats (Emmons 1988, Horne 1998). Horne (1998), in southern Texas, was the first to statistically analyze ocelot habitat selection patterns. He found ocelots used closed (>95% canopy closure) cover types more than cover types with less-than-moderate canopy cover and avoided mixed cover type (50-75% canopy closure). Also in southern Texas, Jackson *et al*. (2005) suggested that ocelots prefer closed canopy over other land cover types, but that areas used by this species tended to consist of more patches with greater edge. No habitat use studies have been conducted in Arizona or Sonora.

Distribution, Abundance, Population Trends
No studies have documented dispersal distance of ocelots in Sonora and Arizona; however, a subadult male ocelot was documented in Arizona in 2010 just west of Globe (it was killed by a car) (Holbrook *et al*. 2011). Ocelots have also been recently detected in the Whetstone (detected in 2009) (Avila-Villegas and Jessica Lamberton-Moreno 2013) and Huachuca Mountains (detections from 2011 to 2016). The nearest recently (in 2011) documented female with young (one kitten) was located about 30 miles) south of the international border in the Sierra Azul of Sonora, Mexico (Avila-Villegas and Jessica Lamberton-Moreno 2013). If ocelots documented in Globe and the Huachuca and Whetstone mountains dispersed from the nearest breeding population, assuming the nearest breeding population is the one previously mentioned, it means the ocelots moved about 135 miles to Globe; 35 miles to the Huachuca Mountains (email from Tim Snow, AGFD, March 18, 2013), and 70 miles to the Whetstone Mountains (Avila-Villegas and Jessica Lamberton-Moreno 2013). Avila-Villegas and Jessica Lamberton-Moreno (2013), however, believe that travel from northern Sonora to Globe seems unlikely. Additionally, a minimal travel distance (round trip) of 52 miles was documented for an ocelot in the Huachuca Mountains who subsequently was documented in the Patagonia Mountains and then back in the Huachucas (Culver 2016).

Ocelots are solitary animals that maintain home ranges (Ludlow and Sunquist 1987, Emmons 1988, Laack 1991, Crawshaw 1995). Home range for the ocelot varies throughout its range. Adult female home range sizes vary from approximately 494 to 4,201 acres while adult male home range sizes vary from approximately 1,235 to 9,390 acres, both depending on the habitat type in which they are found (Tewes 1986, Ludlow and Sunquist 1987, Emmons 1988, Crawshaw and Quigley 1989, Konecny 1989, Laack 1991, Caso 1994, Crawshaw 1995, Fernandez 2002). In the Tamaulipan thornscrub of south Texas and northeastern Mexico, mean ocelot home range sizes reported include: Laack (1991): 1,544 acres for males, 709 acres for females; Navarro-Lopez (1985): 623 acres for males, 512 acres for females; Tewes (1986): 3,039 acres for males and 1,730 acres for females; and Caso (1994): 2,006 acres for males, 2,372 acres for females. No home range studies have been done for ocelots in Arizona or northwestern Mexico. However, in western Mexico, specifically in the tropical deciduous forest of Jalisco, average home range size using the Kernel estimator for male ocelots was 2,891 acres and for females was 1,433 acres; average home range size using the 95% Minimum Convex Polygon estimator was 4,018 acres for males and 1,814 acres for females (Fernandez 2002). Additionally, Culver (2016) estimated minimum observed ranges for ocelots in Arizona and Sonora. The average minimum observed range of three Arizona ocelots was 11.62 miles^2, with minimum observed ranges ranging from 3.00 to 24.48 miles^2. The average minimum observed range of 9 Sonora ocelots was 4.54 miles^2 (0.76 miles^2 to 12.16 miles^2) (Culver 2016).

Ocelots historically ranged from Louisiana, Arkansas, Texas, and Arizona in the U.S. southward through Mexico, Central and South America to Peru and northern Argentina (Murray and

Gardner 1997). Currently, the ocelot ranges from extreme southern Texas and southern Arizona through Mexico and Central America to Ecuador and northern Argentina and Uruguay (Murray and Gardner 1997, USFWS 2016). In Mexico, it has disappeared from much of its historical range on the west coast (Caso *et al.* 2008). There are reports of the species up to 9,842 feet (Caso *et al.* 2008). We are not aware of any range-wide estimates of suitable ocelot habitat.

Estimating population sizes of secretive nocturnal carnivores, especially species that inhabit dense vegetative cover, such as the ocelot, is difficult. We are not aware of any range-wide estimates for ocelots; however, population size has been estimated in a number of countries. An effective population size of 10,000 to 528,732 individuals was estimated for Brazil (Oliveira *et al*. 2013). A total population of 1,500 to 8,000 individuals was estimated for Argentina (Aprile *et al*. 2012). A population of 2,025 +/- 675 ocelots in Sonora was estimated by López-González *et al*. (2003) based on the distribution of these records and the availability of potential habitat. Gómez-Ramírez (2015) estimated a population of 1,421 ocelots in Sonora. The U.S. population of the Texas ocelot subspecies has fewer than 100 individuals, found in two separated populations in southern Texas (USFWS 2016). A third and larger population of the Texas/Tamaulipas ocelot subspecies occurs more than 124 miles south of the Texas/Mexico border in the Sierra of Tamaulipas, Mexico (Caso 1994). Stasey (2012) reported a population estimate of 371 ocelots in a 602 mi^2 patch of habitat in the Sierra of Tamaulipas.

Since 2009, a total of five ocelots have been detected in Arizona, including four detected by trail cameras and hunting dogs, and one dead ocelot that had been struck by a vehicle. A description of these detections follows. In November 2009, a live ocelot (sex unknown) was documented in the Whetstone Mountains in Cochise County, Arizona, with the use of camera-traps (Avila-Villegas and Lamberton-Moreno 2013). In April 2010, a second ocelot was found dead on a road near Globe, Arizona. A genetic analysis was conducted and all data indicated the young male ocelot was not of captive but wild origin (Holbrook *et al*. 2011). Origin of the ocelot recovered in Globe is still unclear due to a lack of comparative samples from Arizona or Sonora although in the DNA analysis, it clustered with samples from Mexico. A two-year camera-trap study in the area near Globe, Arizona, did not photograph any additional ocelots (Featherstone *et al*. 2013).

In February 2011, a third male ocelot was treed by a hunting dog and photographed in the Huachuca Mountains. He was subsequently detected multiple times by trail cameras, including once in the Patagonia Mountains in May 2012 (Culver 2016), and was also treed by hunting dogs again (in the Huachuca Mountains). After being detected in the Patagonia Mountains he returned to the Huachuca Mountains, meaning that he traveled an approximate round trip distance of 52 miles (Culver 2016). He was most recently detected in May 2013. In May 2012, a fourth male ocelot was detected in the Huachuca Mountains via trail camera. He has been detected many times via trail cameras, most recently in 2016, and treed by hunting dogs once. In April 2014, a fifth male ocelot was detected in the Santa Rita Mountains via trail camera. He was photographed several times over a two-month period and has not been detected since. Additionally, an ocelot was detected in December 2013 in the Santa Rita Mountains; however it is unknown if this was the same as the fifth ocelot described above or a different ocelot.

In addition to the recent Arizona sightings, a number of ocelots have been documented just south of the U.S. border in Sonora, Mexico. Specifically, with the use of camera traps, six ocelots were documented between February 2007 and April 2011 in the Sierra Azul, about 30 miles southeast of Nogales, including two males, one female, one kitten, and two of undetermined sex (Avila-Villegas and Lamberton-Moreno 2012). Additionally, one ocelot was documented in 2009 in the Sierra de Los Ajos, about 30 miles south of the U.S. border near Naco, Mexico (USFWS 2016). Also in Sonora, López-González *et al.* (2003) obtained 36 verified ocelot records, 21 of which were obtained after 1990, including 19 individual male records, 6 females, and 11 of undetermined sex. Out of these records, the northern-most record of a female was at 30°30‘ latitude and only one record was of a kitten (located in the southern part of Sonora) (López-González *et al*. 2003).

Although methods used to calculate densities vary among studies, some ocelot population density estimates for particular habitats include: 5.7/38.6 miles^2 in subtropical thornscrub to tropical deciduous forest in Sonora, Mexico (Carrillo and López-González 2002); 25/39 mi^2 to 225/39 mi^2 in the tropical deciduous forest of Jalisco (Casariego Madorell 1998; Fernandez 2002); 30 adult ocelots/39 mi^2 in Bolivian dry-forests (Maffei *et al*. 2005); and 40 adult ocelots/39 mi^2 in the llanos (interspersed dry tropical forest in savanna) of central Venezuela (Ludlow and Sunquist 1987).

Threats

Habitat loss and fragmentation

Although the ocelot is protected over most of its range (Fuller *et al*. 1987), it is still threatened by habitat loss and fragmentation due to increased human development, agriculture, and cattle grazing; illegal killing (e.g., retaliatory killing due to depredation of poultry); and illegal trade (pet and pelt) (Fernandez 2002, Caso *et al*. 2008, USFWS 2016). Widespread commercial harvests for the fur trade ceased decades ago (Caso *et al*. 2008); however, human population growth and development continue throughout the ocelot‘s range. Connectivity among ocelot populations or colonization of new habitats is discouraged by the proliferation of highways and increased road mortality among dispersing ocelots. Increased illegal and law enforcement actions along the Mexico-United States border could limit ocelot movement across the border, but it is uncertain if and how much this is affecting that movement.

Vehicular mortality

In Texas, collisions with motor vehicles appear to be the leading cause of known ocelot mortality and accounted for 45 percent of deaths of 80 radio-tagged ocelots between 1983 and 2002 (USFWS 2016). Since 2007, in Arizona and Northern Sonora, there have been four documented cases of ocelots being killed by vehicles or illegally killed, including: one ocelot struck close to Globe; one ocelot struck on Mexico Highway 2, between Imuris and Cananea, Sonora; and two ocelots illegally killed in the Sierra Azul (pers.comm., Sergio Avila, Sky Island Alliance, March 15, 2013).

Conservation, Consultation and Recovery Planning

The ocelot is included on CITES Appendix I and is protected across most of its range (Caso *et al*. 2008). Part of the species range includes protected areas, including some capable of maintaining long-term viable populations (Caso *et al*. 2008). While loss and fragmentation of habitat adversely affect ocelot populations, there have been notable efforts to acquire, protect, and restore habitat, and decrease mortality of the species throughout its range. See a detailed account of planning and conservation efforts for the ocelots in the Texas-Tamaulipas and Arizona-Sonora Management Units in the 2016 Recovery Plan for the Ocelot, First revision.

The species has a recovery priority number of 5C, meaning that it has a low potential for recovery with a relatively high degree of conflict. Recovery for the ocelot was originally addressed in Listed Cats of Texas and Arizona Recovery Plan (with Emphasis on the Ocelot) (USFWS 1990). The Recovery Plan for the Ocelot (*Leopardus pardalis*), First Revision, finalized in August 2016 (USFWS 2016), has the goal of improving the status of the species to the point that it no longer needs the protection of the ESA. Objectives of the plan call for: 1) the assessment, protection, and restoration of sufficient habitat to support viable populations of the ocelot in the borderlands of the U.S. and Mexico; 2) the reduction of effects of human population growth and development to ocelot survival and mortality; 3) the maintenance or improvement of genetic fitness, demographic conditions, and health of the ocelot; 4) the assurance of long-term viability of ocelot conservation through partnerships, the development and application of incentives for landowners, application of existing regulations, and public education and outreach; 5) the use of adaptive management, in which recovery is monitored and recovery tasks are revised by the FWS in coordination with the Recovery Team as new information becomes available; and 6) the support of international efforts to ascertain the status and conserve the ocelot south of Tamaulipas and south of Sonora.

The major focus of the revised recovery plan is on two cross-border management units, the Texas/Tamaulipas Management Unit and the Arizona/Sonora Management Unit (ASMU). The boundaries of the ASMU are defined as the original range of the subspecies (L. p. sonoriensis) which generally extends from central Arizona south to southern Sinaloa. Delisting criteria for the ASMU are: 1) the ASMU metapopulation is estimated through reliable scientific monitoring to be at least 1,000 animals for 10 years and populations should be stable or increasing; 2) threats from habitat loss, habitat fragmentation, and poaching are reduced such that the ocelot can maintain healthy, viable populations for the foreseeable future; and 3) habitat linkages to facilitate an ASMU metapopulation have been identified and are conserved for the foreseeable future.

Mount Graham Red Squirrel

Description and Legal Status

Mount Graham red squirrels are small, grayish-brown arboreal rodents with a rusty to yellowish tinge along the back (Spicer *et al*. 1985). Their tails are fluffy and the ears are slightly tufted in winter (Spicer *et al*. 1985). In summer, a thin, black lateral line separates the upper parts from the whitish underparts. Based on measurements from ten Mount Graham red squirrel specimens, Hoffmeister (1986) calculated an average total length of 13.3 inches (in), body length of 7.8 in, and tail length of 5.4 in. Koprowski (2005) calculated the average adult weight over the course of two years ranged between 7.90-8.97 ounces (oz) (mean=8.35) for males and 7.90-8.38 (mean=8.06) oz for females. Hoffmeister (1986) found no sexual dimorphism in measurements of adult Mount Graham red squirrel.

The Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*; Mount Graham red squirrel) was listed as endangered in 1987 (52 FR 20994) (USFWS 1987). The final rule concluded that the Mount Graham red squirrel was endangered because its range and habitat were reduced, and its habitat was threatened by a number of factors, including the (then) proposed construction of an astrophysical observatory, occurrences of high-severity wildland fires, proposed road construction and improvements, and recreational developments at high elevations on the mountain. The rule noted that the subspecies might also suffer due to resource competition with the introduced Abert's squirrel. In 1990, we designated critical habitat for the Mount Graham red squirrel (55 FR 425) (USFWS 1990). We finalized the first Mount Graham red squirrel Recovery Plan in 1993 (USFWS1993); it is undergoing revision, and we currently have a revisioned draft recovery plan for the Mount Graham red squirrel (USFWS 2011).

Life History and Habitat

The red squirrel is highly territorial (C.C. Smith 1968), and the concept of one squirrel per midden is widely accepted and used for Mount Graham red squirrel management (Vahle 1978). Occasionally, conditions arise where more than one squirrel occupies a midden or a Mount Graham red squirrel uses more than one midden (Froehlich 1990, Koprowski *et al*. 2003 and 2004), but these are likely exceptional cases and usually seem to occur when food is either extremely abundant or rare. Maximum longevity for the red squirrel in the wild is reported to be 10 years (Walton 1903) and 9 years in captivity (Klugh 1927), although 3-5 years is more typical (Munroe *et al*. 2009).

Depending on climatic conditions and growing seasons, red squirrels throughout North America generally breed from February through July (Koprowski 2005). Female Mount Graham red squirrel give birth to fewer young (reported means=2.35 and 2.15) compared to other red squirrels (reported means=3.69 and 3.72) (Rushton *et al*. 2006 and Munroe *et al*. 2009, respectively). Nests can be in hollow trees, hollow snags, hollow logs, outside trees in nests of grass or foliose lichens (called dreys or bolus nests), or in holes in the ground (C.C. Smith 1968, Leonard and Koprowski 2009). Nests may be built in natural hollows or abandoned cavities made by other animals, such as woodpeckers, and enlarged by squirrels (USFWS 1993). Nest site selection by Mount Graham red squirrel is strongly influenced by stand composition, particularly density of corkbark fir, mature (large) trees, and decaying logs (Merrick *et al*. 2007). The availability of larger snags and cavity-containing trees, especially aspen, is of particular importance for this population, as they provide preferred nesting locations (Merrick *et al*. 2007).

Froehlich (1990) found that Mount Graham red squirrel built 60% of their nests in snags, 18% in hollows or cavities in live trees, and 18% in logs or underground. Only 4% of nests were bolus grasses built among branches of trees. Slightly different proportions were found by Morrell *et al*. (2009), who noted 67% of the Mount Graham red squirrel nests within their study area were located in tree cavities, 27% were bolus nests, and 7% were ground nests. Merrick *et al*. (2007) and Leonard and Koprowski (2009) found that Mount Graham red squirrel appear to favor cavity nests over dreys, whereas the nearest population of red squirrels in the White Mountains, the Mogollon red squirrel, predominantly used dreys. Merrick *et al*. (2007) suggest that cavity nests may offer benefits such as increased insulation, space for caching food when food resources are scarce, and more protection from ever-present avian predators. Leonard and Koprowski (2009) speculate that localized processes such as slightly elevated temperatures and isolation may be responsible for the disparity between these two subspecies.

Foods of Mount Graham red squirrel include: (1) conifer seeds from closed cones, (2) above- and below-ground macro-fungi and rusts, (3) pollen (pistillate cones) and cone buds, (4) cambium of conifer twigs, (5) bones, and (6) berries and seeds from broadleaf trees and shrubs. Fledglings and eggs of birds, mice, young rabbits, carrion, juniper berries, oak acorns, aspen seeds, and ash seeds have been reported as food items for other subspecies of red squirrel

(Warshall 1986). Each food is used seasonally: pollen and buds in the spring, bones by females during lactation, fungi in the spring and late summer, and closed cones low in lipids in the early summer. Closed cones high in lipids are stored for winter-time use (C.C. Smith 1968).

Mount Graham red squirrels eat seeds and store live cones from Englemann spruce, white fir, Douglas-fir, corkbark fir, and white pine (Rushton *et al*. 2006). Midden surveys indicate that Engelmann spruce and Douglas-fir are the most common tree species supplying Mount Graham red squirrel food. Douglas-fir, generally a consistent cone producer (Finely 1969), is important in the Pinaleño Mountains, especially in areas where it co-exists with Engelmann spruce, which is more prone to cone crop failure. Douglas-fir is a more widespread species in the Pinaleño Mountains than Engelmann spruce, but also is more often found in logged and patchy areas at lower elevations where microclimates to support middens may not be as suitable as at higher elevations. This may reduce its overall contribution to the food supply of red squirrel populations. The number of mature seed trees per territory necessary to supply the red squirrels' food requirements in the Pinaleño Mountains has not been determined. As nutritional values of seeds from different conifer species in the Pinaleños vary seasonally and by tree species (Miller 1991), diversity in the red squirrel's diet might be important both nutritionally and in terms of offering options when preferred sources run low.

Mount Graham red squirrels readily consume false truffles and other fungi, which appear during spring snowmelt and after summer rains begin (Brown 1986, Froehlich 1990). Those not eaten may be dried and stored (Brown 1986). Miller (1991) analyzed the nutritional content of the three above-ground species of mushrooms eaten by Mount Graham red squirrel. Percent crude protein and percent digestible protein were higher than all conifer seeds except Engelmann spruce in summer (Miller 1991). Truffle protein content also was as high as some conifer seeds per unit weight (Smith 1968). Mushrooms and truffles may take less effort to eat than extracting seeds from cones. Combined with information on nutritional values, this may explain in part the relative importance of fungi in the diet.

Mount Graham red squirrels inhabit a narrow selection of habitats in the high-elevation areas of the Pinaleño Mountains that support primarily Engelmann spruce (*Picea engelmanii*) and corkbark fir (*Abies lasiocarpa* var. *arizonica*); in the mixed-conifer stands dominated by Douglas fir (*Pseudotsuga menziesii*), with white fir (*Abies concolor*) and Mexican white pine (*Pinus strobiformis*) sub-dominants; and in the ecotone life zone between these community types. The squirrels apparently do not inhabit pure stands of ponderosa pine (*Pinus ponderosa*) (USFWS 1993).

Mount Graham red squirrels create middens, which are areas that consist of piles of cone scales in which squirrels cache live, unopened cones as a food source for over-wintering and during times of cone failure (M.C. Smith 1968, Finley 1969, Steele and Koprowski 2001). Placement of these middens tends to be on gentler, non-southerly-facing slopes in healthier, older forested areas with higher canopy closure, basal area, and number of large live trees (Finley 1969, Zugmeyer and Koprowski 2009, Hatten 2014). This type of placement allows specific moisture levels to be maintained within the midden, thereby creating prime storage conditions for cones and other food items, such as mushrooms, acorns, and bones (Finley 1969, Brown 1984, USFWS 1993, Zugmeyer and Koprowski 2009). They also seem to prefer areas with snags, piles and tangles of downed timber, and a higher volume of logs that provide cover and safe travel routes, especially in winter, when open travel across snow exposes them to increased predation. There appears to be no differentiation in selection of midden sites based on sex (Alanen *et al*. 2009).

Wood *et al.* (2007) used satellite imagery to examine three different-sized areas around middens to determine which size best predicted use by Mount Graham red squirrel when compared to randomly selected locations. They chose a 33-foot buffer distance to mimic previous field studies (Smith and Mannan 1994, Koprowski *et al.* 2005) and to reflect microclimate conditions at the midden that are appropriate for cone storage. They also selected 92-foot and 184-foot buffers to represent the smallest and largest known red squirrel territories reported in the literature (Steele 1998) to evaluate whether midden sites are selected at a larger scale and encompass landscape features farther away from the midden itself (e.g., large cone-producing trees). They identified that site selection best occurred on a 92-foot plot around middens, with strong selection on 184-foot plots as well. This indicates that midden site selection occurs not only at the microclimate level (where conditions are appropriate for cone storage), but also on a larger scale that encompasses other features found on the landscape. They determined that middens at both the 92-foot and 184-foot scale were more likely to be located in areas with a high number of healthy trees and correspondingly high seedfall.

Vahle (1978) noted the importance of single, mature, old growth Douglas-fir trees in home ranges of red squirrels in the White Mountains, Arizona, but also stated that at least 9 to 14 mature seed trees within a red squirrel's home range (average 1.2 acres) ensured an adequate food supply. In general, large, dominant trees are the best cone producers. Red squirrels usually concentrate their cone cutting for winter storage on the few trees in a stand that are the best cone producers (Finley 1969). Froehlich (1990) found that Mount Graham red squirrel tended to concentrate foraging bouts on the few productive trees within a squirrel's home range (average 8.9 acres). Mean diameter at breast height of these "forage trees" was significantly larger than other adult trees of the same species within the home range (Froehlich 1990).

Distribution, Abundance, Population Trends

The Mount Graham red squirrel is found only in the high-elevation forests of the Pinaleño Mountains (Hoffmeister 1986; Figure MGRS-1) in the Safford Ranger District of the CNF in southeastern Arizona. The subspecies inhabits upper elevation, mature to old-growth associations in mixed conifer and spruce-fir above approximately 8,000 feet. As recently as the 1960s, the species ranged possibly as far east as Turkey Flat and as far west as West Peak, but it is now only located as far west as Clark Peak. A local extirpation occurred on West Peak, possibly due to a fire in the mid-1970s that both isolated the West Peak subpopulation from the rest of the range and destroyed red squirrel habitat. Suitable habitat on West Peak is thought to currently exist (Hatten 2009), but no systematic surveys have been conducted there.

The population size of Mount Graham red squirrel throughout its range has been estimated and tracked since 1986 by an interagency team. Originally, the average occupancy rate for all middens was multiplied by the estimated number of middens on the mountain, 444, to yield an estimate of abundance for the red squirrel population (USFS 1988). In fall of 1990, different occupancy rates for each vegetation association (i.e., spruce-fir, transition, and mixed conifer forests) were used. Therefore, population estimates before and after 1990 may not be comparable.

Midden surveys show increasing numbers of Mount Graham red squirrel into 1998-2000, with peaks over 500, after which the population declined due to a decrease in habitat from multiple insect outbreaks and wildlfires (see **Threats**, below). Population estimates dropped 42% in 2001 as compared to 1998-2000; since that time, population estimates have remained fairly stable, varying from 199 to 346. The last survey (conducted in Fall 2016) resulted in a conservative estimate of 252 Mount Graham red squirrel, which is down for the 2015 estimate of 263 Mount Graham red squirrel (AGFD 2016).

As of 2015, a total of 1,394 locations have been documented (T. Snow, pers. comm. 2016). However, some of these have disappeared, some have never been relocated, some are unable to be verified, some were removed because they were inactive for three consecutive survey periods, and some were removed because they were actually a midden shift (meaning they were a duplicate). In 2015, 360 of these middens were considered available to Mount Graham red squirrel, meaning 1,034 had been removed for the reasons described. Of these 360, 87 are in mixed conifer, 32 are in spruce-fir, and 241 are in the ecotone between the two forest types.

Mount Graham red squirrel home-range sizes are 3 to 10 times greater than reported for other populations of red squirrels (Koprowski *et al*. 2008). Koprowski *et al*. (2008) found that male cores (in which they spend 50% of their time) and ranges (in which they spend 95% of their time) were similar to females except during summer, when cores and ranges were enlarged and both males and females could be found farther from their middens than in any other season. Male Mount Graham red squirrel maintain discrete core areas in all seasons except for summer (when they likely are looking for scarce females). Female Mount Graham red squirrel, on the other hand, minimize overlap throughout their home range during all seasons. The expansion of Mount Graham red squirrel home ranges in summer is perhaps because during fall, winter, and spring, Mount Graham red squirrel need to invest energy in defending their middens where food supplies are concentrated. In summer, cached food stocks are depleted and new, widely dispersed, food sources (such as mushrooms and ripening cones) become available, which, along with mate searching, could explain some of the increases in range size during this time of year (Koprowski *et al*. 2008).

Juvenile dispersal distances of Mount Graham red squirrel are significantly larger than other populations of red squirrels, suggesting forests in the Pinaleño Mountains are sub-optimal in comparison to other North American red squirrel habitat (Munroe *et al*. 2009). Merrick (2016) found that natal dispersal distances of Mount Graham red squirrel average 2,230 feet (± 3,502 feet), with a range between 0.0 feet and 15,708 feet. Additionally, she determined this dispersal is male-biased and non-philopatric (philopatry is the tendency of an animal to remain in or return to the area of its birth), which is different than other North American red squirrel populations, which are shown to have sex-unbiased, philopatric natal dispersal. Male Mount Graham red squirrel disperse farther than females (mean dispersal distance: males = 3,180 feet ± 4,018 feet; females = 1,112 feet ± 2,383 feet) and 53% of juveniles exhibit non-philopatric dispersal, with 65% of males dispersing ≥ 492 feet and 40% of females ≥ 328 feet. The distances moved and proportion of juveniles dispersing far from the maternal territory appear to be influenced by annual variation in conifer seed crops (Merrick 2016).

Merrick (2016) found that survivorship of dispersing Mount Graham red squirrel was similar among years, between males and females, and for individuals irrespective of their dispersal distance. Overall, individuals survived an average of 233 ± 90 days, with an average for females of 219.79 ± 92.54 days and 246.97 ± 85.61 days for males, including 48.7 % surviving through their first winter (43.6% of females, 54.1% of males). Long-distance dispersers who successfully settled experienced similar survival through their first winter (68.4% surviving) as individuals that successfully settled close to the natal area (59.0% surviving).

Threats

Habitat loss and fire

In recent years, forests in the Pinaleño Mountains have experienced significant ecological changes, many of which are dramatic and detrimental to the survival of Mount Graham red squirrel. From 1986 to 1995 there was a relatively large amount of predicted Mount Graham red squirrel habitat, with a generally level trend, followed by a gradual decline in predicted habitat between 1996 and 2003 (Hatten 2014). This decline corresponds with the 1996 Clark Peak Fire and multiple outbreaks of forest insects (described below). From 2004 to 2006 a rapid decline in habitat occurred, corresponding with the 2004 Nuttall Complex Fire, followed by a low trough of available habitat between 2007 and 2009 (Hatten 2014). The large, stand-replacing fires in 1996 and 2004 affected approximately 35,000 acres of forested area, which can significantly reduce survivorship of individual squirrels with middens inside the fire boundary (Koprowski et al. 2006). While Hatten (2014) reported a partial recovery in predicted Mount Graham red squirrel habitat between 2011 and 2013, southeastern Arizona currently is experiencing moderate to severe drought conditions in the short-term and abnormally dry conditions in the long-term (Arizona Department of Water Resources 2016). Extended drought creates severe physiological stress on trees, especially in the higher elevation forest types. While this drought is apparently within natural historical variation (Swetnam and Betancourt 1998), various emission scenarios suggest that by the end of the 21st century, average global temperatures are expected to increase 0.5 °F to 8.6 °F with the greatest warming expected over land (IPCC 2014). Localized projections suggest the southwestern U.S. may experience the greatest temperature increase of any area in the lower 48 states (IPCC 2007). Increasing temperatures in turn are predicted to be accompanied by a more arid climate (Seager et al. 2007), increasing insect outbreaks in Southwestern forests, and increasing wildfires (Betancourt 2004).

Human development

Human development, including road improvements to Swift Trail and the potential construction of up to four more telescopes in the future, may remove vegetation (up to 5.9% of red squirrel habitat; USFWS 2011). This could result in decreased food sources, potential increase of tree blowdown, changes in microhabitat, and increased vulnerability to predation, as well as increases in habitat fragmentation and population isolation. Chen and Koprowski (2016) found that forest roads acted as barriers for Mount Graham red squirrel regardless of traffic volume and had long-term impacts on animal space use. Even narrow forest roads with low traffic volume pose barriers for Mount Graham red squirrel. Chen and Koprowski (2016) determined that gaps in the canopy impeded animal movements and that greater canopy cover increased the probability of crossing, with a higher likelihood of road crossing being associated with more variable tree height and mating activity. Tree diseases are also present on the mountain and appear to be increasing in scale and intensity, particularly armillaria root disease (a native, parasitic fungus), which was observed in Engelmann spruce and corkbark fir in the mixed-conifer forest type during an associated blowdown event in 2008. Outbreaks of forest insects, including defoliators, bark beetles, and phloem feeders, have contributed to substantial additional tree mortality, particularly in the Engelmann spruce and corkbark fir populations. In 2005, trees near all 1,251 documented (at that time) red squirrel territories showed signs of insect damage. Additionally, between 1996 and 2010, Mount Graham red squirrel habitat decreased approximately 45% (Hatten 2014). With the loss of most of the higher-elevation habitat in the spruce-fir due to wildland fire and insect damage, red squirrels now occur primarily in the mixed-conifer forest on the mountain but also in remaining patches of spruce-fir. The potential for large-scale fires to occur in the remaining habitat of the Mount Graham red squirrel remains very high.

Predation
Annual adult mortality of Mount Graham red squirrel appears to be higher than for red squirrels throughout North America (47% vs. 34.73%) (Rushton *et al*. 2006). Munroe *et al*. (2009) suggest annual juvenile mortality also could be higher for Mount Graham red squirrel than other populations of red squirrels due to the extreme natal dispersal distance required to establish a new territory. However, this may not be the case. Merrick (2016) found that 48.7% of Mount Graham red squirrel juveniles survived through their first winter (43.6% of females, 54.1% of males), indicating a 51.3% juvenile mortality rate for Mount Graham red squirrel, which is less than the 61.82% juvenile mortality rate reported for red squirrels across their range (Rushton *et al*. 2006). Studies of radio-collared animals suggest predation accounts for a large majority of mortality in red squirrels (Kemp and Keith 1970, Rusch and Reeder 1978, Stuart-Smith and Boutin 1995a and 1995b, Kreighbaum and Van Pelt 1996, Wirsing *et al*. 2002); however, the availability of alternative prey for predators (Stuart-Smith and Boutin 1995a), availability of food for red squirrels (Halvorson and Engeman 1983, Wirsing *et al*. 2002), and variation in vigilance and use of open areas by individual squirrels (Stuart-Smith and Boutin 1995b) have been suggested to predispose some animals to higher susceptibility to predation. Several studies from across the species' range indicate that predation significantly impacts population size, with accounts of 19-70% of mortality being reported due to predation (Kemp and Keith 1970, Rusch and Reeder 1978, Wirsing *et al*. 2002).

Competition
The non-native Abert's squirrel (introduced in the Pinaleño Mountains in the 1940s) likely impacts Mount Graham red squirrel through competition for food resources (Hutton *et al*. 2003, Edelman 2004, Edelman and Koprowski 2005), nest sites (Edelman and Koprowski 2006), and dispersal territory (Steele and Koprowski 2001), and potentially can increase predator density by providing an additional food source, leading to higher predation rates for red squirrels. Conversely, Abert's squirrels could decrease per capita predation on red squirrels by serving as an additional food source for predators. Rushton *et al*. (2006) determined competition with Abert's squirrels has the potential for a much greater impact on Mount Graham red squirrel population size when compared to plausible increases in predation, and suggested further research into and monitoring of the effects of competition and predation on red squirrels.

Low genetic diversity
Koprowski *et al*. (2005) characterized the decline of the Mount Graham red squirrel in their study area as catastrophic. They note that in areas of high tree mortality in Alaska and Colorado, red squirrels did not completely disappear but rather persisted in residual stands of trees where conditions remained suitable. The ability of the Mount Graham red squirrel to survive the current habitat decline is unknown; however, it apparently survived a similar

situation in the late 1600s. Grissino-Mayer *et al*. (1995) sampled fire-scarred trees in four areas of the Pinaleño Mountains from Peter's Flat east to Mt. Graham. The oldest trees in the spruce-fir forest were about 300 years old. They found evidence for a widespread, stand-replacing fire in 1685 that probably eliminated much of the forest atop the Pinaleño Mountains. Although the Mount Graham red squirrel population persisted through that event and may persist through the current habitat-altering event, small populations can exhibit genetic or demographic problems that further compromise the ability of the subspecies to survive. Recent genetic analysis indicates levels of genetic variation in the Mount Graham red squirrel population are extremely low, and that the average relatedness among Mount Graham red squirrel individuals is high, suggesting that the Mount Graham red squirrel has either experienced multiple bottlenecks (including one possibly as a result of the fires and insect outbreaks beginning in 1996), or a single long-term bottleneck (Fitak *et al*. 2013). Low genetic variability in small populations is a concern because deleterious alleles are expressed more frequently, disease resistance might be compromised, and there is little capacity for evolutionary change in response to environmental change. Koprowski *et al*. (2005) recommended management actions to increase available habitat and population size in the near and distant future.

Conservation, Consultation and Recovery Planning

The objectives of the draft revised Mount Graham red squirrel Recovery Plan (USFWS 2011) are to: "restore and maintain sufficient Mount Graham red squirrel habitat to ensure the species' survival despite environmental stochasticity and the threat of climate change", and "maintain a self-sustaining population of Mount Graham red squirrels sufficient to ensure the species' survival." The revised draft recovery plan contains recovery criteria for Mount Graham red squirrel which includes: a mosaic of at least 70 percent of the range (13,838 acres) (downlisting) or at least 80 percent of the range (15,815 acres) (delisting) that meets the criteria for habitat listed in the justification below, and management agreements among the USFWS, CNF, and AGFD that will protect this habitat indefinitely are in place and being implemented; and statistical confidence (90 percent) that the rate of increase over a time of 10 years (5 generations) is 20 percent or greater of the known population (downlisting) or statistical confidence (90 percent) that the rate of increase over the following 20 years (10 generations) is increasing or stable (delisting). The goal of the revised draft plan is to assure the long-term viability of the Mount Graham red squirrel in the wild, allowing initially for reclassification to threatened status and, ultimately, removal from endangered and threatened status (USFWS 2011). Habitat conditions include: mature to old-growth stands that have closed canopies; and downed logs, snags, and interlocking branch networks (USFWS 2011). Areas are considered habitat if they are within the mixed conifer, ecotone, and spruce-fir series and they are above 9,000 feet; or if they are below 9,000 feet, they meet the following criteria: >2,353 m (7,720 feet) elevation, north or east aspect and < 45-degree slope.

Excellent Mount Graham red squirrel habitat is defined as those areas possessing all of the above characteristics. Suitable habitat as defined in the Recovery Plan generally contains many, but not necessarily all, of the optimal characteristics. The Recovery Plan states that habitat requirements may be modified pending the results of further research and monitoring. The Plan is currently in revision. It should be noted that the above characteristics were measured within a 33 foot radius (0.07 acres) surrounding midden locations (Mannan and Smith 1991). As described previously, more recent research indicates that Mount Graham red squirrel territories are much larger than this, up to 3 to 10 times greater than reported for other populations of red squirrels (Koprowski *et al*. 2008), and that midden-site selection best occurs using a 92 foot plot around middens, with strong selection using a 184 foot plot, as well (Wood *et al*. 2007). Therefore, Mount Graham red squirrel appear to select midden sites and territories based on characteristics beyond those described above as excellent habitat (which were measured only near the midden) and that usually correspond to a high number of healthy trees and high seedfall (Wood *et al*. 2007), as well as healthier, older forests: higher, gentler slopes, with non-southerly aspects, especially northward; and outside of heavily burned areas (Hatten 2014). Research continues to be conducted to further refine our understanding of Mount Graham red squirrel habitat characteristics.

Critical Habitat
On January 5, 1990, we designated approximately 1,900 acres as Mount Graham red squirrel critical habitat (Figure MGRS-1; 55 FR 425) (USFWS 1990). Critical habitat includes three areas:

- The area above 10,000 feet in elevation surrounding Hawk and Plain View peaks and a portion of the area above 9,800 feet;
- the north-facing slopes of Heliograph Peak above 9,200 feet; and
- the east-facing slope of Webb Peak above 9,700 feet.

The main attribute of these areas at that time was the existing dense stands of mature (about 300 years old) spruce-fir forest. The Mount Graham red squirrel Refugium established by the Arizona-Idaho Conservation Act has the same boundary as the designated critical habitat boundary surrounding Hawk and Plain View peaks (about 1,700 acres), but does not include critical habitat on Heliograph or Webb Peaks. Unfortunately, most of the habitat in the refugium and in critical habitat has been impacted by wildland fire and insect damage.

Primary Constituent Elements of Critical Habitat
- PCE 1: They are within the mixed conifer, ecotone, and spruce-fir series and they are above 9,000 feet; or
- PCE 2: If they are below 9,000 feet, they meet the following criteria:
    - >2,353 m (7,720 feet) elevation
    - north or east aspect
    - < 45-degree slope

Lesser Long-Nosed Bat

Description and Legal Status
The lesser long-nosed bat is a medium-sized, leaf-nosed bat. It has a long muzzle and a long tongue, and is capable of hover flight. These features are adaptations for feeding on nectar from the flowers of columnar cacti [e.g., saguaro (*Carnegiea gigantea*); cardon (*Pachycereus pringlei*); and organ pipe cactus (*Stenocereus thurberi*)]; and from paniculate agaves [e.g., Palmer's agave (*Agave palmeri*)] (Hoffmeister 1986).

The lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae)* was listed (originally, as *Leptonycteris sanborni*; Sanborn's long-nosed bat) as endangered in 1988 (USFWS 1988, 53 FR 38456). No critical habitat has been designated for this species. A recovery plan was completed in 1997 (USFWS 1997). Loss of roost and foraging habitat, as well as direct taking of individual bats during animal control programs, particularly in Mexico, have contributed to the current endangered status of the species. Recovery actions include roost monitoring, protection of roosts and foraging resources, and reducing existing and new threats. The recovery plan states that the species will be considered for delisting when three major maternity roosts and two post-maternity roosts in the U.S., and three maternity roosts in Mexico have remained stable or increased in size for at least five years, following the approval of the recovery plan. A 5-year review has been completed and recommends downlisting to threatened status (USFWS 2007b, 78 FR 55046). Litigation to cause the FWS to take that recommended action has been initiated. A Species Status Assessment (SSA) of the lesser long-nosed bat was completed in December 2016, which found greater numbers of roosts and lesser long-nosed bats than were previously known to exist, based on enhanced survey efforts (funded by recent mitigation funds from U.S. Customs and Border Protection) (USFWS 2016b). The FWS proposed delisting of the lesser long-nosed bat in a proposed rule recently published in the Federal Register (USFWS 2017, 82 FR 1665).

Life History and Habitat
Lesser long-nosed bats, which often forage in flocks, consume nectar and pollen of paniculate agave flowers; and pollen and fruit produced by a variety of columnar cacti. Nectar of these cacti and agaves is high energy food. Concentrations of some food resources appear to be patchily distributed on the landscape, and the nectar of each plant species used is only seasonally available. Cacti flowers and fruit are available during the spring and early summer; blooming agaves are available primarily from July through October. In Arizona, columnar cacti occur in lower elevational areas of the Sonoran Desert region, and paniculate agaves are found primarily in higher elevation desert scrub areas, semi-desert grasslands and shrublands, and into the oak and pine-oak woodlands (Gentry 1982). Lesser long-nosed bats are important pollinators for agave and cacti, as well as important seed dispersers for some cacti.

The conservation and recovery of lesser long-nosed bats requires the presence of secure and appropriate roost sites throughout the landscape (including maternity roost sites, as well as transitional and migration roost sites) and adequate forage resources in appropriate juxtaposition to provide for life history needs including breeding, parturition, and migration.

Within the U.S., habitat types occupied by the lesser long-nosed bat include Sonoran Desert scrub, semi-desert and plains grasslands, and oak and pine-oak woodlands. Farther south, the lesser long-nosed bat occurs at higher elevations. Maternity roosts, suitable day roosts, and concentrations of food plants are all critical resources for the lesser long-nosed bat. All of the factors that make roost sites suitable have not yet been identified, but maternity roosts tend to be very warm and poorly ventilated (USFWS 1997). Such roosts reduce the energetic requirements of adult females while they are raising their young (Arends *et al*. 1995).

Roosts in Arizona are occupied from late April to September (Cockrum and Petryszyn 1991) and on occasion, as late as November (Sidner 2000); the lesser long-nosed bat has only rarely been recorded outside of this time period in Arizona (Hoffmeister 1986, Sidner and Houser 1990, USFWS 1997). In spring, adult females, most of which are pregnant, arrive in Arizona and gather into maternity colonies in southwestern Arizona. These roosts are typically at low elevations near concentrations of flowering columnar cacti. After the young are weaned, these colonies mostly disband in July and August; some females and young move to higher elevations, primarily in the southeastern parts of Arizona near concentrations of blooming paniculate agaves. Adult males typically occupy separate roosts forming bachelor colonies. Males are known mostly from the Chiricahua Mountains and the Galiuro Mountains (Tim Snow, AGFD, pers. comm. 1999), but also occur with adult females and young of the year at maternity sites (USFWS 1997). Throughout the night between foraging bouts, both sexes will rest in temporary night roosts (Hoffmeister 1986).

Lesser long-nosed bats appear to be opportunistic foragers and extremely efficient fliers. They are known to fly long distances from roost sites to foraging sites. Night flights from maternity colonies to foraging areas have been documented in Arizona at up to 25 miles, and in Mexico, at 25 miles and 36 miles (one way) (Dalton *et al*. 1994, Ober *et al*. 2000, Ober and Steidl 2004, Lowery *et al*. 2009). Lowery *et al*. 2009 and Steidl (pers. comm. 2001) found that typical one-way foraging distance for bats in southeastern Arizona is roughly 6 to 18 miles. A substantial portion of the lesser long-nosed bats at the Pinacate Cave in northwestern Sonora (a maternity colony) fly 25-31 miles each night to foraging areas in OPCNM (USFWS 1997). Horner *et al*. (1990) found that lesser long-nosed bats commuted 30-36 miles round trip between an island maternity roost and the mainland in Sonora; the authors suggested these bats regularly flew at least 47 miles each night. Lesser long-nosed bats have been observed feeding at hummingbird feeders many miles from the closest known potential roost site (Yar Petryszyn, pers. comm. 1997, Lowery *et al*. 2009).

Distribution, Abundance, Population Trends

The lesser long-nosed bat population consists of a migratory subpopulation that migrates from central and southern Mexico to the southwestern United States (Arizona and New Mexico, as well as a resident subpopulation occupying central and southern Mexico. The lesser long-nosed bat is found throughout its historical range, from southern Arizona and extreme southwestern New Mexico, through western Mexico, south into central and southern Mexico. It has been recorded in southern Arizona from the Picacho Mountains (Pinal County) southwest to the Agua Dulce Mountains (Pima County) and Copper Mountains (Yuma County), southeast to the Peloncillo Mountains (Cochise County), and south to the international boundary.

Recent information indicates that lesser long-nosed bat populations appear to be increasing or stable at most Arizona roost sites identified in the recovery plan (AGFD 2005, Tibbitts 2005, Wolf and Dalton 2005, USFWS 2007b, Tibbitts 2009). Lesser long-nosed bat populations additionally appear to be increasing or stable at other roost sites in Arizona and Mexico not included for monitoring in the recovery plan (Sidner 2005, AGFD 2009a). Less is known about lesser long-nosed bat numbers and roosts in New Mexico.

Threats

Though lesser long-nosed bat populations appear to be doing well, many threats to their stability and recovery still exist, including excess harvesting of agaves in Mexico; collection and destruction of cacti in the U.S.; conversion of habitat for agricultural and livestock uses, including the introduction of bufflegrass, a non-native, invasive grass species; wood-cutting; alternative energy development (wind and solar power); illegal border activities and required law enforcement activities; drought and climate change; fires; human disturbance at roost sites; and urban development.

Approximately 50 lesser long-nosed bat roost sites, including maternity and late-summer roosts, have been documented in Arizona. Of these, 10-20 are monitored on an annual basis depending on available resources (USFWS 2016). Monitoring in Arizona between 2010 and 2015 documented approximately 80,000 lesser long-nosed bats in late-summer roosts and approximately 61,200 in maternity roosts (USFWS 2016). Thirteen lesser long-nosed bat roost sites in Mexico are also monitored annually. Over 100,000 lesser long-nosed bats are found at just one natural cave at the Pinacate Biosphere Reserve, Sonora, Mexico (Cockrum and Petryszyn 1991). The numbers above indicate that although a relatively large number of lesser long-nosed bats exist, the relative number of known roosts is quite small.

Roost disturbance and loss
The primary threat to lesser long-nosed bat is roost disturbance or loss. The colonial roosting behavior of this species, where high percentages of the population can congregate at a limited number of roost sites, increases the risk of significant declines or extinction due to impacts at roost sites. Lesser long-nosed bats remain vulnerable because they are so highly aggregated (Nabhan and Fleming 1993). Some of the most significant threats known to lesser long-nosed bat roost sites are impacts resulting from use and occupancy of these roost sites by individuals crossing the border illegally for a number of reasons. Mines and caves, which provide roosts for lesser long-nosed bats, also provide shade, protection, and sometimes water, for border crossers. The types of impacts that result from illegal border activities include disturbance from human occupancy, lighting fires, direct mortality, accumulation of trash and other harmful materials, alteration of temperature and humidity, destruction of the roost itself, and the inability to carry out conservation and research activities related to lesser long-nosed bats. These effects can lead to harm, harassment, or, ultimately, roost abandonment (USFWS 2005a). For example, the illegal activity, presumably by individuals crossing the border, at the Bluebird maternity roost site, caused bats to abandon the site in 2002, 2003, and 2005. Other reasons for disturbance or loss of bat roosts include the use of caves and mines for recreation; the deliberate destruction, defacing or damage of caves or mines; roost deterioration (including both buildings or mines); short or long-term impacts from fire; and mine closures for safety purposes. The presence of alternate roost sites may be critical when this type of disturbance occurs.

Loss of forage
Threats to lesser long-nosed bat forage habitat include excess harvesting of agaves in Mexico; collection and destruction of cacti in the U.S.; conversion of habitat for agricultural and livestock uses; the introduction of buffelgrass and other invasive species that can carry fire in Sonoran Desert scrub; woodcutting; urban development; fires; and drought and climate change.

Fire
Large fires supported by invasive vegetation in 2005 affected some lesser long-nosed bat foraging habitat, although the extent is unknown. For example, the Goldwater, Aux, and Sand Tank Fire Complexes on Barry M. Goldwater Range-East burned through and around isolated patches of saguaros. Rogers (1985) showed that saguaros are not fire-adapted and suffer a high mortality rate as a result of fire. Therefore, fire can significantly affect forage resources for lesser long-nosed bats in the Sonoran desert. Monitoring of saguaro mortality rates should be done to assess the impacts on potential lesser long-nosed bat foraging habitat. More recently, the summer of 2011 saw huge wildfires burning across Arizona. The Wallow Fire (538,049 acres) set a new state record, burning a larger area than the 2002 Rodeo-Chediski Fire (468,638 acres). The Horseshoe 2 Fire (222,954 acres) burned approximately 70 percent of the Chiricahua Mountains and became the 4th largest fire in Arizona history. In addition to the Horseshoe 2

Fire, two other large wildfires (Murphy Complex and the Monument Fire) and numerous smaller fires burned a total of 366,679 acres in the CNF. The Horseshoe 2, Monument, and Murphy fires affected lesser long-nosed bat forage and roost resources throughout those mountain ranges. Fire suppression activities associated with wildfires could also affect foraging habitat. For example, slurry drops can leave residue on saguaro flowers, which could impact lesser long-nosed bat feeding efficiency or result in minor contamination.

Drought and climate change

Drought may affect lesser long-nosed bat foraging habitat, though the effects of drought on bats are not well understood. The drought in 2004 resulted in near complete flower failure in saguaros throughout the range of lesser long-nosed bats. During that time however, in lieu of saguaro flowers, lesser long-nosed bats foraged heavily on desert agave (*Agave deserti*) flowers, an agave species used less consistently by lesser long-nosed bats (Tibbitts 2006). Similarly, there was a failure of the agave bloom in southeastern Arizona in 2006, probably related to the ongoing drought. As a result, lesser long-nosed bats left some roosts earlier than normal and increased use of hummingbird feeders by lesser long-nosed bats was observed in the Tucson area (Scott Richardson, USFWS, pers. comm. January 11, 2008). Climate change impacts to the lesser long-nosed bats in this portion of its range likely include loss of forage resources. Of particular concern is the prediction that saguaros, the primary lesser long-nosed bat forage resource in the Sonoran Desert, will decrease or even disappear within the current extent of the Sonoran Desert as climate change progresses (Weiss and Overpeck 2005). Monitoring bats and their forage during drought years is needed to better understand the effects of drought on this species.

Conservation, Consultation and Recovery Planning

The lesser long-nosed bat recovery plan (USFWS 1997) identifies the need to protect roost habitats and foraging areas and food plants, such as columnar cacti and agaves. The lesser long-nosed bat recovery plan provides specific discussion and guidance for management and information needs regarding bat roosts and forage resources (USFWS 1997). More information regarding the average size of foraging areas around roosts would be helpful to identify the minimum area around roosts that should be protected to maintain adequate forage resources.

The lesser long-nosed bat recovery plan (USFWS 1997), listing document (USFWS 1988), and the 5-year review summary and evaluation for the lesser long-nosed bat (USFWS 2007b), all discuss the status of the species, and threats, and are incorporated by reference.

Consultation History

We have produced numerous BOs on the lesser long-nosed bat since it was listed as endangered in 1988, some of which anticipated incidental take. Incidental take has been in the form of direct mortality and injury, harm, and harassment and has typically been only for a small number of individuals. Because incidental take of individual bats is difficult to detect, incidental take has often been quantified in terms of loss of forage resources, decreases in numbers of bats at roost sites, or increases in proposed action activities.

Examples of more recent BOs that anticipated incidental take for lesser long-nosed bats are summarized below. The 2016 Amended BO/CO for the proposed Rosemont Copper Mine, anticipated take due to: (1) harassment of 6,000 individuals at three post-maternity roosts; (2) harm of ten individuals at known lesser long-nosed bat roosts subject to the implementation of protective measures; and (3) loss of 5,401 acres of affected habitat containing Palmer's agave, a surrogate measure of take (via harm and harassment) of individuals (USFWS 2016a). The 2014 BO related to military activities on Fort Huachuca anticipated the take of 10 lesser long-nosed bats as a result of collisions with vehicles, aircraft, antennas, fences and other project features, the reduction by greater than 50% of 1 roost site due to noise, and the loss of forage plants up to 20% or 10 plants due to ground disturbing activities (USFWS 2014). The 2010 BO related to the NPS's abandoned mine closure program, anticipated the direct take of up to 115 lesser long-nosed bats as a result of collisions with mine closure structures, and the abandonment of one roost site due to mine closure activities (USFWS 2010). The 2009 and 2008 BOs for implementation of the SBInet Ajo 1 and Tucson West Projects, including the installation, operation, and maintenance of communication and sensor towers and other associated infrastructure, each included incidental take in the form of 10 bats caused by collisions with towers and wind turbine bladestrike mortality for the life (presumed indefinite) of the proposed action (USFWS 2009). The 2007 BO for Department of the Army Activities at and near Fort Huachuca (Fort), Arizona anticipated incidental take in the form of direct mortality or injury (six bats over the life of the project), harassment (20 bats per year), and harm (10 bats over the life of the project) (USFWS 2007a). The 2007 BO for the installation of one 600 kilowatt wind turbine and one 50KW mass megawatts wind machine on Fort Huachuca included incidental take in the form of 10 bats caused by blade-strikes for the life (presumed indefinite) of the proposed action (USFWS 2007c). The 2005 BO for implementation of the Coronado National Forest Land and Resource Management Plan (USFWS 2005b) included incidental take in the form of harm or harassment. The amount of take for individual bats was not quantified; instead take was to be considered exceeded if simultaneous August counts (at transitory roosts in Arizona, New Mexico, and Sonora) drop below 66,923 lesser long-nosed bats (the lowest number from 2001 – 2004 counts) for a period of two consecutive years as a result of the action. The 2004 BO for the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management included incidental take in the form of harassment. The amount of incidental take was quantified in terms of loss of foraging resources, rather than loss of individual bats (USFWS 2004). The 2003 BO for Marine Corps Air Station–Yuma Activities on the BMGR included incidental take in the form of direct mortality or injury (five bats every 10 years). Because take could not be monitored directly, it was to be considered exceeded if nocturnal low-level helicopter flights in certain areas on the BMGR increased significantly or if the numbers of bats in the Agua Dulce or Bluebird Mine roosts decreased significantly and MCASYuma activities were an important cause of the decline (USFWS 2003).

Mexican Spotted Owl

Description and Legal Status

In 1993, the FWS listed the Mexican spotted owl (Strix occidentalis lucida) (hereafter, referred to as Mexican spotted owl, spotted owl, and owl) as threatened under the ESA (USFWS 1993, 58 FR 14248). The FWS appointed the Mexican Spotted Owl Recovery Team in 1993, which produced the Recovery Plan for the Mexican spotted owl in 1995 (USFWS 1995). The FWS released the final Mexican Spotted Owl Recovery Plan, First Revision (Recovery Plan) in December 2012 (USFWS 2012, 77 FR 74688). Critical habitat was designated for the spotted owl in 2004 (USFWS 2004, 69 FR 53182).

A detailed account of the taxonomy, biology, and reproductive characteristics of the Mexican spotted owl is found in the Final Rule listing the owl as a threatened species (USFWS 1993), the original Recovery Plan (USFWS 1995), and in the revised Recovery Plan (USFWS 2012). The information provided in those documents is included herein by reference.

Life History and Habitat

The spotted owl occurs in forested mountains and canyonlands throughout the southwestern United States and Mexico (Gutiérrez *et al*. 1995). It ranges from Utah, Colorado, Arizona, New Mexico, and the western portions of Texas south into several States of Mexico. Although the owl's entire range covers a broad area of the southwestern United States and Mexico, it does not occur uniformly throughout its range. Instead, the Mexican spotted owl occurs in disjunct localities that correspond to isolated forested mountain systems, canyons, and in some cases steep, rocky canyon lands. Known owl locations indicate that the species has an affinity for older, uneven-aged forest, and the species is known to inhabit a physically diverse landscape in the southwestern United States and Mexico.

Distribution, Abundance, Population Trends

In addition to this natural variability in habitat influencing owl distribution, human activities also vary across the owl's range. The combination of natural habitat variability, human influences on owls, international boundaries, and logistics of implementation of the Recovery Plan necessitates subdivision of the owl's range into smaller management areas. The 1995 Recovery Plan subdivided the owl's range into 11 "Recovery Units" (RUs): six in the United States and five in Mexico. In the revision of the Recovery Plan, we renamed RUs as "Ecological Management Units" (EMUs) to be in accord with current FWS guidelines (USDC NMFS and USFWS 2010). We divide the Mexican spotted owl's range within the United States into five EMUs: Colorado Plateau (CP), Southern Rocky Mountains (SRM), Upper Gila Mountains (UGM), Basin and Range-West (BRW), and Basin and Range-East (BRE) (Figure MSO-1). Within Mexico, the Revised Recovery Plan delineated five EMUs: Sierra Madre Occidental Norte, Sierra Madre Occidental Sur, Sierra Madre Oriental Norte, Sierra Madre Oriental Sur, and Eje Neovolcanico.

Mexican spotted owl surveys since the 1995 Recovery Plan have increased our knowledge of owl distribution, but not necessarily of owl abundance. Population estimates, based upon owl surveys, recorded 758 owl sites from 1990 to 1993, and 1,222 owl sites from 1990 to 2004 in the United States. The Recovery Plan (USFWS 2012) lists 1,324 known owl sites in the United States. An owl site is an area used by a single or a pair of adult or subadult owls for nesting, roosting, or foraging. The increase in number of known owl sites is mainly a product of new owl surveys being completed within previously unsurveyed areas (e.g., several National Parks within southern Utah, Grand Canyon National Park in Arizona, Guadalupe National Park in West Texas, Guadalupe Mountains in southeastern New Mexico and West Texas, Dinosaur National Monument in Colorado, Cibola National Forest in New Mexico, and Gila National Forest in New Mexico). Thus, an increase in abundance in the species range-wide cannot be inferred from these data (USFWS 2012). However, we do assume that an increase in the number of areas considered to be occupied is a positive indicator regarding owl abundance.

Threats

Habitat loss – logging, catastrophic fire

Two primary reasons were cited for the original listing of the Mexican spotted owl in 1993: 1) the historical alteration of its habitat as the result of timber-management practices; and, 2) the threat of these practices continuing. The danger of stand-replacing fire was also cited as a looming threat at that time. Since publication of the original Recovery Plan (USFWS 1995), we have acquired new information on the biology, threats, and habitat needs of the Mexican spotted owl. Threats to its population in the U.S. (but likely not in Mexico) have transitioned from commercial-based timber harvest to the risk of stand-replacing wildland fire. Recent forest management has moved away from a commodity focus and now emphasizes sustainable ecological function and a return toward pre-settlement fire regimes, both of which have potential to benefit the spotted owl. Southwestern forests have experienced larger and more severe wildland fires from 1995 to the present, than prior to 1995. Climate variability combined with unhealthy forest conditions may also synergistically result in increased negative effects to habitat from fire. The intensification of natural drought cycles and the ensuing stress placed upon overstocked forested habitats could result in even larger and more severe fires in owl habitat. Several fatality factors have been identified as particularly detrimental to the Mexican spotted owl, including predation, starvation, accidents, disease, and parasites.

Livestock grazing, resource extraction, and human recreation

Historical and current anthropogenic uses of Mexican spotted owl habitat include both domestic and wild ungulate grazing, recreation, fuels reduction treatments, resource extraction (e.g., timber, oil, gas), and development. These activities have the potential to reduce the quality of owl nesting, roosting, and foraging habitat, and may cause disturbance during the breeding season. Livestock and wild ungulate grazing is prevalent throughout the range of the owl and is thought to have a negative effect on the availability of grass cover for prey species. Recreation impacts are increasing throughout the Southwest, especially in meadow and riparian areas. There is anecdotal information and research that indicates that owls in heavily used recreation areas are much more erratic in their movement patterns and behavior. Fuels reduction treatments, though critical to reducing the risk of severe wildland fire, can have short-term adverse effects to owls through habitat modification and disturbance. As the human population grows in the southwestern United States, small communities within and adjacent to wildlands are being developed. This trend may have detrimental effects to spotted owls by further fragmenting habitat and increasing disturbance during the breeding season.

Predation and disease

Several fatality factors have been identified as particularly detrimental to the Mexican spotted owl, including predation, starvation, accidents, disease, and parasites. For example, West Nile Virus also has the potential to adversely impact the Mexican spotted owl. The virus has been documented in Arizona, New Mexico, and Colorado, and preliminary information suggests that owls may be highly vulnerable to this disease (Courtney *et al*. 2004). Unfortunately, due to the secretive nature of spotted owls and the lack of intensive monitoring of banded birds, we will most likely not know when owls contract the disease or the extent of its impact to the owl range-wide.

High severity fire
Currently, high-intensity, stand-replacing fires are influencing ponderosa pine and mixed conifer forest types in Arizona and New Mexico. Uncharacteristic, high-severity, stand-replacing wildland fire is probably the greatest threat to the Mexican spotted owl within the action area. As throughout the West, fire severity and size have been increasing within this geographic area. Landscape level wildland fires, such as the Rodeo-Chediski Fire (2002), the Wallow Fire (2011), and the Whitewater-Baldy Complex (2012) have resulted in the loss of tens of thousands of acres of occupied and potential nest/roost habitat across significant portions of the Mexican spotted owl's range.

Climate Change
Global climate variability may also be a threat to the owl. Changing climate conditions may interact with fire, management actions, and other factors discussed above, to increase impacts to owl habitat. Studies have shown that since 1950, the snowmelt season in some watersheds of the western U.S. has advanced by about 10 days (Dettinger and Cayan 1995, Dettinger and Diaz 2000, Stewart et *al*. 2004). Such changes in the timing and amount of snowmelt are thought to be signals of climate-related change in high elevations (Smith *et al*. 2000, Reiners *et al*. 2003). One predicted impact of climate change is the intensification of natural drought cycles and the ensuing stress placed upon high-elevation montane habitats (IPCC 2007, Cook *et al*. 2004, Breshears *et al*. 2005, Mueller *et al*. 2005). The increased stress put on these habitats is likely to result in long-term changes to vegetation, and to invertebrate and vertebrate populations within coniferous forests and canyon habitats that affect ecosystem function and processes.

Critical Habitat
The FWS designated critical habitat for the Mexican spotted owl in 2004 on approximately 8.6 million acres of Federal lands in Arizona, Colorado, New Mexico, and Utah (USFWS 2004). Within the designated boundaries, critical habitat includes only those areas defined as protected habitats (defined as protected activity centers (PAC) and unoccupied slopes >40 percent in the mixed conifer and pine-oak forest types that have not had timber harvest in the last 20 years) and restricted (now called "recovery") habitats (unoccupied owl foraging, dispersal, and future nest/roost habitat) as defined in the 1995 Recovery Plan (USFWS 1995).

Overall, the status of the owl and its designated critical habitat has not changed significantly range-wide in the U.S. (which includes Utah, Colorado, Arizona, New Mexico, and extreme southwestern Texas), based upon the information we have, since issuance of the 2012 LRMP BO for CNF (USFWS 2012). This indicates that the distribution of owls continues to cover the same area and critical habitat is continuing to provide for the life history needs of the Mexican spotted owl throughout all of the EMUs located in the U.S. We do not have detailed information regarding the status of the Mexican spotted owl in Mexico, so we cannot make inferences regarding its overall status.

Wildland fire has resulted in the greatest loss of PACs and critical habitat relative to other actions (e.g., such as forest management, livestock grazing, recreation, etc.) throughout the U.S. range of the Mexican spotted owl. These wildland fires have mainly impacted Mexican spotted owls within the UGM EMU (e.g., Rodeo-Chediski and Wallow Fires on the Apache- Sitgreaves NF and Whitewater-Baldy Complex on the Gila NF) and BRW EMU (e.g., Horseshoe 2 Fire on the CNF); but other EMUs have been impacted as well (SRM EMU, the Santa Fe NF by the Las Conchas Fire; CP EMU by the Warm Fire; BRE EMU by the Little Bear Fire). In severely burned areas (e.g. within some areas of the Rodeo-Chedeski Fire), owl surveys conducted two years following the fire in previously occupied areas, failed to locate Mexican spotted owls (S. Hedwall, pers. comm.). However, we do not know the extent of the effects of these wildland fires on actual owl numbers.

Primary Constituent Elements of Critical Habitat
The primary constituent elements for Mexican spotted owl critical habitat were determined from studies of their habitat requirements and information provided in the Recovery Plan (USFWS 1995). Since owl habitat can include both canyon and forested areas, PCEs were identified in both areas.
The PCEs identified for the owl within mixed-conifer, pine-oak, and riparian forest types that provide for one or more of the owl's habitat needs for nesting, roosting, foraging, and dispersing are:

- PCE 1: Related to forest structure:
    - A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30 to 45 percent of which are large trees with mean diameter at breast height (4.5 feet above ground) of 12 inches or more;
    - A shade canopy created by the tree branches covering 40 percent or more of the ground; and
    - Large, dead trees (snags) with a mean diameter at breast height of at least 12 inches.
- PCE 2: Related to maintenance of adequate prey species:
    - High volumes of fallen trees and other woody debris;
    - A wide range of tree and plant species, including hardwoods; and
    - Adequate levels of residual plant cover to maintain fruits and seeds, and allow plant regeneration.

The PCEs listed above usually are present with increasing forest age, but their occurrence may vary by location, past forest management practices or natural disturbance events, forest-type productivity, and plant succession. These PCEs may also be observed in younger stands, especially when the stands contain remnant large trees or patches of large trees. Certain forest management practices may also enhance tree growth and mature stand characteristics where the older, larger trees are allowed to persist.

Steep-walled rocky canyonlands occur typically within the Colorado Plateau EMU, but also occur in other EMUs. Canyon habitat is used by owls for nesting, roosting, and foraging, and includes landscapes dominated by vertical-walled rocky cliffs within complex watersheds, including many tributary side canyons. These areas typically include parallel-walled canyons up to 1.2 miles in width (from rim to rim), with canyon reaches often 1.2 miles or greater, and with cool north-facing aspects. The PCEs related to canyon habitat include one or more of the following:

- Presence of water (often providing cooler and often higher humidity than the surrounding areas);
- Clumps or stringers of mixed-conifer, pine-oak, pinyon-juniper, and/or riparian vegetation;

- Canyon walls containing crevices, ledges, or caves; and,
- High percent of ground litter and woody debris.

Western Yellow-Billed Cuckoo

Description and Legal Status

Adult yellow-billed cuckoos have moderate to heavy bills, somewhat elongated bodies and a narrow yellow ring of colored bare skin around the eye. The plumage is grayish-brown above and white below, with reddish primary flight feathers. The tail feathers are boldly patterned with black and white below. They are medium-sized birds about 12 inches in length, and about 2 ounces in weight. Males and females differ slightly; the males have a slightly smaller body size, smaller bill, and the white portions of the tail tend to form distinct oval spots. In females the white spots are less distinct and tend to be connected (Hughes 1999).

Morphologically, the yellow-billed cuckoos throughout the western continental United States and Mexico are generally larger, with significantly longer wings, longer tails, and longer and deeper bills (Franzreb and Laymon 1993). Birds with these characteristics occupy the Western Distinct Population Segment (DPS) and we refer to them as the "western yellow-billed cuckoo." Only the Western DPS was listed as a threatened species (USFWS 2014b). Yellow-billed cuckoos in the west arrive on the breeding grounds 4 to 8 weeks later than eastern yellow-billed cuckoos at similar latitude (Franzreb and Laymon 1993, Hughes 1999).

The western Distinct Population Segment (DPS) of the yellow-billed cuckoo (*Coccyzus americanus)* was listed as a threatened species on October 3, 2014 (USFWS 2014a, 79 FR 59992). Critical habitat was proposed on August 15, 2014 (USFWS 2014b, 79 FR 48548) and as of yet, has not been finalized. Proposed critical habitat encompasses 546,335 acres across the western United States. We expect to publish a modified re-proposal for critical habitat for the cuckoo in 2017.

Additional details on the status of this species and proposed critical habitat are found in the final rule to list the species as threatened (79 FR 59992) and the proposed rule to designate critical habitat (79 FR 48548). A revised proposed rule that may include additional proposed critical habitat is under development. The discussions of the status of this species in these documents are incorporated herein by reference.

Life History and Habitat

Western populations of yellow-billed cuckoos are most commonly found in dense riparian woodlands, consisting primarily of cottonwood (*Populus fremontii*), willow (*Salix* spp.), and mesquite (*Prosopis* spp.), along riparian corridors in otherwise arid areas (Laymon and Halterman 1989, Hughes 1999). Occupied riparian habitat in Arizona may also contain box elder (*Acer negundo*), Arizona alder (*Alnus oblongifolia*), Arizona walnut (*Juglans major*), Arizona sycamore (*Platanus wrightii*), oak (*Quercus* spp.), netleaf hackberry (*Celtis reticulata*), velvet ash (*Fraxinus velutina*), Mexican elderberry (*Sambuccus mexicanus*), tamarisk (*Tamarix* spp.; also called salt cedar), acacia (*Acacia* spp.), and seepwillow (*Baccharis glutinosa*) (Corman and Magill 2000, Corman and Wise-Gervais 2005, USFWS unpubl. data). Tamarisk may be a component of breeding habitat, but there is usually a native riparian tree component within the occupied habitat (Gaines and Laymon 1984, Johnson *et al*. 2008a, McNeil *et al*.

2013, Carstensen *et al*. 2015). Although cuckoos are most commonly found in gallery riparian forest, in Arizona they may also use narrow bands of riparian woodland [Arizona Game and Fish Department (AGFD) 2015, Cornell Lab of Ornithology 2016]. Adjacent habitat on terraces or in the upland (such as mesquite) can enhance the value of these narrow bands of riparian woodland.

In most of the range, western yellow-billed cuckoos primarily breeds in riparian habitat along low-gradient (surface slope less than 3%) rivers and streams, and in open riverine valleys that provide wide floodplain conditions (greater than 325 feet). However, in the southwest, cuckoos can also breed in higher gradient drainages, and narrower and drier reaches of riparian habitat. Western yellow-billed cuckoos in Arizona will also use areas of mesquite and oak woodlands some distance from riparian gallery forests, including in the mountains of southeastern Arizona. Recent surveys found yellow-billed cuckoos with some regularity in these non-traditional habitats (Corman and Magill 2000; WestLand Resources, Inc. 2011, 2013a, 2013b, 2013c, 2015a, 2015b, 2015c; Tucson Audubon 2015; MacFarland and Horst 2015, 2016).

Throughout the western yellow-billed cuckoo range, a large majority of nests are placed in willow trees, but cottonwood, mesquite, walnut, box elder, sycamore, hackberry, oak, alder, soapberry (*Sapindus saponaria*), acacia, and tamarisk are also used (Laymon 1980; Hughes 1999; Corman and Magill 2000; Corman and Wise-Gervais 2005; Holmes *et al*. 2008; Tucson Audubon 2015; MacFarland and Horst 2015, 2016; USFWS unpubl. data).

Within the boundaries of the western distinct population segment (DPS) (see Figure 2 at 78 FR 61631), cuckoos occur from sea level to 7,000 feet (or slightly higher in western Colorado, Utah, and Wyoming) in elevation. The moist conditions that support riparian plant communities that provide western yellow-billed cuckoo habitat typically exist in lower elevation, broad floodplains, as well as where rivers and streams enter impoundments. In southeastern Arizona, however, cuckoos are also found nesting along more arid ephemeral and intermittent drainages with sycamore, mesquite, walnut, hackberry, alder, or mixed oak assemblages (Corman and Magill 2000; Corman and Wise-Gervais 2005; WestLand Resources, Inc. 2011, 2013a, 2013b, 2013c, 2015a, 2015b, 2015c; American Birding Association 2014; AGFD 2015; Tucson Audubon 2015; MacFarland and Horst 2015, 2016; Cornell Lab of Ornithology 2016). In the extreme southern portion of their summer range in the States of Sonora (southern quarter) and Sinaloa, Mexico, western yellow-billed cuckoos also nest in upland thorn scrub and dry deciduous habitats away from the riparian zone (Russell and Monson 1988), although their densities are lower in these habitats than they are in adjacent riparian areas.

Habitat for the western yellow-billed cuckoo in much of its range is largely associated with perennial rivers and streams that support the expanse of vegetation characteristics needed by breeding western yellow-billed cuckoos. The range and variation of stream flow frequency, magnitude, duration, and timing that will establish and maintain riparian habitat can occur in different types of regulated and unregulated flows depending on the interaction of the water and the physical characteristics of the landscape (Poff *et al*. 1997; USFWS 2002). Hydrologic conditions at western yellow-billed cuckoo breeding sites can vary widely between years and during low rainfall years, water or saturated soil may not be present. Cuckoos may move from one area to another within and between years in response to hydrological conditions. They may also nest at more than one location in a year. Some individuals also roam widely (several hundred miles), apparently assessing food resources before selecting a nest site (Sechrist *et al*. 2012).

Humid conditions created by surface and subsurface moisture appear to be important habitat parameters for western yellow-billed cuckoo. The species has been observed as being restricted to nesting in drainages where humidity is adequate for successful hatching and rearing of young (Hamilton and Hamilton 1965, Gaines and Laymon 1984, Rosenberg *et al*. 1991).

At the landscape level, the available information suggests the western yellow-billed cuckoo requires large tracts of willow-cottonwood or mesquite forest or Madrean evergreen woodland for their nesting season habitat. Habitat can be relatively dense, contiguous stands, irregularly shaped mosaics of dense vegetation with open areas, or narrow and linear. The association of breeding with large tracts of suitable riparian habitat is likely related to home range size. Individual home ranges during the breeding season average over 98 acres, and home ranges up to 500 acres have been recorded (Laymon and Halterman 1987, Halterman 2009, Sechrist *et al*. 2009, McNeil *et al*. 2011, McNeil *et al*. 2012). Within riparian habitat, western yellow-billed cuckoos require relatively large (>49 acres), patches of multilayered habitat for nesting, with optimal size generally greater than 197 acres (Laymon and Halterman 1989). The multilayered canopy provides shade and traps moisture to create the relatively cooler and more humid streamside conditions which are believed to be important for nesting success. They are also known to nest in early to mid-successional native riparian habitat.

In addition to the dense nesting grove, western yellow-billed cuckoos need adequate foraging areas near the nest. Foraging areas can be less dense or patchy with lower levels of canopy cover and may be a mix of shrubs, ground cover, and scattered trees (Carstensen *et al*. 2015, Sechrist *et al*. 2009, USFWS, unpubl. data). Cuckoos often forage in open areas, woodlands, orchards and adjacent streams (Hughes 1999), which include stands of smaller mesquite trees and even tamarisk (Rosenberg *et al*. 1991). In Arizona, adjacent habitat is usually more arid than occupied nesting habitat. This adjacent habitat can be used for foraging where large insects are produced. Habitat types include Sonoran desertscrub, Mojave desertscrub, Chihuahuan desertscrub, chaparral, semidesert grassland, plains grassland, and Great Basin grasslands (Brown and Lowe 1982, Brown 1994, Brown *et al*. 2007).

<u>Hydroriparian and Xeroriparian Cuckoo Habitat</u>. Large expanses of gallery riparian woodland (hydroriparian) habitat supports greater densities of cuckoos than less dense reaches of scattered riparian trees (cottonwood, willow, walnut, ash, mesquite) or xeroriparian woodlands of mesquite, oak, acacia, hackberry, desert willow, and juniper. However, these less dense reaches of scattered riparian trees and xeroriparian woodlands are also important to yellow-billed cuckoos as nesting substrate, foraging habitat, and as a buffer between more hydric sites and the adjacent, xeric uplands, which decreases the edge/interior ratio of a given hydroriparian patch.

<u>Migration habitat</u>. Migration habitat needs are not well known, although they appear to include a relatively wide variety of conditions. Migrating yellow-billed cuckoos have been found in coastal scrub, second-growth forests and woodlands, hedgerows, forest edges, and in smaller riparian patches than those used for breeding.

Distribution, Abundance, Population Trends
The yellow-billed cuckoo is a member of the avian family Cuculidae and is a neo-tropical migratory bird that winters in South America and breeds in North America. The breeding range of the entire species formerly included most of North America from southeastern and western Canada (southern Ontario and Quebec and southwestern British Colombia) to the Greater Antilles and northern Mexico [American Ornithologists Union (AOU) 1957, 1983, 1998].

Based on historical accounts, the western yellow-billed cuckoo was formerly widespread and locally common in California and Arizona, more narrowly distributed but locally common in New Mexico, Oregon, and Washington and uncommon along the western front of the Rocky Mountains north to British Columbia (AOU 1998, Hughes 1999). The species may be extirpated from British Colombia, Washington, and Oregon (Hughes 1999). The western yellow-billed cuckoo is now very rare in scattered drainages in western Colorado, Idaho, Nevada, and Utah, with single, non-breeding birds most likely to occur (USFWS 2014a, 2014b). The largest remaining breeding areas are in southern and central California, Arizona, along the Rio Grande in New Mexico, and in northwestern Mexico (USFWS 2014b).

In Arizona, the species was a common resident in the (chiefly lower) Sonoran zones of southern, central, and western Arizona (Phillips *et al*. 1964). The yellow-billed cuckoo now nests primarily in the central and southern parts of the state.

Yellow-billed cuckoos spend the winter in South America, east of the Andes, mainly south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (Ehrlich *et al*. 1992, AOU 1998). Wintering yellow-billed cuckoos generally use woody lowland vegetation near fresh water. However, wintering habitat of the western yellow-billed cuckoo is poorly known.

Arizona
In a survey in 1999 that covered 265 miles of river and creek bottoms (a subset of statewide cuckoo habitat), 172 Yellow-billed cuckoo pairs and 81 single birds were located in Arizona (Corman and Magill 2000). Drainages with greater than 10 yellow-billed cuckoo detections were found at 12 locations in Arizona: Bill Williams River, Colorado River, Gila River, Upper Cienega Creek, Hassayampa River, San Pedro River, Santa Maria River, Verde River, Sonoita Creek, Santa Cruz River, Altar Valley, and Agua Fria River. Sites with smaller populations were found at the Roosevelt Lake complex, Upper Tonto Creek, Pinto Creek, Sycamore Creek in Pajarito Mountains, Oak Creek, Lower Cienega Creek, Babocomari River, Pinal Creek, Bonita Creek, San Bernardino National Wildlife Refuge, Hooker Hot Springs, Big Sandy River, and many smaller drainages. Cuckoos have also been found during the breeding season in several drainages in the Santa Rita Mountains, Patagonia Mountains, Canelo Hills, Huachuca Mountains, Santa Catalina Mountains, Rincon Mountains, and Pajarito/Atascosa Mountains (WestLand Resources, Inc. 2012a, 2012b, 2013a, 2013b, 2014, 2015; MacFarland and Horst 2015, 2016; Cornell Lab of Ornithology 2016). Many drainages throughout Arizona have not been thoroughly surveyed and it is likely that additional yellow-billed cuckoo locations will be discovered. These include, but are not limited to the mountain ranges of southeastern Arizona, Eagle Creek, and along the Gila, San Francisco, and Blue Rivers.

Threats

Loss of riparian nesting habitat

The primary threat to the western yellow-billed cuckoo is loss or fragmentation of high-quality riparian habitat suitable for nesting (Corman and Wise-Gervais 2005, USFWS 2014a, 2014b). Habitat loss and degradation results from several interrelated factors, including alteration of flows in rivers and streams, mining, encroachment into suitable habitat from agricultural and other development activities on breeding and wintering grounds, stream channelization and stabilization, diversion of surface and ground water for agricultural and municipal purposes, poorly managed livestock grazing, wildfire, establishment of non-native vegetation, drought, and prey scarcity due to pesticides (Ehrlich *et al*. 1992, USFWS 2014b).

Gallery riparian woodland (hydroriparian) habitat for the western yellow-billed cuckoo has been modified and curtailed, resulting in only remnants of formerly large tracts of native riparian forests, many of which are no longer occupied by western yellow-billed cuckoos. Despite recent efforts to protect existing, and restore additional, riparian habitat in the Sacramento, Kern, and Colorado Rivers, and other rivers in the range of the western yellow-billed cuckoo, these efforts offset only a small fraction of historical habitat that has been lost. Therefore, we expect the threats resulting from the combined effects associated with small and widely separated habitat patches to continue to affect a large portion of the range of the western yellow-billed cuckoo.

Pesticide impacts

Pesticide use is widespread in agricultural areas in the western yellow-billed cuckoo breeding range in the United States and northern Mexico. Yellow-billed cuckoos have also been exposed to the effects of pesticides on their wintering grounds, as evidenced by DDT found in their eggs and eggshell thinning in the United States (Grocki and Johnston 1974, Laymon and Halterman 1987, Hughes 1999, Cantu-Soto *et al*. 2011). Because much of the species' habitat is in proximity to agriculture, the potential exists for direct and indirect effects to a large portion of the species in these areas through altered physiological functioning, prey availability, and, therefore, reproductive success, which ultimately results in lower population abundance and curtailment of the occupied range (Laymon 1980, Laymon 1998, Hughes 1999, Colyer 2001, Mineau and Whiteside 2013, Hopwood *et al*. 2013, Mineau and Palmer 2013, USFWS 2014b).

Fragmentation

The ongoing threats, including small isolated populations, cause the remaining populations to be increasingly susceptible to further declines and local extirpations through increased predation rates, barriers to dispersal by juvenile and adult yellow-billed cuckoos, chance weather events, fluctuating availability of prey populations, collisions with tall vertical structures during migration, defoliation of tamarisk by the introduced tamarisk leaf beetle (*Diorhabda* spp.), increased fire risk, and climate change events (Thompson 1961, McGill 1975, Wilcove *et al*. 1986).

Climate change

The warmer temperatures already occurring in the southwestern United States may alter the plant species composition of riparian forests over time. An altered climate may also disrupt and change food availability for the western yellow-billed cuckoo if the timing of peak insect emergence changes in relation to when the cuckoos arrive on their breeding grounds to feed on this critical food source.

Conservation, Consultation and Recovery Planning
Because western yellow-billed cuckoos were only recently listed as threatened in 2014, no projects in the action area have undergone formal section 7 consultation for effects to the cuckoo, with the exception of the April 28, 2016 *Revised Final Reinitiated Biological and Conference Opinion for the Rosemont Copper Mine, Pima County, Arizona*. Ongoing grazing and travel management projects will undergo reinitiation of consultation.

Proposed Critical Habitat
The FWS has proposed to designate approximately 546,335 acres of critical habitat in Arizona, California, Colorado, Idaho, Nevada, New Mexico, Texas, Utah, and Wyoming (USFWS 2014a).

Primary Constituent Elements of Proposed Critical Habitat
The PCEs of proposed critical habitat are based on riparian plant species, structure and quality of habitat and an adequate prey base. The physical and biological features of yellow-billed cuckoo proposed critical habitat are the principal biological or physical elements essential to yellow-billed cuckoo conservation which may require special management considerations or protection (USFWS 2014b). The proposed critical habitat rule identifies the following physical or biological features of yellow-billed cuckoo habitat to include (USFWS 2014b):

(We note that the following PCEs in the proposed critical habitat rule are undergoing review and may be adjusted to better characterize Arizona habitat conditions in a future revised proposed rule).

- *Riparian woodlands.* Riparian woodlands with mixed willow-cottonwood vegetation, mesquite-thorn forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are generally greater than 325 feet in width and 200 acres or more in extent. These habitat patches contain one or more nesting groves, which are generally willow-dominated, have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surround riparian and upland habitats;
- *Adequate prey base.* Presence of a prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas; and
- *Dynamic riverine processes*. River systems that are dynamic and provide hydrologic processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). This allows habitat to regenerate at regular intervals, leading to riparian vegetation with variously aged patches from young to old.
- Rivers and streams of lower gradient and more open valleys with a broad floodplain;
- Presence of abundant, large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, and dragonflies) and frogs during nesting season;
- Flowing rivers and streams, elevated subsurface groundwater tables, and high humidity;
- Flowing perennial rivers and streams and deposited fine sediments;

- Riparian trees including willow, cottonwood, alder (*Alnus* sp.), walnut (*Juglans* sp.), sycamore (*Platanus* sp.), boxelder (*Acer* sp.), ash (*Fraxinus* sp.), mesquite, and tamarisk that provide cover and shelter for foraging and dispersing yellow-billed cuckoos; and
- Blocks of riparian habitat greater than 200 acres in extent and greater than 325 feet in width, with one or more densely foliaged, willow-dominated nesting sites and cottonwood dominated foraging sites.

Sonoran Tiger Salamander

Description and Legal Status

The Sonoran tiger salamander is a large salamander with a dark venter and light-colored blotches, bars, or reticulation on a dark background. Metamorphosed terrestrial Sonoran tiger salamanders have a color pattern ranging from a reticulate pattern with an irregular network of light coloration, often coupled with light spots, on a dark background color to a pattern of large, well-defined light or yellow spots or transverse bars, some of which encroach on the dark venter (Jones *et al*. 1988). Metamorphosed Sonoran tiger salamanders measure from about 2.6 to 4.9 inches snout to vent length (SVL) (Lowe 1954, Jones *et al*. 1988). Male and female adult Sonoran tiger salamanders can be distinguished by the presence of two black folds of tissue (cloacal folds) on the caudal side of a male's vent.

Branchiate adults are gray to olive on the dorsum, head, and tail, and off-white to yellow on the ventral surface. They have three external gills on each side of their head. Larvae are aquatic with external plume-like gills and well-developed tail fins (Behler and King 1980). At this stage, they are gray on the dorsum, head, and tail, with little pigment on the ventral surface. They hatch without legs, but grow hind and forelimbs early in development.

Sonoran tiger salamanders are one of three subspecies of tiger salamanders found in Arizona; the other two subspecies are Arizona tiger salamanders (*A. t. nebulosum*) and barred tiger salamanders (*A. t. mavortium*). The barred tiger salamander is an introduced species in the San Rafael Valley and elsewhere in southern Arizona. The Sonoran tiger salamander was discovered in 1949 at the J.F. Jones Ranch stock tank in Parker Canyon, San Rafael Valley, Arizona (Reed 1951).

The eggs, larvae, and branchiate adults of the three subspecies appear similar, except that larval and branchiate adult Arizona and barred tiger salamanders sometimes develop into a cannibalistic morph that has a wider head, enlarged vomerine teeth, and feeds preferentially on smaller conspecifics. Metamorphosed Arizona tiger salamanders have 11-50 irregularly shaped, yellow to olive spots and blotches, often with indistinct edges (Stebbins 2003), on a dark dorsal ground, with a similar pattern on the head and tail. Metamorphosed barred tiger salamanders have large, distinct, yellowish bars, spots, or transverse bars on a darkly grounded dorsum. Some of the spots or bars encroach on the dark venter. The reticulate pattern that can be seen in Sonoran tiger salamanders is not seen in Arizona or barred tiger salamanders, however, many metamorphosed Sonoran tiger salamanders do not have the reticulate pattern and are visually indistinguishable from barred tiger salamanders.

The Sonoran tiger salamander was listed as an endangered species in 1997 as the Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*) (62 FR 665) (USFWS 1997). The listing covered the entire historical range in the United States and Mexico. Critical habitat was not designated for the salamander. A recovery plan for the species was completed in 2002 (USFWS 2002). Loss of natural standing water habitat; predation by non-native fish, bullfrogs, and crayfish; disease; and potential genetic swamping by the introduced, non-native barred tiger salamander (*A. m. mavortium*) have contributed to the current endangered status of the species. A recent update to the taxonomy of this subspecies is provided by Crother (2008); therefore, common and scientific names used herein follow Crother (2008).

Life History and Habitat

Past surveys indicate that Sonoran tiger salamander breeding takes place from late winter through spring with the potential for opportunistic breeding occurring after summer monsoon rains (Allison *et al*. 1994, Maret and Collins 1998). Courtship and breeding in tiger salamanders typically occurs at night and underwater, proving difficult to observe (USFWS 2002b). When fully developed, females may oviposit anywhere from 200 to 2000 gelatinous eggs either individually or in clumps of up to 50, attaching them to aquatic vegetation, sticks, fencing, and other substrata (Behler and King 1980). Hatching time is variable and dependent upon water temperature, but typically takes 2 to 4 weeks (USFWS 2002b). Once hatched, larval salamanders have well developed tails, small legs, and plume like gills. Their diet consists of zooplankton, algae, and a variety of aquatic macroinvertebrates (Behler and King 1980, Collins and Holomuzki 1984). From this point, their course of development is dependent upon the persistence of water. If the breeding site dries, some larvae metamorphose into terrestrial adults in as little as two months and a minimum snout vent length of 1.77 in (Collins *et al*. 1988, Maret and Collins 1998, Brodman and Jaskula 2002). If water persists, roughly 17 to 40 percent of Sonoran tiger salamanders may metamorphose into terrestrial adults (Collins *et al*. 1988), the remainder grow and mature into branchiate adults. Branchiate adults retain all the characteristics of the larvae, but are much larger and reproductively mature. Branchiate adults also feed on macroinvertebrates, but their diet may include salamander and other amphibian eggs and larvae (Holomuzki 1986). Although rare, under certain conditions the branchiate adult may further metamorphose into a cannibal morph, denoted by a larger head, bigger mouth, and more developed teeth (Pfennig and Collins 1993).

Little is known about the behavior and ecology of terrestrial Sonoran tiger salamanders outside their breeding sites. Using knowledge of other species as surrogates, we can assume that they feed mostly on terrestrial insects and spend the majority of their life in burrows, emerging on rainy nights or during periods of high humidity. While breeding site fidelity has been documented, terrestrial metamorphs are also the only life history stage that enables salamanders to disperse and colonize new habitat (Stenhouse 1985, USFWS 2002b, Jenkins *et al*. 2006). There are few data to evaluate the extent to which metamorphosed Sonoran tiger salamanders move away from breeding ponds. However, marked Sonoran tiger salamanders have been found 0.9 and 1.2 miles from tanks where they had been found the previous spring, and others have been found 1.9 to 2.5 miles from the nearest potential source population (Maret *et al*. 2006). Dispersal distance from a breeding site is likely dependent upon local topography, vegetation, precipitation, and availability of burrows.

Historically, the Sonoran tiger salamander probably inhabited springs, ciénegas, and possibly backwater pools of the Santa Cruz River and streams in the San Rafael Valley where permanent or nearly permanent water allowed survival of mature branchiates. The grassland community of the San Rafael Valley and adjacent montane slopes, where all extant populations of Sonoran tiger salamander occur, may represent relictual grassland and a refugium for grassland species. Tiger salamanders in this area might have become isolated and, over time, genetically distinct from ancestral *A. m. mavortium* and *A. m. nebulosum* (Jones *et al*. 1995, Storfer *et al*. 2004). The Sonoran tiger salamander apparently has opportunistically taken advantage of available stock tank habitats as natural habitats disappeared (Hendrickson and Minckley 1984) or were invaded by non-native predators with which the salamander cannot coexist (USFWS 2007c).

Although most records for Sonoran tiger salamanders occur at stock tanks where breeding occurs, terrestrial adults potentially may wander considerable distances from these aquatic habitats, and are occasionally encountered in upland habitats. A terrestrial adult Sonoran tiger salamander was captured in a pit fall trap at Oak Spring in Copper Canyon, Huachuca Mountains, by AGFD personnel. The nearest known breeding site is about 0.6 miles to the south, suggesting the salamander may have moved at least that far. Capture in a pit fall trap also confirms that the individual was surface active. On Fort Huachuca, S. Stone (pers. comm., 1998) reported finding terrestrial tiger salamanders (probably *A. m. mavortium*) 1.9 to 2.5 miles from the nearest known breeding pond. Referring to conservation of the California tiger salamander, *A. californiense*, Petranka (1998) finds that based on studies of movements of other *Ambystoma* species, conservation of a 650 to 1,650 feet radius of natural vegetation around a breeding pond would protect the habitat of most of the adult terrestrial population. Adults of *A. mavortium* subspecies typically live in or about mammal burrows (Petranka 1998), although metamorphs may construct their own burrows as well (Gruberg and Stirling 1972, Semlitsch 1983). Some species of salamanders exhibit migrations of up to several miles each way from breeding sites to upland habitats (Stebbins and Cohen 1995). If such migrations occur in the Sonoran tiger salamander, we have no information about migration corridors or non-breeding habitat. Because of the arid nature of the environments where the subspecies occurs, if salamanders move very far from breeding ponds, they likely do so during more mesic times of year, such as during the monsoon.

Distribution, Abundance, Population Trends

The distribution of the Sonoran tiger salamander is limited to the Santa Cruz and San Pedro river drainages in the San Rafael Valley and surrounding foothills of the Patagonia Mountains (called the Sierra San Antonio in Sonora) and Huachuca Mountains in Arizona, USA and likely extends into northern Sonora, Mexico. Most aquatic populations have been found in cattle tanks or impounded ciénegas, all within the Santa Cruz and San Pedro river drainages. The Sonoran tiger salamander has not been confirmed south of the US-Mexico border via genetic testing. Metamorphosed adult salamanders were observed in Portrero de Álamo ciénega at Rancho Los Fresnos, San Rafael Valley, Sonora, but not verified as *A.m. stebbinsi* (Varela-Romero *et al*. 1992, Rorabaugh *et al.* 2013). Most recently, Hossack *et al.* (2016a) detected tiger salamanders in six stock tanks in northern Sonora, one of which was a metamorphosed adult. Although genetic testing has yet to confirm these salamanders as Sonoran tiger salamanders, Hossack *et al*. (2016a) states that the metamorphosed adult had "dorsal and ventral patterns consistent with *A. m. stebbinsi*."

The Sonoran tiger salamander is known from at least 81 aquatic localities, although some sites may not be currently occupied by the subspecies (Collins and Jones 1987, Collins 1996, Abbate 1998, Hossack *et al.* 2016b). During intensive surveys in 1997, from one to 150 Sonoran tiger salamanders were found at 25 stock tanks (Abbate 1998). Populations and habitats are dynamic, thus the number and location of extant aquatic populations change over time, as exhibited by the differences between survey results in 1985 and 1993 to 1996 (Collins and Jones 1987; Collins 1996; J. Collins, 1996, pers. comm.). In 1999, the lab of Dr. James Collins, Arizona State University, found Sonoran tiger salamanders at 17 localities (Collins 1999). During a 10-year monitoring program conducted by AGFD to look at trends in occupancy, Sonoran tiger salamanders were found at 67 of 156 stock tanks surveyed, each of which was sampled for 1 to 8 years (Hossack *et al.* 2016b). Estimated occupancy of Sonoran Tiger Salamanders increased by 2.2% (95% CI = 0.4%–3.8%) per year during the 10-year study (Hossack *et al*. 2016b). However, the increase in occupancy coincided with a 2% annual increase in the proportion of ponds that contained water when surveyed (Hossack *et al*. 2016b). This increase in ponds that contained water when surveyed likely explains part of the trend in salamander occupancy (Hossack *et al*. 2016b).

Threats

Habitat loss

Before the 20th century, the San Rafael Valley contained many more cienegas and vernal pools than it does today. Erosion and arroyo cutting in the late 19th and early 20th centuries caused the San Rafael Valley water table to drop and many natural standing water habitats to disappear (Hendrickson and Minckley 1984, Hadley and Sheridan 1995). However, at the same time natural standing water habitats were disappearing, cattle ponds were built. Many of the remaining springs and cienegas were converted into impoundments at this time, so most of the small standing water habitats remaining in the San Rafael Valley are cattle ponds. Currently, Sonoran tiger salamanders breed almost exclusively in these cattle ponds. The fact that Sonoran tiger salamanders breed in human-constructed cattle ponds instead of natural habitats does not necessarily threaten persistence of the taxon. Sonoran tiger salamanders have successfully bred in cattle ponds for decades, but salamanders are now dependent on humans to maintain the habitat. In particular, cattle ponds require occasional re-excavation because they fill in with silt, and pond dams also require occasional maintenance. Cattle pond habitats are also vulnerable to extreme weather conditions. Long-term drought could dry many of the ponds, and if ponds remained dry for several years, lack of breeding could lead to local extirpation of the salamander population.

Non-native species predation and competition

There are reports of introduced non-native fish occurring in the San Rafael Valley as early as the 1950s, and various introduced fish species now occur in San Rafael Valley ponds, including mosquitofish, green sunfish, bluegill sunfish, black bullheads, and largemouth bass. Bullfrogs have also been in the valley since at least the early 1970s. Laboratory and field experiments have shown that metamorphosed bullfrogs and all of the fish species listed above quickly eat salamander larvae, and even adult Sonoran tiger salamanders have been found in the stomachs of adult bullfrogs (Snyder *et al*. 1998). In addition, whenever non-native fish are introduced to a pond, the salamanders almost always disappear within the next few years, and do not reappear unless all fish are removed (Snyder *et al*. 1998). Given the observation that bullfrogs eat salamanders and the effect of bullfrogs on other native western herpetofauna populations (Rosen *et al*. 1996, Kupferberg 1997, Kiesecker and Blaustein 1997), bullfrogs should be considered a threat to Sonoran tiger salamanders. Occasional drying of cattle ponds due to drought or siltation has limited the number of ponds occupied by non-native fish and bullfrogs, because both taxa are vulnerable to drying. Crayfish are potential predators on salamanders as well, but have only been found in a few San Rafael Valley ponds, and those did not contain salamanders (USFWS 2002b). Crayfish are in many San Rafael Valley streams; however, and if they are introduced to ponds with salamanders, it is likely they will harm Sonoran tiger salamanders, much as they have harmed other western herpetofauna populations (Gamradt and Kats 1996, Fernandez and Rosen 1996).

Disease

Tiger salamander populations in the western United States and Canada, including populations of the Sonoran tiger salamander, exhibit frequent epizootics, or disease outbreaks (Collins *et al*. 2001). Sonoran tiger salamander populations experience frequent disease-related die-offs (about 8% of populations are affected each year) in which almost all salamanders and larvae in the pond die. *Ambystoma tigrinum* virus (ATV) is the pathogen believed to be primarily responsible for these die-offs (Jancovich *et al*. 1997). ATV may be spread by bullfrogs, birds, cattle, or other animals that move among tanks (Jancovich *et al*. 1997); however, the viral life cycle appears to be restricted to tiger salamanders - no other syntopic hosts have been identified (Jancovich *et al*. 2001). In the laboratory, Sonoran tiger salamanders exhibited lower survival and growth rates when exposed to the disease as compared to Arizona tiger salamanders from the White Mountains of Arizona (Collins *et al*. 2003). Animals that survive ATV exposure may harbor transmissible infection for more than six months. Dispersing metamorphosed salamanders have been found carrying ATV, and when they return to a pond to breed, they may reinfect the aquatic population (Collins *et al*. 2003). ATV is an emerging pathogen (Storfer 2003), and genetic analysis suggests a single introduction and recent spread over a large geographic area from Arizona to Saskatchewan (Jancovich *et al*. 2005). ATV may have switched from sport fishes to salamanders or was introduced with water dogs (*A. m. mavortium*) imported for use as fish bait in Arizona and elsewhere (Jancovich *et al*. 2005). Collins *et al*. (2003) identified ATV in waterdogs obtained from a Phoenix bait shop.

Sonoran tiger salamanders can also be infected with *Batrachochytrium dendrobatidis* (*Bd*), a pathogenic chytridiomycete fungus associated with global declines of frogs and toads (Berger *et al*. 1998, Longcore *et al*. 1999, Speare and Berger 2000, Davidson *et al*. 2003). However, compared to anurans, infected salamanders exhibit only minimal symptoms (Davidson *et al*. 2000). In the laboratory, infected Sonoran tiger salamanders did not die from the disease and are capable of ridding themselves or much reducing chytrid infections by frequent sloughing of the skin (Davidson *et al*. 2003). Another fungal pathogen, *Batrachochytrium salamandrivorans* (*Bsal*), has caused recent die-offs of native salamanders in Europe, but has not been detected in the US yet (Gray *et al*. 2015). Death is generally preceded by a brief episode of abnormal body posture and behavior. Like *Bd*, *Bsal* infects the epidermal cells of amphibian skin, but *Bsal* seems to be more pathogenic to salamanders causing skin ulcerations with significant destruction of the epidermis. Loss of epidermal integrity with subsequent impairment of vital skin functions (e.g., electrolyte homeostasis, fluid balance, gas exchange, barrier against opportunistic pathogens) leads to death in susceptible species within two to three weeks after exposure (Martel *et al*. 2013). Modes of *Bsal* transmission are currently unknown, but are probably similar to that of *Bd* including direct contact between individuals and exposure to contaminated water or soil (Gray *et al*. 2015, Kilkpatrick *et al*. 2010).

Illegal collection

Illegal collection of salamanders for bait has been reported from the San Rafael Valley although there are no data on the number of Sonoran tiger salamanders that are collected for bait (Collins and Jones 1987, USFWS 2002b). If large numbers of salamanders are collected for bait, it could threaten the persistence of Sonoran tiger salamander populations. Given the popularity of other salamanders as bait, it is reasonable to assume that illegal collection of salamanders will continue to occur. Collecting *Ambystoma* in the San Rafael Valley is prohibited under Arizona Game and Fish Commission Orders 40 and 41, except under special permit. Furthermore, transport and stocking of live bullfrogs and fishing with live bait fish or *Ambystoma* within the range of the Sonoran tiger salamander in Arizona are prohibited (R1-316). Sale of live waterdogs at Parker Canyon Lake is prohibited under the same regulation. In the San Rafael Valley, live crayfish can be used as bait, but only at the place of capture. Transported crayfish must be dead. Arizona Game and Fish Department includes Sonoran tiger salamander in Arizona's Species of Greatest Conservation Need (AGFD 2012b); however, this designation affords the species and its habitat no legal protection. State of Arizona Executive Order Number 8-16 (Streams and Riparian Resources), signed on June 10, 1989, directs state agencies to evaluate their actions and implement changes, as appropriate, to allow for restoration of riparian resources.

Hybridization

Sonoran tiger salamanders also face the threat of genetic swamping by introduced barred tiger salamanders which are often sold as large larvae or branchiate adults for fishing bait or to anglers trying to establish a population that could be harvested at a later date. However, the data are inconclusive. Genetic analysis was conducted between the gene loci of Sonoran tiger salamanders and the gene loci of rosy salamanders (*A. rosaceum*), barred tiger salamander, and Arizona tiger salamanders (Jones *et al*. 1988). Based on distinctive reticulate color patterns, low heterozygosity, and apparent geographic isolation, subspecific designation of Sonoran tiger salamander was considered warranted by Collins and Jones (1987) and Jones *et al*. (1988). Further analysis of mitochondrial DNA reaffirmed subspecific designation (Collins *et al*. 1988). In more recent genetic analysis, Storfer *et al*. (2004) concluded that barred salamanders *(A. m. mavortium*) or hybrids between barred salamanders and Sonoran tiger salamanders may be present at seven stock tanks along Highway 83 and near Parker Canyon Lake in the San Rafael Valley (Storfer *et al*. 2004). Storfer *et al*. (2004) reported 6 microsatellite loci that had alleles that were diagnostic for the hybrids of *A. m. stebbinsi* and *A. m. mavortium*. A salamander population in Upper Garden Canyon Pond on Fort Huachuca, near the crest of the Huachuca Mountains, may also be putative hybrids of *A. m. mavortium* and *A. m. stebbinsi* (Storfer *et al*. 1999). In 2009, Andy Baldwin of the Arizona Sonora Desert Museum sampled tissues of five salamanders collected from Peterson Ranch Pond in Scotia Canyon (USFWS files). He concluded that two individuals appear to be A. m. stebbinsi and three appear to be A. m. nebulosum based on one microsatellite locus (USFWS files). One of these samples still needs to be redone (T. Jones, 2014, pers. comm.). The data are certainly suggestive of hybridization, but only one microsatellite locus is not particularly conclusive and further analysis is needed (T. Jones, pers. comm., 2014). An additional difficulty is that we don't know which microsatellites were which in recent analyses; as both Storfer *et al*. (1999) and Andy Balwin didn't report them.

Livestock grazing
With the exception of Bog Hole in the San Rafael Valley, Upper Garden Canyon Pond on Fort Huachuca, and Rancho Los Fresnos in Sonora, Mexico, cattle grazing occurs throughout the range of the Sonoran tiger salamander. Cattle can degrade habitat at stock tank breeding sites and overgrazing can cause loss of cover and erosion that can threaten the integrity of stock tanks used by the salamander. However, the salamander has coexisted for about 250 years with grazing and because of its current use of livestock tanks for breeding, is now dependent upon maintenance of cattle waters by ranchers (USFWS 2002b). For further information on the ecology, taxonomy, range, and threats to this subspecies, refer to Lowe (1954), Gehlbach (1967), Collins and Jones (1987), Snyder *et al*. (1998), and Crother (2008).

Conservation, Consultation and Recovery Planning
The conservation and recovery of Sonoran tiger salamanders requires the presence of secure breeding populations throughout the landscape and protection of adequate available habitat that supports viable populations in the long term. About 75 percent of the lands that fall within the range of the Sonoran tiger salamander is managed by Federal agencies, so that many activities that might affect the salamander or its habitat are also subject to section 7 consultation. A total of 19 section 7 consultations on Sonoran tiger salamanders included programmatic efforts for CNF Land Management Plans that address watershed management and multiple uses (livestock grazing, and wildfire and prescribed burns), fire suppression activities, military base operations, Department of Homeland Security infrastructure, sportfish stocking, and conservation actions for the species. Biological opinions on actions potentially affecting Sonoran tiger salamanders may be found at our website www.fws.gov/southwest/es/arizona in the section 7 Biological Opinion page of the Document Library. Consultations with the CNF in the late 1990's resulted in the development of a "Stock Pond Management and Maintenance Plan" addressing cattle pond maintenance guidelines to minimize incidental take of salamanders associated with cleaning out ponds (USFWS 1999a, b). The "Stock Pond Management and Maintenance Plan" was later included as an appendix to the species recovery plan. Consultations with the CNF also provided measures to reduce the possibility that salamanders might be unintentionally killed or moved among cattle ponds by fire suppression activities (USFWS 1999a, b; 2002c). A recent consultation regarding the effects of sportfish stocking provided conservation measures to reduce the risks from introduction of non-native tiger salamanders and non-native predatory organisms into Sonoran tiger salamander habitat (USFWS 2011a). At least 17 of the 81 sites where salamanders have been detected are on private lands to the west of Fort Huachuca (USFWS files). These private lands are used primarily for grazing, but potentially could be subdivided and developed as ranchettes, or used for other purposes. Compliance with the Act for activities on private lands that may affect the Sonoran tiger salamander, but are not addressed by section 7 consultation, could occur through section 10(a)(1)(B) of the Act.

Since completion of the Sonoran Tiger Salamander Recovery Plan in 2002, conservation actions ongoing for the salamander throughout its range include surveys and monitoring of populations, improvements to stock tanks that provide habitat, and when documented, enforcement of prohibition of illegal stocking of barred tiger salamanders in the habitat of the salamander. From 2003 through 2013, AGFD conducted monitoring of the salamander with a goal of estimating the proportion of area occupied (PAO), or fraction of actual habitat occupied by the species out of all available habitat that could be occupied. This methodology has allowed researchers to make inferences about the overall population and potential changes in abundance of a species across the greater landscape (MacKenzie and Kendall 2002, MacKenzie and Nichols 2004). Sampling is achieved by randomly conducting presence-absence surveys on a subset of all available habitats selected by a probability based sampling technique (Bailey *et al*. 2004). We are currently seeking funding in 2014 to analyze the PAO monitoring data, and use results to determine further needs for recovering the species. The FWS also conducted a 5-year review of the species in 2007 per requirements of the Act. This 5-year review emphasizes the threat of introgression to the species with barred tiger salamanders and recommends adaptive management for mixed populations of Sonoran and barred tiger salamanders, including eliminating such populations to reduce potential introgression. The overall recommendation of this 5-year review was to leave the species status as endangered (USFWS 2007c).

Chiricahua Leopard Frog

Description and Legal Status

The frog is distinguished from other members of the *Lithobates pipiens* complex by a combination of characters, including a distinctive pattern on the rear of the thigh consisting of small, raised, cream-colored spots or tubercles on a dark background; dorsolateral folds that are interrupted and deflected medially; stocky body proportions; relatively rough skin on the back and sides; and often green coloration on the head and back (Platz and Mecham 1979). The species also has a distinctive call consisting of a relatively long snore of 1 to 2 seconds in duration (Platz and Mecham 1979, Davidson 1996). Snout-vent lengths of adults range from approximately 2.1 to 5.4 inches (Platz and Mecham 1979, Stebbins 2003). The Ramsey Canyon leopard frog (*Lithobates* "*subaquavocalis*"), found on the eastern slopes of the Huachuca Mountains, Cochise County, Arizona, has recently been subsumed into *Lithobates chiricahuensis* (Crother 2008) and recognized by the FWS as part of the listed entity (USFWS 2009).

The Chiricahua leopard frog (*Lithobates [=Rana] chiricahuensis*) was listed as a threatened species without critical habitat in a Federal Register notice dated June 13, 2002 (USFWS 2002, 67 FR 40790). Included was a special rule to exempt operation and maintenance of livestock tanks on non-Federal lands from the section 9 take prohibitions of the Act. Critical habitat was designated in 2012 and includes 44 critical habitat units in Arizona and New Mexico (USFWS 2012, 77 FR 16324). The Chiricahua leopard frog Final Recovery Plan (Recovery Plan) was finalized in April 2007 (USFWS 2007).

Life History and Habitat

The life history of the Chiricahua leopard frog can be characterized as a complex life cycle, consisting of eggs and larvae that are entirely aquatic and adults that are primarily aquatic, making the species a habitat specialist (USFWS 2007). The species has a distinctive call and males can be temporarily territorial (USFWS 2007). Amplexus is axillary and the male fertilizes the eggs as the female attaches a spherical mass to submerged vegetation. Eggs are laid from February into October, with most masses found in the warmer months (USFWS 2007). Numbers of eggs in a mass range from 300 to 1,485 (Jennings and Scott 1991) and may be correlated with female body size. The hatching time of egg masses in the wild ranges between 8-14 days, depending on water temperature (USFWS 2007). Upon hatching, tadpoles are mainly herbivorous and remain in the water, where they feed and grow, with growth rates faster in warmer conditions. Tadpoles have a long larval period, from three to nine months, and may overwinter. After metamorphosis, Chiricahua leopard frogs eat an array of invertebrates and small vertebrates and are generally inactive between November and February (USFWS 2007). Males reach sexual maturity at 2.1-2.2 in, a size they can attain in less than a year (Sredl and Jennings 2005). Under ideal conditions, Chiricahua leopard frogs may live as long as 10 years in the wild (Platz et al. 1997, p. 553).

Chiricahua leopard frogs can be found active both day and night, but adults tend to be active more at night than juveniles (Sredl and Jennings 2005). Chiricahua leopard frogs presumably experience very high mortality (greater than 90 percent) in the egg and early tadpole stages, high mortality when the tadpole turns into a juvenile frog, and then relatively low mortality when the frogs are adults (Zug et al. 2001, USFWS 2007). Adult and juvenile Chiricahua leopard frogs avoid predation by hopping to water (Frost and Bagnara 1977).

They also possess an unusual ability among members of the *Rana pipiens* complex; they can also darken their ventral skin under conditions of low reflectance and low temperature (Fernandez and Bagnara 1991; Fernandez and Bagnara 1993), a trait believed to enhance camouflage and escape predation (USFWS 2007).

Males have larger home range sizes than females, with the largest home range for a male documented at 251,769 ft^2 (7,674 by 32 feet) (USFWS 2007). The maximum distance moved by a radio-telemetered Chiricahua leopard frog in New Mexico was 2.2 miles in one direction (preliminary findings of telemetry study by R. Jennings and C. Painter, Technical Subgroup, 2004). In 1974, Frost and Bagnara (1977) noted passive or active movement of Chiricahua and Plains (*Lithobates blairi*) leopard frogs for five miles or more along West Turkey Creek in the Chiricahua Mountains. In August 1996, Rosen and Schwalbe (1998) found up to 25 young adult and subadult Chiricahua leopard frogs at a roadside puddle in the San Bernardino Valley, Arizona. They believed that the only possible origin of these frogs was a stock tank located 3.4 miles away. Although amphibians are known to have limited dispersal and colonization abilities due to physiological constraints, limited movements, and high site fidelity (Blaustein *et al*. 1994), Chiricahua leopard frogs can disperse to avoid competition, predation, or unfavorable conditions (Stebbins and Cohen 1995). Dispersal most likely occurs within favorable habitat, making the maintenance of corridors that connect disjunct populations possibly critical to preserve populations of frogs. Active or passive dispersal (while carried along stream courses) of juveniles or adults to discrete aquatic habitats facilitates the creation and maintenance of metapopulations (USFWS 2007), an important option for a water-dependent frog in an unpredictable environment like the arid Southwest.

For far more detailed information on this species, please refer to the Recovery Plan (USFWS 2007), which is the baseline in regard to the current status, biology, and threats to the Chiricahua leopard frog.

The Chiricahua leopard frog is an inhabitant of montane and river valley cienegas, springs, pools, cattle (stock) tanks, lakes, reservoirs, streams, and rivers. The species requires permanent or semi-permanent pools for breeding and water characterized by low levels of contaminants and moderate pH, and may be excluded or exhibit periodic die-offs where *Bd*, a pathogenic chytridiomycete fungus, is present (see further discussion of this in the threats section below and in USFWS 2011). The diet of the Chiricahua leopard frog includes primarily invertebrates such as beetles, true bugs, and flies, but fish and snails are also eaten (Christman and Cummer 2006).

Prior to the invasion of perennial waters by predatory, non-native species (American bullfrog, crayfish, fish species), the frog was historically found in a variety of aquatic habitat types. Today, leopard frogs in the Southwest are so strongly impacted by harmful non-native species, which are most prevalent in perennial waters, that their occupied niche is increasingly restricted to the uncommon environments that do not contain these non-native predators, and these now tend to be ephemeral and unpredictable. This increased narrowing of its realized niche is a primary reason for the threatened status of the Chiricahua leopard frog.

Distribution, Abundance, Population Trends

The range of the Chiricahua leopard frog includes central and southeastern Arizona; west-central and southwestern New Mexico; and, in Mexico, northeastern Sonora, the Sierra Madre Occidental of northwestern and west-central Chihuahua, and possibly as far south as northern Durango (Platz and Mecham 1984, Degenhardt *et al*. 1996, Lemos-Espinal and Smith 2007, Rorabaugh 2008) (Figure CLF-1). Reports of the species from the State of Aguascalientes (Diaz and Diaz 1997) are questionable. The distribution of the species in Mexico is unclear due to limited survey work and the presence of closely related taxa (especially *Lithobates lemosespinali*) in the southern part of the range of the Chiricahua leopard frog (see further discussion below).

Evidence indicates that since the time of listing, the species has probably made at least modest population gains in Arizona, but is apparently declining in New Mexico. Overall in the U.S., the status of the Chiricahua leopard frog is either static or, more likely, improving, with much of the increase attributable to an aggressive recovery program. The effort is showing considerable results on the ground through the reestablishment of populations (mainly in Arizona), captive rearing programs, creation of refugia populations, and enhancement and development of habitat have helped stabilize or improve the status of the species in some areas (USFWS 2011). In Arizona and New Mexico, there are currently two main captive breeding facilities – the Phoenix Zoo and the Ladder Ranch. In Arizona, a captive breeding program was established with the Phoenix Zoo in 2005 and the Ladder Ranch (a private 155,553 acre ranch in Sierra County, New Mexico) began captive propagation-headstarting-release in 2011. These programs, in concert with habitat restoration activities occurring across both states, are contributing to range-wide recovery of the frog. Population status and trends in Mexico are unknown.

Arizona

In Arizona, the frog still occurs in seven of eight major drainages of historical occurrence (Salt, Verde, Coronado, San Pedro, Santa Cruz, Yaqui/Bavispe, and Magdalena river drainages), but appears to be extirpated from the Little Colorado River drainage on the northern edge of the species' range. Within the drainages where the species occurs, it was not found recently in some major tributaries and/or in river mainstems. For instance, the species has not been reported since 1995 from the following drainages or river mainstems where it historically occurred: White River, West Clear Creek, Tonto Creek, Verde River mainstem, San Carlos River, upper San Pedro River mainstem, Santa Cruz River mainstem, Aravaipa Creek, Babocomari River mainstem, and Sonoita Creek mainstem. In southeastern Arizona, no recent records (1995 to the present) exist for the following areas: Pinaleno Mountains, Peloncillo Mountains, and Sulphur Springs Valley. Moreover, the species is now absent from all but one of the southeastern Arizona valley bottom cienega complexes. Large valley bottom cienega complexes may have once supported the largest populations in southeastern Arizona, but non-native predators are now so abundant that the cienegas do not presently support the frog in viable numbers (USFWS 2002).

A review of the status of the species in Arizona from 2002, when the species was listed, to 2009 was conducted by Rorabaugh (2010). A comparison of survey results during 2005-2009 versus 1999-2002 revealed increasing numbers of sites occupied by Chiricahua leopard frogs from 2002-2008. The total number of occupied sites increased from 49 in 2002 to 80 in 2008 and 90 in 2009, while the number of robust breeding populations increased from 5 in 2002 to 13 in 2008, and then declined slightly to 11 in 2009. The total number of breeding populations increased from 26 in 2002 to 34 in 2008 and then declined by 1 for a total of 33 sites in 2009. These trends were also generally reflected at the RU level of analysis. Exceptions included a reduction in number of breeding populations in RU 3 from three to two and in RU 6 from three to zero. Recovery Unit 5 also exhibited a reduction in the number of robust breeding populations from two to zero. Overall, the data suggest that there has been an increase in the number of occupied sites from 2002-2009. However, the increase in sites may only represent a positive response to temporarily favorable environmental conditions (i.e., such as adequate summer rains in rare years that allow for limited dispersal, rather than an intrinsic improvement that will endure over time due to factors such as long-term drought) and/or it could be a result of our underestimating the number of sites in 2002 due to lack of surveys in areas the frog actually occurred in at that time.

The above data suggest substantial gains in the number of known locations of Chiricahua leopard frogs since the time of listing. However, basing status and trends on differences in numbers of occupied sites from 2002-2009 can be problematic for several reasons. First, if increasing trends are accurate, they may represent population response to temporarily favorable environmental conditions, such as adequate summer rains that allow dispersal, rather than an intrinsic improvement that will endure over time. Second, there are sources of bias that affect the conclusions. For instance, both data sets likely underestimate the number of occupied sites existing at the time, because some sites were unknown or surveys had not been conducted within the last three years to categorize all sites as occupied or unoccupied. But there is further bias in the survey data in that the 2009 data set benefits from recent discoveries of populations that could have existed in 2002, but we did not know of them at the time.

The latter type of bias can be eliminated by adding to the 2002 total all of the occupied sites that were discovered after 2002, except for those for which we are reasonably certain were unoccupied in 2002. If analyzed in this way, the total number of occupied sites, in 2002, increases from 49 to 83. This is roughly the same number of occupied sites as in 2008 (85). Based on this, the total number of occupied sites was fairly stable or increasing slightly in Arizona from 2002 (83) to 2008 (85) and 2009 (92). However, this correction inserts yet another type of bias into the sample – analyzed in this way, the 2002 total is based not only on what was found during 1999 to 2002, but also surveys during period 2003 to 2009. Yet the 2008 and 2009 totals are only based on surveys during 2005-2008 and 2006-2009 respectively. The number of occupied sites in 2009 would no doubt increase if we could add in new sites during the equivalent future period (through 2016). Though we cannot provide an exact number of expected new sites that may be established by 2016, each RU stakeholder group has identified locations for potential new sites, so we potentially could work towards establishing four to eight new sites per year (though not all of these site are guaranteed to be successful).

As a result, concluding there were 83 extant sites in 2002, 85 in 2008, and 92 in 2009, is likely the worst case scenario, in that this analysis is most likely to show any declines, if they occurred from 2002-2009. The actual trend is probably somewhere between that (roughly stable) to what was concluded in the previous analysis (substantial increases). In conclusion, there is no evidence of decline in Arizona; rather, the data suggest at least modest increases.

New Mexico
In New Mexico, the frog historically occurs in west-central and southwestern New Mexico in Catron, Grant, Hidalgo, Luna, Socorro, and Sierra Counties and has been collected or observed at 182 localities over time (Painter 2000). In 1995, Jennings reported that frogs still occurred at only eleven sites in New Mexico. Based on additional work, Painter (2000) listed forty-one localities at which frogs were found from 1994-1999. Thirty-three of these are north of Interstate 10 and eight are in the southwestern corner of the state. Thirty-one of the 41 populations were verified extant during 1998-1999 (Painter 2000). However, during May-August 2000, the frog was found at only eight of 34 sites (USFWS 2002). Three populations east of Hurley in Grant County declined or were extirpated during 1999 to 2000, and preliminary data indicate another population on the Mimbres River, also in Grant County, has experienced a significant die-off (USFWS 2002). Survey results from the 2004 field season indicate that there are 31 locations where the frog can be considered as likely to occur in New Mexico (R. Williams, USFWS, 2004, unpubl. data; R. Jennings, Western New Mexico University, 2005, unpubl. data).

A similar analysis as was done for Arizona populations (see above) was not possible in New Mexico because all sites have not been monitored annually and much of the reported survey information is reported as presence or absence. Due to the evolving nature of Chiricahua leopard frog monitoring since the early 1990s and the ability of frogs to move up to 5 miles, survey information has resulted in different definitions of "sites" and "populations" over time. Often site boundaries are indistinct making some connected areas a single site, and other connected areas several sites. Thus it is difficult to assess the frog's status by enumerating sites and often comparisons among sites are not equivalent. However, based upon the data available, we can conclude that the frog has continued to decline annually in New Mexico since listing.

As background, the final rule listing the species indicated the frog had been found at 41 sites from 1994-1999, and 31 of these 41 sites were verified as extant during 1998-1999. The rule explains that frogs were found at only 8 of 34 surveyed sites (of the original 41 sites) in 2000. The Recovery Plan indicated that 30-35 populations of Chiricahua leopard frogs were likely extant in New Mexico at the time of writing (2006-7). The tally of these 30-35 populations included dispersal sites, which indicates that not all of these populations were robust, breeding sites. Starting with the 41 sites from 1994-1999, 27 of those sites are now extirpated, four of them are considered unstable with low population numbers or are possibly extirpated, two are considered dispersal observations with no reproduction, one has an unknown status due to inaccessibility, and seven sites support reproduction and no significant die-off or population loss has been observed.

Based on the above data, collected from 2002 to 2010, 27 of the 41 sites are considered extirpated, representing a 66 percent drop in the known Chiricahua leopard frog sites in New Mexico during this 5- year period (USFWS 2011). Since listing in 2002, an additional 30 new sites have been identified. To date, of these 30 new sites, 15 have become extirpated, six are unstable with low population numbers or are possibly extirpated, four are considered dispersal observations with no reproduction, one site is on private property with an unknown population status, and at four sites reproduction is occurring and no significant die-off or population loss has been observed. New sites have been found due to increased surveying efforts in remote areas and growing access to private lands through partnership activities. Although undiscovered occupied sites may still exist, the rate and likelihood of finding new sites will diminish, as the area of unsurveyed habitat is reduced each year. Furthermore, while the frog has a large capacity for dispersal, because of the many of the new observations were not near known occupied sites, we assume that most of the new observations were existing locations and not newly colonized locations. Thus in the past eight years, these newer sites have reflected a similar trend of decline, with half of the sites no longer occupied.

Disease, particularly infection caused by *Bd*, has accounted for the majority of Chiricahua leopard frog declines. This disease seems to present more of a threat to the frog in New Mexico than it does in Arizona, perhaps due to the higher elevations and cooler conditions found at sites in New Mexico. However, non-native species (bullfrogs, crayfish, and non-native fish) also continue to significantly impact extant populations and threaten the frog in New Mexico. All remaining frog populations in New Mexico are extremely vulnerable to extirpation from disease, non-native species, small population sizes, habitat drying, and lack of connectivity between other suitable habitats or populations.

In recent years, New Mexico Chiricahua leopard frog partners have gained momentum in conservation actions. In an effort to stave off permanent genetic losses, much of the recovery activities in New Mexico have been focused on creating off-site refugia populations. This entails collecting wild eggs, tadpoles, or metamorphs and bringing them into captivity for rearing and disease testing and treatment if needed, and releasing them into confined steel rim tanks. Currently, the New Mexico Ecological Services Field Office and the BLM have the capacity to rear, hold, and treat animals; the FS has set up a quarantine holding facility (for first use in Spring 2011); and the Ladder Ranch has outdoor holding pens for adult frogs (for captive reproduction). For the Chiricahua leopard frog in New Mexico, our hope is that not only will the refugia sites serve as a back-up if there is a dieoff at the source population, but that with time, they will also serve as a source for additional repatriation efforts. The facilities that are contributing to these efforts will also serve to produce animals for repatriation projects once extant populations have been boosted. As of 2010, we have attempted to establish eight refugia populations.

Mexico: Sonora and Chihuahua

Based on published and unpublished reports and review of Sonora, Mexico collection data from 23 museums, the Chiricahua leopard frog is known from about 26 localities in Chihuahua, Mexico and 19 localities in Sonora (Lemos-Espinal and Smith 2007). *Lithobates [Rana] chiricahuensis* have been reported as far south as the Mexican state of Aguascalientes, but frogs south of central Chihuahua are of questionable identification (USFWS 2007). Based on limited surveys, populations of leopard frogs, gartersnakes, and other native aquatic herpetofauna are generally more intact and non-native predators are much less widely distributed in Sonora and at least parts of Chihuahua (Rosen and Melendez 2010, Lemos-Espinal and Smith 2007, Rorabaugh 2008). However, specifically for the Chiricahua leopard frog, data are insufficient to determine status or trends in Mexico. None of the Chiricahua leopard frog localities in Sonora have been revisited recently, with the exception of one in the Sierra Los Ajos. No frogs were found at that site (L. Portillo, pers. comm. 2009). Chiricahua leopard frogs have been observed recently at several sites in Chihuahua (R. Jennings, pers. comm. 2007), but not enough is known to assess status or trends.

The data suggest the status of the Chiricahua leopard frog is at least stable and probably improving in Arizona, declining in New Mexico, and unknown in Mexico. In pooled data for the U.S., a worst case analysis shows essentially no change in the number of occupied sites from 2002 to 2009 (133 versus 131, respectively); however, as discussed above, this likely underestimates the status of the species in Arizona, overestimates the status of the species in New Mexico, and includes data that are not standardized to be truly comparable. The actual situation is probably that the status of the species is stable in the U.S overall, but the different conditions between Arizona and New Mexico indicate that improvement is occurring only in Arizona at this time, while in New Mexico, frog numbers continue to decline. Continued and new aggressive recovery actions are needed to address threats to the species rangewide, to maintain positive trends in Arizona, to stabilize population losses in New Mexico, and to assist partners in Mexico with their conservation efforts. If on-going recovery actions are interrupted, drought worsens, or other threats intensify, the status of the species across its range could easily deteriorate.

Threats

The primary threats to this species are predation by non-native organisms and die-offs caused by a fungal skin disease – chytridiomycosis. The chytridiomycete skin fungus, (*Bd* is the organism that causes chytridiomycosis) is responsible for global declines of frogs, toads, and salamanders (Berger *et al*. 1998, Longcore *et al*. 1999, Speare and Berger 2000, Hale 2001). Additional threats include: drought, floods, degradation and loss of habitat as a result of water diversions and groundwater pumping, poor livestock management, altered fire regimes, mining, development, and other human activities; disruption of metapopulation dynamics, resulting from an increased chance of extirpation or extinction resulting from small numbers of populations and individuals, and environmental contamination (USFWS 2007). Loss of Chiricahua leopard frog populations is part of a pattern of global amphibian decline, suggesting other regional or global causes of decline may be important as well (Carey *et al*. 2001). Witte *et al*. (2008) analyzed risk factors associated with disappearances of ranid frogs in Arizona and found that population loss was more common at higher elevations and in areas where other ranid population disappearances occurred. Disappearances were also more likely where introduced crayfish occur, but were less likely in areas close to a source population of frogs.

Conservation, Consultation and Recovery Planning

The goal of the Recovery Plan (USFWS 2007) is to improve the status of the species to the point that it no longer needs the protection of the Endangered Species Act. The recovery strategy calls for reducing threats to existing populations; maintaining, restoring, and creating habitat that will be managed in the long term; translocation of frogs to establish, reestablish, or augment populations; building support for the recovery effort through outreach and education; monitoring; conducting research needed to provide effective conservation and recovery; and application of research and monitoring through adaptive management. Recovery actions are recommended in each of eight RUs throughout the range of the species. Management Areas are also identified within RUs where the potential for successful recovery actions is greatest.

The Recovery Plan identifies eight RUs in Arizona and New Mexico (Figure CLF-1 & Table CLF-1). Focus areas, referred to as Management Areas, are identified within each RU. Management Areas are areas with the greatest potential for successful recovery actions and threat alleviation. Hydrologic units and mountain ranges are used as Management Area boundaries. Within Management Areas, sites where metapopulations and robust, isolated populations occur or will be established are referred to herein as "recovery sites." Management Areas have been delineated to include all habitats of known extant Chiricahua leopard frog populations as well as other sites with the highest potential for recovery, including sites where habitat restoration or creation, and establishment or re-establishment of Chiricahua leopard frog populations will likely occur or has already occurred. We include all known extant populations within Management Areas boundaries because of the high value of those populations for recovery.

For the Chiricahua leopard frog to be recovered, conservation must occur in each RU (Table CLF-1). Successful conservation is not necessary in every Management Area and recovery does not depend upon an even distribution of recovery efforts across an RU. Rather, we anticipate that recovery efforts will be focused in those Management Areas and portions of RUs in which opportunities are best. Recovery criteria to delist the Chiricahua leopard frog includes: 1) at least two metapopulations located in different drainages, plus at least one isolated and robust population in each RU, 2) protection of these populations and metapopulations, 3) connectivity and dispersal habitat protection, and 4) reduction or elimination of threats and long-term protection. As noted in the USFWS's 1998 Consultation Handbook, RUs are population units that have been documented as necessary to both the survival and recovery of the species. Avoiding loss of populations or other serious adverse effects in a RU will ensure continued contribution of that RU to the recovery of the species.

Existing populations and suitable habitat in Management Areas will be protected through management. Management will include maintaining or improving watershed conditions both upstream and downstream of Chiricahua leopard frog habitats to reduce physical threats to aquatic sites and allow for Chiricahua leopard frog dispersal, reducing or eliminating non-native species, preventing and managing disease, and other actions. Suitable or potentially suitable unoccupied habitat with high potential for supporting Chiricahua leopard frog populations or metapopulations (referred to here as recovery sites) will be protected, and restored or created as needed, within Management Areas. These habitats will include aquatic breeding habitats and uplands or ephemeral aquatic sites needed for movement among local populations in a meta-population. Activities to achieve this include habitat management, removal of non-native species (e.g. American bullfrogs, non-native fishes, and crayfish), enhancing water quality conditions, and reducing sedimentation. Populations of Chiricahua leopard frogs will be established or reestablished in these Management Areas.

Critical Habitat

The 2012 final rule for the designation of critical habitat includes 39 critical habitat units across the range of the species in Arizona and New Mexico (USFWS 2012). Through the critical habitat designation process, the FWS determined the PCEs for the Chiricahua leopard frog. We consider the PCEs to be the elements of the physical or biological features that provide for a species' life-history processes and are essential to the conservation of the species.

With the exception of impoundments, livestock tanks, and other constructed waters, critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located.

The purpose of the designation of critical habitat is to conserve the PCEs essential to the conservation of the species through the identification of the appropriate quantity and spatial arrangement of the PCEs sufficient to support the life-history functions of the species. Because not all life-history functions require both PCEs, not all areas designated as critical habitat contain both PCEs. Each of the areas designated as critical habitat have been determined to contain sufficient PBFs, or with reasonable effort, PBFs can be restored to provide for one or more of the life-history functions of the Chiricahua leopard frog.

All areas designated as critical habitat will require some level of management to address the current and future threats to the Chiricahua leopard frog and to maintain or restore the PCEs. Special management in aquatic breeding sites will be needed to ensure that these sites provide water quantity, quality, and permanence or near permanence; cover; and absence of extraordinary predation and disease that can affect population persistence. In dispersal habitat, special management will be needed to ensure frogs can move through those sites with reasonable success.

Approximately 31 percent of all critical habitat for the Chiricahua leopard frog is located on five NFs in Region 3 (Coronado, Gila, Tonto, Coconino, and Apache-Sitgreaves NFs). In total, approximately 3,265 acres of critical habitat occurs on these five NFs and the majority of these critical habitat units are represented by populations occupying cattle tanks. The CNF, which is the subject of this BO, includes approximately 1,688 acres of the critical habitat.

Primary Constituent Elements of Critical Habitat

Based on the above needs and our current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, we have determined that the PCEs essential to the conservation of the Chiricahua leopard frog are:

- PCE 1: Aquatic breeding habitat and immediately adjacent uplands exhibiting the following characteristics:
    - Standing bodies of fresh water (with salinities less than 5 parts per thousand, pH greater than or equal to 5.6, and pollutants absent or minimally present), including natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, off-channel pools, and other ephemeral or permanent water bodies that typically hold water or rarely dry for more than a month. During periods of drought, or less than average rainfall, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but they would still be considered essential breeding habitat in non-drought years.
    - Emergent and or submerged vegetation, root masses, undercut banks, fractured rock substrates, or some combination thereof, but emergent vegetation does not completely cover the surface of water bodies.
    - Non-native predators (e.g., crayfish (*Orconectes virilis*), American bullfrogs (*Lithobates catesbeiana*), non-native predatory fishes) absent or occurring at levels that do not preclude presence of the Chiricahua leopard frog.

  - Absence of chytridiomycosis, or if present, then environmental, physiological, and genetic conditions are such that allow persistence of Chiricahua leopard frogs.
  - Upland areas that provide opportunities for foraging and basking that are immediately adjacent to or surrounding breeding aquatic and riparian habitat.
- PCE 2: Dispersal and non-breeding habitat, consisting of areas with ephemeral (present for only a short time), intermittent, or perennial water that are generally not suitable for breeding, and associated upland or riparian habitat that provides corridors (overland movement or along wetted drainages) for frogs among breeding sites in a metapopulation with the following characteristics:
  - Are not more than 1.0 mile overland, 3.0 miles along ephemeral or intermittent drainages, 5.0 miles along perennial drainages, or some combination thereof not to exceed 5.0 miles.
  - In overland and non-wetted corridors, provides some vegetation cover or structural features (e.g., boulders, rocks, organic debris such as downed trees or logs, small mammal burrows, or leaf litter) for shelter, forage, and protection from predators; in wetted corridors, provides some ephemeral, intermittent, or perennial aquatic habitat.
  - Are free of barriers that block movement by Chiricahua leopard frogs, including, but not limited to, urban, industrial, or agricultural development; reservoirs that are 50 acres or more in size and contain predatory non-native fishes, bullfrogs, or crayfish; highways that do not include frog fencing and culverts; and walls, major dams, or other structures that physically block movement.

Northern Mexican Gartersnake

Description and Legal Status

The northern Mexican gartersnake, which reaches up to 44 inches total length, ranges in color from olive to olive-brown or olive-gray with three lighter-colored stripes that run the length of the body, the middle of which darkens towards the tail. It may occur with other native gartersnake species and can be difficult for people without specific expertise to identify because of its similarity of appearance to other native gartersnake species.

The northern Mexican gartersnake (*Thamnophis eques megalops*) was designated a threatened species under the ESA on July 8, 2014 (USFWS 2014, 79 FR 38678). Please refer to this rule for more in-depth information on the ecology and threats to the species, including references. Critical habitat was proposed on July 10, 2013 (USFWS 2013, 78 FR 41500) and has not yet been designated. We expect to publish a modified re-proposal for critical habitat and an accompanying Notice of Availability announcing the draft Environmental Assessment and draft Economic Analysis in the future. Details on critical habitat are provided below. The final listing and proposed critical habitat rules are incorporated herein by reference.

Life History and Habitat

The northern Mexican gartersnake is an active predator and is thought to heavily depend upon a native prey base (Rosen and Schwalbe 1988). Northern Mexican gartersnakes forage along vegetated stream banks, searching for prey in water and on land, using different strategies (Alfaro 2002). Primarily, its diet consists of amphibians and fishes, such as adult and larval (tadpoles) native leopard frogs, as well as juvenile and adult native fish (Rosen and Schwalbe 1988), but earthworms, leeches, lizards, and small mammals are also taken. In situations where native prey species are rare or absent, this snake's diet may include non-native species, including larval and juvenile bullfrogs, western mosquitofish (Holycross *et al.* 2006, Emmons and Nowak 2013), or other non-native fishes. In northern Mexican gartersnake populations where the prey base is skewed heavily towards harmful non-native species, recruitment of gartersnakes is often diminished or nearly absent.

Sexual maturity in the subspecies occurs at two years of age in males and at two to three years of age in females (Rosen and Schwalbe 1988). Gartersnakes are viviparous (bringing forth living young rather than eggs). Mating has been documented in April and May followed by the live birth of between 7 and 38 newborns in July and August (Rosen and Schwalbe 1988, Nowak and Boyarski 2012).

Throughout its rangewide distribution, the northern Mexican gartersnake occurs at elevations from 130 to 8,497 feet (Rossman *et al.* 1996) and is considered a "terrestrial-aquatic generalist" by Drummond and Marcías-García (1983). The northern Mexican gartersnake is often found in riparian habitat, but has also been found hiding under cover in grassland habitat up to a mile away from any surface water (Cogan 2015). The subspecies has historically been associated with three general habitat types: 1) source-area wetlands (e.g., Cienegas or stock tanks); 2) large-river riparian woodlands and forests; and 3) streamside gallery forests (Hendrickson and Minckley 1984, Rosen and Schwalbe 1988). Emmons and Nowak (2013) found this subspecies most commonly in protected backwaters, braided side channels and beaver ponds, isolated pools near the river mainstem, and edges of dense emergent vegetation that offered cover and foraging opportunities. In the northern-most part of its range, the northern Mexican gartersnake appears to be most active during July and August, followed by June and September.

Distribution, Abundance, Population Trends

The northern Mexican gartersnake historically occurred in every county and nearly every subbasin within Arizona, from perennial or intermittent creeks, streams, and rivers as well as lentic wetlands such as cienegas, ponds, or stock tanks (Rosen and Schwalbe 1988, Rosen *et al.* 2001; Holycross *et al.* 2006, Cotton *et al.* 2013). In New Mexico, the gartersnake had a limited distribution that consisted of scattered locations throughout the Upper Gila River watershed in Grant and western Hidalgo Counties (Price 1980, Fitzgerald 1986, Degenhardt *et al.* 1996, Holycross *et al.* 2006). Within Mexico, northern Mexican gartersnakes historically occurred within the Sierra Madre Occidental and the Mexican Plateau, comprising approximately 85 percent of the total rangewide distribution of the subspecies (Rossman *et al.* 1996).

The only viable northern Mexican gartersnake populations in the United States where the subspecies remains reliably detected are all in Arizona: 1) the Page Springs and Bubbling Ponds State Fish Hatcheries along Oak Creek; 2) lower Tonto Creek; 3) the upper Santa Cruz River in the San Rafael Valley; 4) the Bill Williams River; and, 5) the middle/upper Verde River. In New Mexico and elsewhere in Arizona, the northern Mexican gartersnake may occur in extremely low population densities within its historical distribution; limited survey effort is inconclusive to determine extirpation of this highly secretive species. The status of the northern Mexican gartersnake on tribal lands, such as those owned by the White Mountain or San Carlos Apache Tribes, is poorly understood. Less is known about the current distribution of the northern Mexican gartersnake in Mexico due to limited surveys and limited access to information on survey efforts and field data from Mexico.

We have concluded that in as many as 23 of 33 known localities in the United States (70 percent), the northern Mexican gartersnake population is likely not viable and may exist at low population densities that could be threatened with extirpation or may already be extirpated (Table NMGS-1). Only five populations of northern Mexican gartersnakes in the United States are considered likely viable where the species remains reliably detected.

Threats
Predators
Natural predators of the northern Mexican gartersnake include birds of prey, other snakes, wading birds, mergansers, belted kingfishers, raccoons, skunks, and coyotes (Rosen and Schwalbe 1988, Brennan *et al.* 2009). Historically, large, highly predatory native fish species such as Colorado pikeminnow may have preyed upon northern Mexican gartersnakes where they co-occurred. Native chubs in their largest size class may also prey on neonatal gartersnakes, but this has not been confirmed in the literature or through field observation.

Harmful non-native species are a significant concern in almost every northern Mexican gartersnake locality in the United States and the most significant reason for their decline. Non-native species can contribute to starvation of gartersnake populations through competitive mechanisms, and may reduce or eliminate recruitment of young gartersnakes through predation. Other threats include alteration of rivers and streams from dams, diversions, flood-control projects, and groundwater pumping that change flow regimes, reduce or eliminate habitat, and favor harmful non-native species; and effects from climate change and drought (USFWS 2014, 79 FR 38678).

Critical Habitat
The action area for this project overlaps the following proposed critical habitat units: Cienega Creek Subbasin Unit, Upper Santa Cruz River Subbasin Unit, Redrock Canyon Unit, Bear Creek portion of San Pedro River Subbasin Unit and Babocomari River Subbasin Unit.

Cienega Creek Subbasin Unit
The Cienega Creek Subbasin Unit, which contains a combined 50,393 acres of proposed critical habitat within three subunits, the Cienega Creek Subunit, the Las Cienegas National Conservation Area Subunit, and the Cienega Creek Natural Preserve Subunit (Figure NMGS-1). This proposed unit is uniquely important for the northern Mexican gartersnake because it is the only unit in southern Arizona that provides an intact native prey base and is currently free of harmful non-native species. Only one other area proposed for designation as critical habitat in Arizona or New Mexico retains similar attributes, the Spring Creek Subunit, within the Verde River Subbasin Unit in central Arizona which is isolated from northern Mexican gartersnake populations in southern Arizona.

- In the Las Cienegas National Conservation Area Subunit, we have also proposed to designate critical habitat for a total of 45,020 acres of springs, seeps, streams, stock tanks, and terrestrial space between these features within the Las Cienegas National Conservation Area, including portions of Cienega Creek and upper Empire Gulch that occur within the boundary of the Las Cienegas National Conservation Area. Native fish and both Chiricahua and lowland leopard frog populations provide prey for northern Mexican gartersnakes, and ongoing bullfrog eradication has eliminated bullfrogs in the area, and reduces the threat of bullfrogs returning to this subunit. This subunit currently contains sufficient physical or biological features, including all PCEs, but will require special management to maintain or develop the physical or biological features, including preventing the invasion or reinvasion of bullfrogs from adjacent watersheds.

- The Cienega Creek Natural Preserve Subunit includes the proposal to designate critical habitat for a total of 4,260 acres of springs, seeps, streams, stock tanks, and terrestrial space between these features within the Cienega Creek Natural Preserve in Pima County, Arizona, including the reach of Cienega Creek that occurs within the Cienega Creek Natural Preserve. The Cienega Creek Natural Preserve is owned and managed by Pima County. Native fish and lowland leopard frog populations provide prey for northern Mexican gartersnakes, and ongoing bullfrog eradication in the area has eliminated them within this subunit. This subunit contains sufficient physical or biological features, including all PCEs but special management will be required to maintain or develop the physical or biological features, including preventing the invasion or reinvasion of bullfrogs. This subunit is being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act due to its conservation and management plan for native species.
- Within the Cienega Creek Subunit, and between the Las Cienegas National Conservation Area and Cienega Creek Natural Preserve subunits, we have also proposed to designate 1,113 acres of critical habitat along 7.1 stream miles of Cienega Creek, from the northern boundary of the Las Cienegas National Conservation Area to the southern boundary of Cienega Creek Natural Preserve in Pima County, Arizona. The Cienega Creek Subunit occurs on lands managed by the Arizona State Land Department in addition to a small amount of private land. Native fish and both Chiricahua and lowland leopard frog populations provide prey for northern Mexican gartersnakes, and recent, ongoing bullfrog eradication in the area reduces the threat of bullfrogs within this subunit. This subunit contains sufficient physical or biological features, including all PCEs. However, special management may be required to maintain or develop the physical or biological features, including preventing the invasion or reinvasion of bullfrogs.

The Cienega Creek Subbasin Unit was proposed as critical habitat for the northern Mexican gartersnake because it was occupied at the time of listing and contained sufficient physical or biological features to support life-history functions essential for the conservation of the species. We expect the physical or biological features in this unit will require special management consideration due to ongoing and regional threat of bullfrogs from adjacent watersheds.

Upper Santa Cruz River Subbasin Unit

The Upper Santa Cruz River Subbasin Unit is generally located in southeastern Arizona, east of Nogales, southeast of Patagonia, and southwest of Sierra Vista, in the San Rafael Valley, in Santa Cruz and Cochise Counties, Arizona (Figure NMGS-2). This unit consists of springs, seeps, streams, stock tanks, and terrestrial space (overland areas) between these features within a total of 113,895 acres of proposed critical habitat in the San Rafael Valley, including portions of Parker and Scotia canyons of the Huachuca Mountains, Arizona. For the streams within this unit, we are proposing the reach of Parker Canyon that includes 5.8 stream miles from Duquesne Road south of Loop Road, upstream to and including Parker Canyon Lake. The reach of Scotia Canyon we are proposing as critical habitat includes 3.7 stream miles from its confluence with an unnamed drainage at the junction with Bodie Canyon, upstream to its origin west of the Coronado National Forest-Fort Huachuca Boundary. The upper Santa Cruz River occurs within the San Rafael Valley, flowing south into Mexico. We are proposing 13.8 stream miles of the upper Santa Cruz River, from the International Border, upstream to its headwaters at the top of Sheep Ridge Canyon. The Upper Santa Cruz River Subbasin Unit occurs on lands primarily managed by the CNF, with remaining land management under the Arizona State Parks Department. This unit also contains private lands. All identified areas described in this unit have records for northern Mexican gartersnakes, and all identified areas are considered as being currently within the geographical area occupied by the species. Therefore, we are proposing this unit under section 3(5)(A)(i) of the Act because it is occupied by the species and because it contains sufficient amounts of the essential physical or biological features that may require special management considerations or protection.

This unit contains adequate populations of Chiricahua and lowland leopard frogs, as well as native fish species in various locations and densities, with the former being actively recovered in Scotia Canyon. Bullfrogs and non-native, spiny-rayed fish are also known to occur at various densities within this unit, and Parker Canyon Lake is managed as a warm-water sport fishery. Crayfish are also likely to occur in various locations and densities within this unit. Within this unit, primary constituent elements of aquatic habitat characteristics, terrestrial habitat characteristics and prey base are generally met, but the requirement for the absence or low level of harmful non-native species is deficient. Special management may be required to maintain or develop the physical or biological features, including continuing to promote the recovery or expansion of native leopard frogs and fish, and eliminating or reducing harmful non-native species. The San Rafael Ranch is being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act.

The Upper Santa Cruz River Subbasin Unit is proposed as critical habitat for the northern Mexican gartersnake because it was occupied at the time of listing and contains sufficient physical or biological features to support life-history functions essential for the conservation of the species. The physical or biological features in this unit may require special management consideration due to competition with, and predation by, non-native species that are present in this unit and potential effects from future high-intensity wildfires.

Redrock Canyon Unit

We are proposing to designate 1,971 acres of critical habitat along 14.0 stream miles of Redrock Canyon, from its confluence with Sonoita Creek, upstream to its origin north of Meadow Valley in the Canelo Hills, in Santa Cruz County. Redrock Canyon occurs predominately on lands managed by the CNF with remaining land in private ownership (Figure NMGS-3). The area proposed along Redrock Canyon is within the area considered occupied by the northern Mexican gartersnake. Therefore, we are proposing the areas in this unit under section 3(5)(A)(i) of the Act because they are occupied by the species and because they contain sufficient amounts of the essential physical or biological features that may require special management considerations or protection.

Redrock Canyon supports four species of native fish, and Chiricahua leopard frogs and Sonoran tiger salamanders have been reported. This subunit contains primary constituent elements of aquatic habitat characteristics, terrestrial habitat characteristics and the prey base is adequate, but the requirement for the absence or low level of harmful non-native species is deficient. Special management may be required to maintain or develop the physical or biological features, including the elimination or reduction of bullfrogs and the prevention of potential invasions from non-native, spiny-rayed fish. Lands within The Nature Conservancy's Patagonia-Sonoita Creek Preserve in this unit are being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act.

The Redrock Canyon Unit is proposed as critical habitat for the northern Mexican gartersnake because it is occupied at the time of listing and contains sufficient physical or biological features to support life-history functions essential for the conservation of the species. The physical or biological features in this unit may require special management consideration due to competition with, and predation by, harmful non-native species that are present in this unit.

San Pedro River Subbasin Unit
The San Pedro River Subbasin Unit is generally located in southeastern Arizona, east of Sierra Vista, Tucson, and Florence and west Douglas, Wilcox, and Safford, in Cochise, Pima, and Pinal Counties (Figure NMGS-4). This unit consists of a total of 23,690 acres along 165 stream miles of proposed critical habitat along the San Pedro River and Bear Creek. Land ownership or land management within this unit consists of lands managed by the BLM, CNF, Arizona State Land Department, San Carlos Apache Tribe, and privately owned lands. All identified areas described in the San Pedro River Subbasin Unit have records for northern Mexican gartersnakes, and all identified areas are considered as being currently within the geographical area occupied by the species. Therefore, we are proposing the areas in this unit under section 3(5)(A)(i) of the Act because they are occupied by the species and because they contain sufficient amounts of the essential physical or biological features that may require special management considerations or protection. The following narratives describe all of the subunits proposed as critical habitat in the San Pedro River Subbasin Unit.

- In the Bear Canyon Creek Subunit we proposed to designate 1,022 acres of critical habitat along 7.1 stream miles of Bear Canyon Creek, from the International Border, upstream to its origin south of Granite Peak in the Huachuca Mountains, in Cochise County, Arizona. The Bear Canyon Creek Subunit occurs predominately on lands managed by the CNF with remaining land in private ownership. Native fish comprise the fishery of Bear Canyon Creek, and GIS analysis suggests that native leopard frogs may also occur in limited density. Crayfish are also present. This subunit primary constituent elements of aquatic habitat characteristics, terrestrial habitat characteristics and prey base are generally met, but the requirement for the absence or low level of harmful non-native species is deficient. Special management may be required to maintain or develop the physical or biological features, including the elimination or reduction of crayfish and the establishment of secure leopard frog populations.
- The San Pedro River Subbasin Unit is proposed as critical habitat for the northern Mexican gartersnake because it is occupied at the time of listing and contains sufficient physical or biological features to support life-history functions essential for the conservation of the species. The physical or biological features in this unit may require special management consideration due to competition with, and predation by, harmful non-native species that are present in this unit.

Babocomari River Subbasin Unit
The Babocomari River Subbasin Unit is generally located in southeastern Arizona, east of Santa Rita Mountains, north of the Canelo Hills and Huachuca Mountains, south of the Whetstone Mountains, and west of the San Pedro River, in Santa Cruz and Cochise Counties (Figure

NMGS-5). This unit consists of springs, seeps, streams, stock tanks, and terrestrial space between these features within a total of 14,334 acres of proposed critical habitat in the Canelo Hills Cienega Preserve and Appleton-Whittell Research Ranch as well as along a total of 45 stream miles of portions of the Babocomari River, Post Canyon, O'Donnell Canyon, and Turkey Creek. Land ownership or management within this unit consists of lands managed by the BLM, CNF, Arizona State Land Department, and privately owned lands. All identified areas described in the Babocomari River Subbasin Unit have records for northern Mexican gartersnakes, and all identified areas are considered as being currently within the geographical area occupied by the species. Therefore, we are proposing the areas in this unit under section 3(5)(A)(i) of the Act because they are occupied by the species and because they contain sufficient amounts of the essential physical or biological features that may require special management considerations or protection. The following narratives describe all of the subunits proposed as critical habitat in the Babocomari River Subbasin Unit.

- In the Post Canyon Subunit we proposed to designate 795 acres of critical habitat along approximately 5.7 stream miles of Post Canyon, from the western boundary of the Appleton-Whittell Research Ranch, upstream to Post Well at the top of Post Canyon, in Santa Cruz County, Arizona. The Post Canyon Subunit occurs largely on privately owned lands as well as those managed by the CNF. Lowland leopard frogs and, perhaps, Chiricahua leopard frogs provide prey for northern Mexican gartersnakes in Post Canyon. Native fish may also occur due to a connection with nearby habitat that native fish are known to occupy. Crayfish occur in Post Canyon, and non-native, spiny-rayed fish, as well as bullfrogs, are known from the vicinity and may be present. This subunit contains sufficient primary constituent elements of aquatic habitat characteristics, terrestrial habitat characteristics and prey base are generally met, but the requirement for the absence or low level of harmful non-native species is deficient. Special management may be required to maintain or develop the physical or biological features, including the elimination or reduction of crayfish and the prevention of potential bullfrog and non-native, spinyrayed fish invasions. Lands owned by the Appleton-Whittell Research Ranch within this subunit are being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act.
- In the O'Donnell Canyon Subunit we proposed to designate 398 acres of critical habitat along approximately 2.5 stream miles of O'Donnell Canyon, between the southern boundary of the Appleton-Whittell Research Ranch upstream to the northern boundary of the Canelo Hills Cienega Preserve, and then from the southern boundary of the Canelo Hills Cienega Preserve upstream to its confluence with Pauline and Middle canyons, in Santa Cruz County, Arizona. The O'Donnell Canyon Subunit occurs predominantly on privately owned lands and those managed by the CNF. The area proposed along O'Donnell Canyon is within the area considered occupied by the northern Mexican gartersnake. Populations of native fish and Chiricahua leopard frogs provide a prey base for northern Mexican gartersnakes in O'Donnell Canyon, but crayfish and non-native, spiny-rayed fish may be present. Bullfrogs inhabit the region and present a threat of invasion. This subunit contains sufficient primary constituent elements of aquatic habitat characteristics, terrestrial habitat characteristics and prey base are generally met, but the requirement for the absence or low level of harmful non-native species is deficient. Special management may be required to maintain or develop the physical or biological features, including the elimination or reduction of crayfish and non-native,

spiny-rayed fish, as well as the prevention of potential bullfrog invasions. Lands owned by the Appleton-Whittell Research Ranch and the Canelo Hills Cienega Preserve within this subunit are being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act.

- In the Turkey Creek Subunit we proposed to designate 1,678 acres of critical habitat along approximately 12.0 stream miles of Turkey Creek, from its confluence with the Babocomari River, upstream to the northern boundary of the Appleton-Whittell Research Ranch, and then from the southwestern boundary of the Appleton-Whittell Research Ranch to its origin at an unnamed pond east of State Highway 83 and south of Forest Road 201, in Santa Cruz and Cochise Counties. The Turkey Creek Subunit occurs predominantly on privately owned lands and those managed by the CNF. Turkey Creek historically supported two species of native fish, which could still remain and supplement possible resident amphibian prey sources. One bullfrog was detected in 2004 within Turkey Creek, but no crayfish or non-native, spiny-rayed fish species are thought to currently occur there. This subunit contains sufficient primary constituent elements of aquatic habitat characteristics, terrestrial habitat characteristics and prey base are generally met, but the requirement for the absence or low level of harmful non-native species is deficient. However, special management may be required to maintain or develop the physical or biological features, including preventing harmful non-native species from becoming established and reintroducing native fish and leopard frogs into Turkey Creek. Lands owned by the Appleton-Whittell Research Ranch within this subunit are being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act.
- Appleton-Whittell Research Ranch Subunit. We are proposing to designate critical habitat on approximately 7,798 acres of springs, seeps, streams, stock tanks, and terrestrial space between these features within the Appleton-Whittell Research Ranch, in Santa Cruz County, Arizona. Portions of Post Canyon, O'Donnell Canyon, and Turkey Creek are included in this subunit. The Appleton-Whittell Research Ranch subunit occurs on privately owned lands, as well as lands managed by the BLM and CNF. The management of the Appleton-Whittell Research Ranch is overseen by The Audubon Society. Native fish and native leopard frog populations occur throughout Ranch and provide prey for northern Mexican gartersnakes. However, crayfish, bullfrogs, and non-native, spiny-rayed fish occur regionally and are an ongoing threat to northern Mexican gartersnakes in this area. This subunit contains sufficient physical or biological features, including all PCEs. However, special management may be required to maintain or develop the physical or biological features, including preventing the invasion of harmful non-native species. Private lands in this subunit are being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act.
- Canelo Hills Cienega Preserve Subunit. We are proposing to designate critical habitat on approximately 213 acres of springs, seeps, streams, stock tanks, and terrestrial space between these features within the Canelo Hills Cienega Preserve, in Santa Cruz County, Arizona. Portions of Post Canyon and O'Donnell Canyon are included within this subunit. The Canelo Hills Cienega Preserve includes lands owned by The Nature Conservancy, as well as other private lands under conservation easements with The Nature Conservancy. Native fish and leopard frogs may occur within this subunit. We do not have updated information on the status of harmful non-native species in this

subunit, but its management likely favors native species within the Preserve. Therefore, we conclude that this subunit contains all PCEs. However, special management may be required to maintain or develop the physical or biological features, including preventing harmful non-native species from becoming established. This subunit is being considered for exclusion from the final rule for critical habitat under section 4(b)(2) of the Act.

The Babocomari River Subbasin Unit is proposed as critical habitat for the northern Mexican gartersnake because it is occupied at the time of listing and contains sufficient physical or biological features to support life-history functions essential for the conservation of the species. The physical or biological features in this unit may require special management consideration due to competition with, and predation by, harmful non-native species that are present in this unit.

Primary Constituent Elements of Critical Habitat

Critical habitat for the northern Mexican gartersnake has been proposed in 14 units in portions of Arizona and New Mexico totaling 421,423 acres. Within these areas, the primary constituent elements of the physical and biological features essential to northern Mexican gartersnake conservation are:

- PCE 1: Aquatic or riparian habitat that includes:
  - Perennial or spatially intermittent streams of low to moderate gradient that possess appropriate amounts of in-channel pools, off-channel pools, or backwater habitat, and that possess a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of processing sediment loads; or
  - Lentic wetlands such as livestock tanks, springs, and cienegas; and
  - Shoreline habitat with adequate organic and inorganic structural complexity to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities (e.g., boulders, rocks, organic debris such as downed trees or logs, debris jams, small mammal burrows, or leaf litter); and
  - Aquatic habitat with characteristics that support a native amphibian prey base, such as salinities less than 5 parts per thousand, pH greater than or equal to 5.6, and pollutants absent or minimally present at levels that do not affect survival of any age class of the northern Mexican gartersnake or the maintenance of prey populations.
- PCE 2: Adequate terrestrial space (600 feet lateral extent to either side of bankfull stage) adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation (extended inactivity).
- PCE 3: A prey base consisting of viable populations of native amphibian and native fish species.
- PCE 4: An absence of non-native fish species of the families Centrarchidae and Ictaluridae, bullfrogs, and/or crayfish (*O. virilis, P. clarki*, etc.), or occurrence of these non-native species at low enough levels such that recruitment of northern Mexican gartersnakes and maintenance of viable native fish or soft-rayed, non-native fish populations (prey) is still occurring.

Conservation, Consultation and Recovery Planning
Several Federal actions affect this species every year that require formal section 7 consultation. There have been 15 biological opinions that have included the northern Mexican gartersnake. A complete list of all consultations affecting this species can be found here: https://www.fws.gov/southwest/es/arizona/Biological.htm. Survey work and recovery projects also occur periodically, and are summarized in the listing document (USFWS 2014d).

New Mexico Ridge-Nosed Rattlesnake

Description and Legal Status
The New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*) was listed as a threatened species on August 4, 1978 (USFWS 1978, 43 FR 34476). Critical habitat was also designated in Bear, Spring, and Indian Canyons of the Animas Mountains from 6,048 to 8,320 feet elevation. This subspecies is only known from three mountain ranges: the Animas and Peloncillo Mountains in southeastern Arizona and southwestern New Mexico, as well as the Sierra San Luis Mountains in northeastern Sonora and northwestern Chihuahua, Mexico (Degenhardt *et al*. 1986, Campbell *et al*. 1989, Painter 1995, Keegan *et al*. 1999). Its primary threats include illegal collection, severe wildfire, effects from climate change, and the potential for fixation of deleterious mutations associated with random genetic drift in small, isolated populations. One of five recognized subspecies under *Crotalus willardi*, the New Mexico ridge-nosed rattlesnake is a small (maximum of 2.19 feet total length) montane species.

Further information on the taxonomy, range, distribution, biology, and threats to the New Mexico ridge-nosed rattlesnake can be found in Degenhardt (1972), Applegarth (1980), Johnson (1983), Degenhardt *et al*. (1986), Campbell *et al*. (1989), Barker (1992, 1991), Painter (1995), Holycross (1995a & b, 1996, 1998, 2000), Holycross and Douglas (1997, 2007), Holycross and Goldberg (2001), Smith *et al*. (2001), and Ernst and Ernst (2003).

Life History and Habitat
The New Mexico ridge-nosed rattlesnake is an inhabitant of insular woodlands that were more widespread and continuous during Pleistocene glaciation events (Maldonado-Koerdell 1964, Barker 1992, Van Devender 1995). The New Mexico ridge-nosed rattlesnake has been found in steep, rocky canyons with intermittent streams or on talus slopes at elevations ranging from approximately 5,200-8,500 feet (Degenhardt *et al*. 1986, Campbell *et al*. 1989, Barker 1991, Painter 1995, A. Holycross, Arizona State University, pers. comm., 1997), and likely occurs as low as 5,000 feet in the Peloncillo Mountains (Holycross 1999). Geographic isolation, genetic divergence, and ecological nonexchangeability define evolutionary significant units (ESUs) in a threatened sky-island rattlesnake. Holycross and Douglas (2007) used molecular genetics to examine connectivity among the three disjunct populations of New Mexico ridge-nose rattlesnake. Data supported a hypothesis of northward range expansion from Mexico followed by isolation on sky island mountain ranges as the climate warmed and dried out. The Peloncillo population was found to be especially bottlenecked, apparently occurs in low density, and is ecologically quite different from the Animas and Sierra San Luis populations in regard to habitat use as well as diet. The authors label the Peloncillo population as an ESU, with the Animas and San Luis populations comprising management units of a second ESU.

Threats

Illegal Collection

Because of the small and disjunct nature of the populations, the subspecies is sensitive to habitat destruction or modification, and collection. FWS (1985) estimated that as many as 130 New Mexico ridge-nosed rattlesnakes may have been collected in the Animas Mountains between 1961 and 1974. Collection during this period may have significantly affected the Animas population (Harris and Simmons 1976, USFWS 1985). The Animas Mountains are largely privately owned, access to habitat areas is strictly controlled, and the New Mexico ridge-nosed rattlesnake population is now protected from collection. The majority of the subspecies' suitable habitat in the Peloncillo Mountains is managed by the CNF and the BLM and is open to public use, providing greater opportunities for illegal collection.

Fire

Holycross *et al*. (2002) stated that preservation of encinal and pine-oak woodlands and associated faunal communities is essential to the conservation of the New Mexico ridge-nosed rattlesnake. Fire, combined with climate change that drives declining forest health and susceptibility to fire (van Mantgem *et al*. 2009), may be the most important threat to the subspecies and its woodland habitat (Smith *et al*. 2001, Barker 1991). Large, high intensity, stand-replacing fire occurred in the snake's habitat in the Animas Mountains in 1989 (Swetnam and Baisan 1996) and in the Sierra San Luis in 1989 (Barker 1991) and before 1952 (Marshall 1957). The 1997 escaped Maverick prescribed fire in the Peloncillo Mountains burned woodlands at high intensities in two of the 12 areas where *C. w. obscurus* had been observed in that mountain range. The 2003 Baker prescribed burn took place in the southeastern headwater areas of Sycamore Creek, the northwestern and northeastern headwater areas of Guadalupe Canyon, and the northeastern aspects of the Guadalupe Mountains. The CNF estimated that approximately 54 percent of the 47,528-acre project area burned to some degree (USFS 2004). Approximately 105 acres (2 percent) of the approximately 5,000 acres of New Mexico ridge-nosed rattlesnake habitat ranked as 3 and 4 in the Peloncillo Mountains burned at a high intensity.

Consultation on the Peloncillo Programmatic Fire Management Plan on the CNF (USFWS 2004, #02-21-04-F-0474) was completed in 2005. This plan includes the use of wildland fire and prescribed burns in the Peloncillo Mountains on FS lands. Other recent fires include the Adobe fire in the Animas Mountains, 2007, and the Whitmire fire, 2008, in the Peloncillo Mountains. The Adobe wildfire burned through designated critical habitat for this species, with much of the area in Indian Creek being subjected to high-severity fire effects. Much of the riparian and pine woodland overstory in Indian Creek was lost to this wildfire. Areas in Bear and Spring Canyons appear to have been similarly affected, but an evaluation has not occurred. Several occupied talus slides in Indian Creek were partially buried in sediment and ash during post-fire runoff events. A total of 3,990 acres were burned by the Whitmire fire in the Peloncillo Mountains. The fire burned through part of three polygons of core New Mexico ridge-nosed rattlesnake habitat identified by Smith *et al*. (2001). Preliminary analysis indicated that the fire effects were low and the upper canopy in the core habitat polygons was not impacted.

Livestock grazing
Overgrazing can result in negative effects for the subspecies (USFWS 1985) due to reduction in snake hiding cover (grassy clumps) and prey cover, and habitat reduction and alteration. Relatively small litter size and long female reproductive cycles suggest that New Mexico ridge-nosed rattlesnake populations are not capable of rapid growth, making them particularly sensitive to factors causing population decline (Holycross 2001, Holycross and Goldberg 2001).

Critical Habitat and Primary Constituent Elements of Critical Habitat
Critical habitat for the New Mexico ridge-nosed rattlesnake was designated concurrently with listing and consists of Bear, Spring, and Indian Canyons in the Animas Mountains between 6,048 feet and 8,320 feet in elevation (USFWS 1978, 43 FR 34479). The critical habitat primary constituent elements for the New Mexico ridge-nosed rattlesnake are:

- PCE 1: Dens are available which provide winter and summer retreats,
- PCE 2: Vegetation provides cover, and
- PCE 3: Lizards and rodents are abundant in the area and provide an adequate source of food items.

Activities that would impact designated critical habitat for the New Mexico ridge-nosed rattlesnake are not identified in the final designation, but activities that impact these constituent elements would include, but are not limited to; high-severity wildfire, excessive erosion and sedimentation into talus slides, and use of pesticides that may impact the forage base for this species.

Gila Chub

Description and Legal Status
Gila chub is a member of the roundtail chub (*Gila robusta*) complex that also includes headwater chub (*G. nigra*). The roundtail chub complex has had a turbulent and controversial taxonomic history that includes an assortment of classification schemes. Much of the debate has centered on whether the complex represents a number of nominal species or subspecies of *Gila robusta*. A nomenclatorial synonymy for Gila chub can be found in Minckley (1973).

Gila chub is a thick-bodied species, chunky in aspect, whereas roundtail chub is slender and elongate, and headwater chub is intermediate in meristic and morphometric characteristics (Rinne 1969, 1976; Minckley 1973; DeMarais 1986; Minckley and DeMarais 2000; Minckley and Marsh 2009). Females can reach 9.8” in total length (TL), but males rarely exceed 5.9” (Minckley 1969, 1973; Rinne and Minckley 1991; Schultz and Bonar 2006). Body coloration is typically dark overall, sometimes black or with diffuse, longitudinal stripes, with a lighter belly speckled with gray. The lateral scales often appear to be darkly outlined, lighter in center. Breeding males, and to a lesser extent females, develop red or orange on lower parts of the head and body and on bases of the pectoral, pelvic, and anal fins.

Gila chub has long been recognized as distinct. Miller (1945), following the arrangement of Jordan and Evermann (1896), supported full generic rank for the genus *Gila* (Baird and Girard 1853) with a “*Gila robusta* complex” that included Gila chub. Miller (1946) considered Gila chub to be an “ecological subspecies” of *G. robusta* (i.e., *G. r. intermedia*) characteristic of the small tributaries they inhabit. Rinne (1969, 1976), using univariate analyses of morphological and meristic characters, argued for recognition of both *G. robusta* and *G. intermedia* as distinct species and against the ecological subspecies concept. This approach was supported by some (e.g. Minckley 1973; Minckley *et al*. 1986), but it was not until further evidence was generated by DeMarais (1986, 1995) that the specific status for *G. intermedia* was generally accepted. DeMarais (1995) supported continued recognition of *G. intermedia* based on the following arguments: 1) phenotypic extremes between *G. intermedia* and *G. robusta* are widely divergent and each possesses many morphologically uniform populations; (2) the geographic distributions of both species is an overlapping mosaic, therefore not satisfying traditional geographic criteria; and, (3) contiguous populations of *G. intermedia* and *G. robusta* show no evidence of genetic exchange, thus each species maintains its evolutionary independence.

Gila chub (*Gila intermedia*) was listed as endangered with critical habitat on November 11, 2005 (USFWS 2005, 67 FR 51948). The final rule cites collection records, historical habitat data, the 1996 AGFD Gila chub status review (Weedman *et al*. 1996), and FWS information documenting currently occupied habitat to conclude that Gila chub has been eliminated from 85 to 90 percent of formerly occupied habitat. It was also estimated that 90 percent of the currently occupied habitat is degraded due to the presence of non-native species and land management actions. Due to fragmented and often small population sizes, extant populations are susceptible to environmental conditions such as drought, flood events, and wildfire. Primary threats to Gila chub include predation by and competition with non-native organisms; secondary threats are habitat alteration, destruction, and fragmentation.

Life History and Habitat
The Gila chub is considered a habitat generalist (Schultz and Bonar 2006), and commonly inhabits pools in smaller steams, cienegas, and artificial impoundments throughout its range in the Gila River basin at elevations between 2,000 to 5,500 feet (Miller 1946, Minckley 1973, Rinne 1975, Weedman *et al*. 1996).

Gila chub is a highly secretive species, remaining near cover including undercut banks, terrestrial vegetation, boulders, root wads, fallen logs, and thick overhanging or aquatic vegetation in deeper waters, especially pools (Rinne and Minckley 1991, Nelson 1993, Weedman *et al*. 1996). Recurrent flooding and a natural hydrograph are important in maintaining Gila chub habitats and in helping the species maintain a competitive edge over invading non-native aquatic species (Propst *et al*. 1986, Minckley and Meffe 1987). They can survive in larger steam habitats, such as the San Carlos River, and artificial habitats, like the Buckeye Canal (Minckley 1985, Rinne and Minckley 1991, Stout *et al*. 1970, Rinne 1976), and they interact with spring and small-stream fishes regularly (Meffe 1985).

Young Gila chub are active throughout the day and feed on small invertebrates as well as aquatic vegetation (especially filamentous algae) and organic debris (Bestgen 1985, Griffith and Tiersch 1989, Rinne and Minckley 1991). Adult Gila chub are crepuscular feeders, consuming a variety of terrestrial and aquatic invertebrates, and fishes (Griffith and Tiersch 1989, Rinne and Minckley 1991). Benthic feeding may also occur, as suggested by presence of small gravel particles.

Gila chub evolved in a fish community with low species diversity and where few predators existed, and as a result developed few or no mechanisms to deal with predation (Carlson and Muth 1989). This species is known to be associated with speckled dace (*Rhinichthys osculus*), longfin dace (*Agosia chrysogaster*), desert sucker (*Pantosteus clarki*), Sonora sucker (*Catostomus insignis*), Gila topminnow (*Poeciliopsis occidentalis*), desert pupfish (*Cyprinodon macularius*), and monkey spring pupfish (*Cyprinodon arcuatus*). Prior to the widespread introduction of non-native fishes, Gila chub was probably the most predatory fish within the habitats it occupied. In the presence of the non-native green sunfish (*Lepomis cyanellus*) in lower Sabino Creek, Arizona, Gila chub failed to recruit young (Dudley and Matter 2000). Direct predation by green sunfish on young was the acknowledged cause of this observation.

While most reproductive activity by Gila chub occurs during late spring and summer, in some habitats it may extend from late winter through early autumn (Minckley 1973). Schultz and Bonar (2006) data from Bonita and Cienega creeks suggested that multiple spawning attempts per year per individual were likely, with a major spawn in late February to early March, followed by a secondary spawn in autumn after monsoon rains. Reproductive activities in Monkey Spring (where Gila chub are now extirpated) reportedly occurred for longer periods than in other populations, as breeding appeared to last virtually all season (Minckley 1969, 1973, 1985). Bestgen (1985) concluded that temperature was the most significant environmental factor triggering spawning. Spawning probably occurs over beds of submerged aquatic vegetation or root wads. Minckley (1973) observed a single female closely followed by several males over a bed of aquatic vegetation in a pond. Nelson (1993) also suspected deep pools with vegetation in Cienega Creek were important sites for spawning but did not witness any associated behavior near submerged vegetation.

Distribution, Abundance, Population Trends

Historically, Gila chub were recorded from nearly 50 rivers, streams and spring-fed tributaries throughout the Gila River basin in southwestern New Mexico, central and southeastern Arizona, and northern Sonora, Mexico (Miller and Lowe 1967, Rinne and Minckley 1970, Minckley 1973, Rinne 1976, DeMarais 1986, Sublette *et al*. 1990, Weedman *et al*. 1996); and, occupancy of Gila chub throughout its range was more dense, and currently-occupied sites were likely more expansive in distribution (Hendrickson and Minckley 1984, Minckley 1985, Rinne and Minckley 1991). Gila chub now occupies an estimated 10 to 15 percent of its historical range (Weedman *et al*. 1996, USFWS 2005) and approximately 25 of these current localities are considered occupied, but all are small, isolated and face one or more threats (Weedman *et al*. 1996, USFWS 2005). The biological status of several of these populations is uncertain, and the number of localities currently occupied may overestimate the number of remnant populations in that some might not persist if its core connected population was extirpated (eliminated).

The Gila chub occurs in the Agua Fria River, the Verde River, Santa Cruz, San Pedro, and Upper Gila subbasins. The Santa Cruz subbasin is within the project area and is discussed further in the environmental baseline. Information regarding the Agua Fria River, the Verde River, San Pedro, and Upper Gila subbasins is included in FWS files.

Threats

Habitat loss

Decline of Gila chub is primarily due to habitat loss from various land-use practices and predation by, and competition with non-native fish species. The highly fragmented and disconnected nature of the remaining Gila chub populations increases their vulnerability to these threats (FWS 2005a). Land uses that have caused past habitat loss and continue to threaten Gila chub habitat include hydrologic modification of rivers, springs, and cienegas for human uses (groundwater pumping, dewatering, diversion of water channels, impoundments, and flow regulation), poorly managed livestock grazing, logging and fuel wood cutting, road construction and use, recreation, mining, and urban and agricultural development (FWS 2005a). All of these activities have promoted erosion and arroyo formation and the introduction of predaceous and competing non-native fish species (Miller 1961, Minckley 1985), and at least one or some combination of these activities is occurring in all of the remaining populations.

Fire
Wildfires and wildfire suppression activities also pose a threat to the remaining populations by causing water quality changes that can kill fish, (Rinne 2004, FWS 2005a, Rhodes 2007), negatively altering food base for fishes (Earl and Blinn 2003), and resulting in stream and riparian vegetation alteration that negatively affects fish habitat (FWS 2005a).

Predation and competition with non-native species
Perhaps the most serious threat to Gila chub is predation by and competition with non-native organisms, including numerous non-native fish species, bullfrogs (Lithobates catesbeiana), and virile crayfish (Orconectes virilis). The impacts of non-native fish species on native fish including Gila chub have been well documented (Hubbs 1955, Miller 1961, Minckley and Deacon 1968, Minckley 1973, Meffe 1985, Minckley 1985, Williams and Sada 1985, Moyle et al. 1986, Minckley and Deacon 1991, Ruppert et al. 1993, Clarkson et al. 2005). Dudley and Matter (2000) correlated green sunfish presence with Gila chub decline, documented green sunfish predation on Gila chub, and found that even small green sunfish readily consume young-of-year Gila chub. Dudley (1995) found that green sunfish appeared to displace both subadult and adult Gila chub from preferred habitats, found that Gila chub utilized similar habitat types to green sunfish indicating competition for food and space was likely occurring, and concluded that predation by and competition with green sunfish virtually eliminated small chub from where the two species co-occurred, indicating recruitment failure. Unmack et al. (2003) similarly found that green sunfish presence was correlated with the absence of young-of-year Gila chub in Silver Creek, Arizona. Non-native fish parasites, such as Asian tapeworm (Bothriocephalus acheilognathi) may also be a threat to Gila chub (FWS 2005a).

Population Growth
The U.S. Census predicts that Arizona will be the second fastest growing state in the country through 2030, adding an additional 5.6 million people (U.S. Census 2005). During the 2010 Census, Arizona maintained its standing as having the second fastest population growth rate by growing more than 20 percent between 2000 and 2010 (Pollard and Mather 2010). If these predictions hold true, already severe threats to Gila chub and its habitat will worsen, primarily due to increased human demand for surface and ground water and decreased supply. Water demands continue to increase as the population increases. The agriculture population is also increasing and agriculture is Arizona’s largest water demand. Most of Arizona’s developed areas groundwater is pumped out faster than the aquifer can recharge, resulting in more dependence on freshwater sources from nearby rivers (U.S. Environmental Protection Agency 2011).

Climate Change
Several climate-related trends have been detected since the 1970s in the southwestern U.S. including increases in surface temperatures, rainfall intensity, drought, heat waves, extreme high

temperatures, and average low temperatures (Overpeck 2008). Annual precipitation amounts in the southwestern U.S. may decrease by 10 percent by the year 2100 (Overpeck 2008).

Current predictions of drought and/or higher winter low temperatures may also stress ponderosa pine forests in which Gila chub occurs. Ganey and Vojta (2010) studied tree mortality in mixed conifer and ponderosa pine forests in Arizona from 1997-2007, a period of extreme drought. They found the mortality of trees to be severe; the number of trees dying over a five-year period increased by over 200 percent in mixed-conifer forest and by 74 percent in ponderosa pine forest during this time frame (Ganey and Vojta 2010). Ganey and Vojta (2010) attributed drought and subsequent insect (bark beetle) infestation for the die-offs in trees.

Drought stress and a subsequent high degree of tree mortality from bark beetles make high elevation forests more susceptible to unnaturally intense wildfires. Warming trends, and fuel load accumulations will support larger, frequent severe wildfires in the southwest. Severity will also be influenced by a predicted reduction in snowpack and an earlier snowmelt (Fulé 2010). Wildfires are expected to reduce vegetative cover, increase soil erosion from increased droplet splash-erosion, and reduced infiltration capacity, subsequently resulting in increased sediment flows in streams (Fulé 2010).

Overall, the populations of Gila chub rangewide (Arizona and New Mexico) currently appear to be stable. The current distribution Gila chub populations remain extant to the Agua Fria, Blue, Gila, San Francisco, Santa Cruz and Verde Rivers. These populations are spread across the drainages, and most are isolated from other populations.

Conservation, Consultation and Recovery Planning

Our information indicates that, rangewide, more than 34 consultations have been completed or are underway for actions affecting Gila chub. These opinions primarily include the effects of livestock grazing, water developments, fire, species control efforts, recreation, sportfish stocking, native fish restoration efforts, and mining.

Critical Habitat

Critical habitat for Gila chub is designated for approximately 160.3 miles of stream reaches in Arizona and New Mexico that includes cienegas, headwaters, spring-fed streams, perennial streams, and spring-fed ponds. Critical habitat includes the area of bankfull width plus 300 feet on either side of the banks. The bankfull width is the width of the stream or river at bankfull discharge (i.e., the flow at which water begins to leave the channel and move into the floodplain) (Rosgen 1996, USFWS 2005). Critical habitat is organized into seven areas or river units:

- Upper Gila River, Grant County, New Mexico, and Greenlee County, Arizona, which includes Turkey Creek (New Mexico), Eagle Creek, Harden Cienega Creek, and Dix Creek;
- Middle Gila River, Gila and Pinal Counties Arizona, consists of Mineral Creek;
- Babocomari River, Santa Cruz County, Arizona, includes O'Donnell Canyon and Turkey Creek (Arizona);
- Lower San Pedro River, Cochise and Graham counties, Arizona, includes Bass Canyon, Hot Springs Canyon, and Redfield Canyon;
- Lower Santa Cruz River, Pima County, Arizona, includes Cienega Creek, Mattie Canyon, Empire Gulch, and Sabino Canyon;

- Upper Verde River, Yavapai County, Arizona, includes Walker Creek, Red Tank Draw, Spring Creek, and Williamson Valley Wash; and
- Agua Fria River, Yavapai County, Arizona, includes Little Sycamore Creek, Sycamore Creek, Indian Creek, Silver Creek, Lousy Canyon, and Larry Creek (USFWS 2005).

Primary Constituent Elements of Critical Habitat
There are seven PCEs of critical habitat, which include those habitat features required for the physiological, behavioral, and ecological needs of the species:

- PCE 1: Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies all found in headwaters, springs, and cienegas, generally of smaller tributaries;
- PCE 2: Water temperatures for spawning ranging from 63°F to 75 °F, and seasonally appropriate temperatures for all life stages (varying from about 50°F to 86 °F);
- PCE 3: Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (e.g. ranging from 6.5 to 9.5), dissolved oxygen (i.e., ranging from 3.0 ppm to 10.0 ppm) and conductivity (i.e., 100 mmhos to 1,000 mmhos);
- PCE 4: Prey base consisting of invertebrates (i.e., aquatic and terrestrial insects) and aquatic plants (i.e., diatoms and filamentous green algae);
- PCE 5: Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, a high degree of stream bank stability, and a healthy, intact riparian vegetation community;
- PCE 6: Habitat devoid of non-native aquatic species detrimental to Gila chub or habitat in which detrimental non-native species are kept at a level that allows Gila chub to continue to survive and reproduce; and
- PCE 7: Streams that maintain a natural flow pattern including periodic flooding.

Yaqui Chub

Description and Legal Status
The Yaqui chub is a medium-sized minnow of the family Cyprinidae, with adults rarely exceeding 6 in in length (Minckley 1973). The body is generally dark over all, but usually somewhat lighter below. Some breeding males have a distinctive bluish sheen over the body while reproductive females are a straw yellow to light brown. Lateral bands are absent or scarcely developed. A vertically elongate, diffuse triangle-shaped caudal spot is usually present (Minckley 1973). Head and anterior body are thickened, thinning posteriorly. Scales are large and broadly imbricate with radii on all fields.

The Yaqui chub was first collected and described from San Bernardino Creek (Black Draw), just south of the U.S.-Mexico border, in the latter half of the 19th century (Girard 1857, Rutter 1896). The Yaqui chub was originally described as *Tigoma purpurea* (Girard 1857). Initially, *Gila purpurea* was thought to occur in the basins of the Río Sonora, Rio Matape, and Rio Yaqui in Arizona and Sonora, Mexico (Hendrickson *et al*. 1980). However, in 1991, it was recognized that the chub in the Ríos Sonora and Matape and the Río Yaqui system downstream from San Bernardino Creek is a different species, *Gila eremica* (DeMarais 1991).

The FWS listed the Yaqui chub as an endangered species on August 31, 1984. The range of this species has been significantly reduced, primarily due to habitat degradation and destruction. The remaining populations are in danger of being subjected to intense competition through the indiscriminate release of non-native fish. Threats to the Yaqui chub come from surface water development and groundwater pumping that reduces or eliminates spring flows or surface water in small streams. Introduced non-native fish are predators or competitors on Yaqui chub and have been eliminated from the San Bernardino NWR; however, non-native bullfrogs remain and are predators on this small fish. Non-native fish and bullfrogs are also present in some portions of the range in Mexico.

Life History and Habitat

The Yaqui chub is a small to medium sized cyprinid fish. Males in breeding condition are bluish and females and non-reproducing males are brownish-grey. Breeding occurs from March to September. Yaqui chub are omnivores. Yaqui chub infected to Asian tapeworm have considerably lower growth rates than those not infected. The population-level effect of this lower growth rate is unknown, and field observations show no pattern. Yaqui chub are oviparous (egg laying) and spawn throughout the warmer months with increased activity in spring. Spawning probably occurs in deep pools where there is aquatic vegetation (Matthews and Moseley 1990). Yaqui chub often mature within the first summer (USFWS 1994). Reproductive potential is high and large populations can develop quickly from a few adults (DeMarais and Minckley 1993).

They feed mostly on algae, insects, and detritus (Galat and Gerhardt 1987). Arachnids and small fishes (Poeciliopsis) may be eaten when available (Matthews and Moseley 1990, Haynes and Schuetze 1997).

The Yaqui chub has proven to be highly resilient (DeMarais and Minckley 1991, 1993). Populations can expand rapidly from a few tens to thousands of individuals in a matter of weeks or months. Large, viable populations of Yaqui chub have established themselves almost everywhere recovery reestablishments have occurred, with far more success than other species (Hendrickson and Brooks 1991, Minckley 1995). Additionally, the Yaqui chub persist for long periods under severe conditions and rebounds dramatically when conditions improve. Thus, hundreds of individuals could be lost during a catastrophic flood, sustained drought, or extensive fire, and yet the population would be expected to re-establish so long as adequate refugia exist. For example, thousands of individuals were lost through suffocation or poisoning when runoff carrying ash and other materials from the Rattlesnake Fire swept through the system. The Yaqui chub recruited in ponds of the West Turkey Creek watershed immediately after that event. Thus, most losses, even of a catastrophic nature, are not anticipated to extirpate the population.

In the original listing, chubs from other areas of the Rio Yaqui were assumed to be Yaqui chub; however, recent taxonomic information has separated the chubs in the western and southern portions of the range to be a different species.

The Yaqui chub's historical range throughout the Yaqui River Basin consists of intermediate to low elevation warm-water creeks, cienegas, and moderate- to large-sized rivers. Creeks typically have alternating riffles and pools in which heterogeneity is enhanced by undercut banks, boulders, and wood debris. Gravel bottoms in swift areas are vegetated with algae. Cienegas, streams and associated marshlands with low, emergent aquatic plants and hydric-adapted trees, were historically common but have suffered severe degradation since the arrival of Europeans (Hendrickson and Minckley 1985). Rivers vary from pool-riffle types with boulder and gravel bottoms to long, strongly flowing reaches over gravel and sand (Campoy-Favela *et al*. 1989). Elevations in Arizona range from 3,730 to 6,200 feet.

Adult Yaqui chub live in deep freshwater pools in creeks, scoured areas of cienegas, and other stream associated quiet waters. They seek cover in daylight, especially undercut banks and in areas of accumulated debris often associated with higher aquatic plants (Lee *et al*. 1980). In artificial ponds, adults tend to occupy the lower part of the water column and seek shade. Young occupy near-shore zones, often near the lower ends of riffles. Maes (1995) observed a vertical stratification of age classes in both lentic and lotic environments with younger fish occupying the areas higher in the water column regardless of depth. Adult Yaqui chub avoided waters with detectable water velocity, but younger fish occasionally were found in flowing water (Maes 1995).

Distribution, Abundance, Population Trends

The historical range of Yaqui chub includes the northern Rio Yaqui basin, which occurs in the USA and in Mexico. The Rio Yaqui basin drains western Sonora and portions of eastern Chihuahua in Mexico and the San Bernardino Valley in southeastern Arizona, U.S. (Minckley 1980, Minckley and Brown 1994). The drainage in the USA includes parts of Cochise County, Arizona, and Hidalgo County, New Mexico (USFWS 1995). Yaqui chub historical distribution included West Turkey Creek in the Chiricahua Mountains and its terminus, the Sulphur Springs Valley; both are immediately adjacent to the CNF and, thus, are within the Action Area.

The Yaqui chub was extirpated from its historical habitat in Arizona; however, populations have been reestablished in Leslie Canyon in the Swisshelm Mountains, in Leslie Canyon National Wildlife Refuge (NWR) and the Barboot Ranch, and in ponds and the mainstream of West Turkey Creek in the Chiricahua Mountains, Arizona (USFWS 2010). Waterbodies include, but are not limited to, Leslie Creek, House, Twin, North, and Mesquite Ponds, and El Coronado Ranch, including West Turkey Creek and ponds (AGFD 2001). Reintroductions into West Turkey Creek on the CNF have taken place in recent years; the habitat on the CNF is spatially intermittent, but temporally permanent, and fish have been found in follow-up monitoring. The mainstream of West Turkey Creek is, however, occupied by Yaqui chub just downstream from the NF. Since the LRMP consultation in 2005, it appears that Yaqui chub have not become established on the CNF but still persist in West Turkey Creek just downstream. In Mexico, Yaqui chub historically and currently occupy only a short perennial reach of Rio San Bernardino (Black Draw) in Sonora (Varela-Romero *et al*. 1992, Minckley 2013).

Threats

Habitat loss and modification

The Yaqui chub is affected by a variety of habitat modifications. This species existed in San Bernardino Creek (Astin Spring), Arizona, until the spring flows supporting the creek diminished and the remaining aquatic habitat was destroyed by cattle. Arroyo cutting, diverting stream headwaters, construction of impoundments, and excessive pumping of underground aquifers are responsible for the reduction of permanent stream habitat and for failing springs. As explained above, the remaining U.S. populations of Yaqui chub are limited to a few springs and ponds on the San Bernardino NWR, Leslie Creek on the Leslie Canyon NWR, West Turkey

Creek and ponds within the CNF, and the El Coronado Ranch (Silvey 1975; USFWS 1995, 1999). Both NWR populations are threatened by a gradually dwindling spring flow. The San Bernardino Valley is known to have potential geothermal energy resources (Hahman 1979), although the area is not a Known Geothermal Resource Area. The BLM has issued leases for geothermal resources on some of their lands adjacent to the San Bernardino NWR. Exploration and development of these leases could potentially cause depletion or pollution of the underground aquifers that supply water to the springs of the San Bernardino NWR, and could result in loss or pollution of the flows of those springs.

Non-native fish predation and competition
Introduced predatory fishes such as largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), black bullhead (*Ameirus melas*), channel catfish (*Ictalurus punctatus*), and green sunfish (*Lepomis cyanellus*) are present in some portions of the remaining range of the Yaqui chub, and probably forage opportunistically on them. The introduction of non-native species has been shown to be detrimental to other native fishes, as illustrated by the rapid elimination of the native Yaqui topminnow populations (listed as endangered and found in the same drainage as the Yaqui chub) after introduction of the closely related western mosquitofish (*Gambusia affinis*), documented by Minckley (1973), Schoenherr (1973), and others. This threat to the Yaqui chub is minor at present in U.S. habitats, and steps are being taken to alleviate it. The threat of such predation will continue to increase in the remaining habitats of the Yaqui chub in Mexico.

Livestock grazing, agriculture, mining
Most of the U.S.-Mexico borderlands (Gehlbach 1981, Humphrey 1986), including all of southeastern Arizona and southwestern New Mexico, has been heavily used for cattle grazing and local farming. Mining and other activities also resulted in some detrimental habitat or landscape changes. Diversity of natural landscapes quickly diminished under grazing pressure, especially when ranges were overstocked (Wagoner 1960). Chihuahuan Desert scrub expanded, grasslands deteriorated or locally disappeared, and riparian and aquatic habitats were destroyed or reduced to disturbed, disjunct remnants (USFWS 1994). Today's regional vegetation nonetheless remains desert grassland, closely intermingled with Chihuahuan desert scrub on drier sites (Lanning 1981). Mesquite (*Prosopis glandulosa*) bosques are the predominant lowland communities, along with pockets of riparian broad-leafed woodlands and cienega habitats where water persists at or near the surface (Marrs-Smith 1983).

Climate Change
Climate forecasts project not only temperature increases but also an increase in the frequency of hot extremes, heat waves, and heavy precipitation events. Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature may also lead to an increase in water temperature, which would allow other warm-water fishes (native and non-native) to expand their range into the limited habitat occupied by Yaqui chub. This would be detrimental to the Yaqui chub. Due to climate change projections, we anticipate that fish species including the Yaqui chub will face the following conditions as a result of climate change:

- Increased water temperature;

- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods).

Despite the current limits of climate change effects analysis, the FS Southwestern Region has developed guidance for addressing climate change in NF LRMP revisions, which are broad and general in scope and which rely on adaptive management as climate change science evolves. Therefore, as we better understand the potential effects of climate change on Yaqui chub distribution, FWS expects that this increased knowledge will be incorporated into revisions of the CNF LRMP.

Conservation, Consultation and Recovery Planning
In 2005, 60 Yaqui chub were collected from West Turkey Creek using minnow traps and immediately trucked up the canyon for release into three historically perennial pool habitats within the CNF. Twenty adult chub were released into each pool (USFS 2005). Follow-up monitoring at each of the pools returned no fish in one of the pools, a few fry at another release site, and a few adults in two of the pools. In 2006, four Yaqui chub (and 80 longfin dace) were collected via electroshocking from an adjacent private land site and immediately transported up canyon for release into the three perennial pools on the CNF. Yaqui chub from previous introductions were not observed. Follow-up monitoring for the 2006 stocking revealed no fish in the lower two pools, and a few dead/dying longfin dace along with one chub in the upper pool. Low water conditions were suspected as the reason for poor survival (USFS 2006). Surveys on the CNF were conducted with assistance from AGFD and FWS in conjunction with the translocation efforts, as part of an on-going project to re-introduce a population of Yaqui chub (and associated fish species) into West Turkey Creek on the Douglas Ranger District.

The CNF completed three surveys in 2007, and six surveys in 2008, both on and off the CNF. Private land below the CNF has an extant population. However, no Yaqui chub have been found in West Turkey Creek on the CNF since 2006. The probable reason for the loss of this population is most likely drought (USFS 2008). Pool habitats within the CNF have likely diminished in quantity and quality due to drought and sediment flows following wildfires, although this has not been documented using a standardized habitat assessment methodology.

In 2009, three sites on West Turkey Creek within the CNF boundary were surveyed, but no fish were found due to low water levels. Habitats on the Forest are spatially intermittent, but healthy populations persist in private ponds and in perennial stream reaches at El Coronado Ranch downstream of the CNF monitoring sites. Riparian areas are largely ungrazed and in good condition (USFS 2010).

On August 31, 1984, the FWS listed the Yaqui chub (*Gila purpurea*) as an endangered species with designated critical habitat (USFWS 1984, 49 FR 34490). A final Recovery Plan for the species was signed on March 29, 1995 (USFWS 1995).

Critical Habitat
Critical habitat for the Yaqui chub includes all aquatic habitats of San Bernardino NWR, Cochise County, Arizona, excluding the Leslie Canyon complex. These areas provide habitat for nine populations of Yaqui chub (USFWS San Bernardino NWR – Summary of Activities 2014-2015 (by B. Radke). Additionally, the aquatic habitats on San Bernardino NWR provide

expansion habitat for the Yaqui chub. There is no critical habitat for the Yaqui chub on the CNF.

Primary Constituent Elements of Critical Habitat
Critical habitat is described by PCEs, which are the physical and biological features the FWS has determined are essential to the conservation of the species. For the Yaqui chub, the PCEs are:

- PCE 1: Clean, small, permanent streams and spring pools without any exotic fishes.
- PCE 2: The streams should have deep pool areas separated by riffles and flowing areas with moderate current; and
- PCE 3: Backwater areas of streams and springs with overgrown cut banks and accumulations of detritus are necessary for feeding and shelter.

Gila Topminnow

Description and Legal Status
Gila topminnow (*Poeciliopsis occidentalis occidentalis*) was listed as endangered in 1967 without critical habitat (USFWS 1967, 32 FR 4001). Only Gila topminnow populations in the United States, and not in Mexico, are listed under the ESA. The reasons for decline of this fish include past dewatering of rivers, springs and marshlands, impoundment, channelization, diversion, regulation of flow, land management practices that promote erosion and arroyo formation, and the introduction of predacious and competing non-native fishes (Miller 1961, Minckley 1985). Other listed fish suffer from the same impacts (Moyle and Williams 1990). Life history information can be found in the 1984 recovery plan (USFWS 1984), the draft revised Gila topminnow recovery plan (Weedman 1999), and references cited in the plans.

Distribution, Abundance, Population Trends
Historically, the Gila topminnow was abundant in the Gila River drainage in Arizona and was one of the most common fishes of the Gila River basin, particularly in the Santa Cruz system (Hubbs and Miller 1941). Gila topminnow were also recorded from the Gila River basin in New Mexico (Minckley and Marsh 2009). In the last 50 years, this was reduced to only 16 naturally occurring populations. Presently, only 9 of the 16 known natural Gila topminnow populations are considered extant (Weedman and Young 1997, Voeltz and Bettaso 2003, USFWS files). Only eight have no non-native fish present and can be considered secure from non-native fish threats. There have been at least 200 wild sites stocked with Gila topminnow, however, topminnow persist at only 33 of these localities. Of these, two sites are outside topminnow historical range and one contains non-native fish (Voeltz and Bettaso 2003). All of these sites except two are in Arizona. Many of the reestablished sites are very small and may not contain viable populations, as defined in the draft revised recovery plan (Weedman 1999). In addition several of the 33 sites have been reestablished in the last few years, and their eventual disposition is unknown.

The status of the species is mixed. A recovery program actively stocks Gila topminnow in Arizona and New Mexico, reestablishing topminnow in “new” sites (Robinson 2011, 2012, 2013). However, natural sites continue to slowly decline. Gila topminnow has gone from being one of the most common fishes of the Gila basin to one that exists at about 42 localities (9 natural and 33 stocked). Many of these localities are small and highly susceptible to pertubation. The theory of island biogeography can be applied to these isolated habitat remnants, as they function similarly (Meffe *et al*. 1982, Laurenson and Hocutt 1985). Species on islands are more prone to extinctions than continental areas that are similar in size (MacArthur and Wilson 1967). Meffe *et al*. (1982) considered extinction of Gila topminnow populations almost as critical as recognized species extinctions.

Threats

Gila topminnow are highly vulnerable to adverse effects from non-native aquatic species (Johnson and Hubbs 1989). Predation and competition from non-native fishes have been a major factor in their decline and continue to be a major threat to the remaining populations (Meffe *et al*. 1983, Meffe *et al*. 1985, Brooks 1986, Marsh and Minckley 1990, Stefferud and Stefferud 1994, Weedman and Young 1997, Minckley and Marsh 2009). The native fish fauna of the Gila basin and of the Colorado basin overall, was naturally depauperate and contained few fish that were predatory on or competitive with Gila topminnow (Carlson and Muth 1989). In the riverine backwater and side-channel habitats that formed the bulk of Gila topminnow natural habitat, predation and competition from other fishes was essentially absent. As a result Gila topminnow did not evolve adaptive behaviors against predation or competition and is predator- and competitor-naive. Both large (Bestgen and Propst 1989) and small (Meffe *et al*. 1983) non-native fish cause problems for Gila topminnow as can non-native crayfish (Fernandez and Rosen 1996) and bullfrogs.

Climate Change

Climate models predict not only temperature increases but also an increase in the frequency and severity of storm events, heat waves, and precipitation events. Temporal asynchronicity will exacerbate the impacts on aquatic habitats and organisms. Ultimately, climate change predicts regionally drier conditions for the Southwest and an increasing probability of drought. Assuming those predictions hold, we anticipate that fish species in the southwest will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature is likely to lead to increased water temperature, streams will become increasingly intermittent, and aquatic habitat will degrade.

Conservation, Consultation and Recovery Planning

Our information indicates that, rangewide, over 100 formal consultations have been completed for actions affecting Gila topminnow. These opinions primarily include the effects of grazing, water developments, fire, species control efforts, recreation, land management planning, native fish restoration efforts, and mining.

Gila Trout

Description and Legal Status

The Gila trout (*Oncorhynchus gilae gilae*), was designated as an endangered species under the Federal Endangered Species Preservation Act of 1966 (USFWS 1967), and subsequent designation of the species as endangered continued under the ESA. Reasons for listing included hybridization, competition, and predation by non-native rainbow trout (*O. mykiss*), cutthroat trout (*O. clarkii*), and brown trout (*Salmo trutta*), and habitat degradation. The Gila trout was listed as federallyendangered before the FWS designated critical habitat, therefore there is no critical habitat for this species (USFWS 2006).

The Gila Trout Recovery Plan was completed in 1979 in collaboration with the FWS, FS, AGFD, New Mexico Game and Fish Department, and academic institutions. The Recovery Plan was most recently revised in 2003 (USFWS 2003). In 2001, the Gila Trout Recovery Team recommended to the FWS that the Gila trout be down-listed from endangered to threatened, based in part on successful reestablishments of the species in New Mexico and Arizona. By 2003, Gila trout were reported to be found in 14 populations in the wild (USFWS 2003). The species was down-listed to threatened status in 2006 (USFWS 2006).

Life History and Habitat

Gila trout require welloxygenated and cool water (below 77^{o} F), coarse sand, gravel and cobble substrate; stable stream banks, and abundant overhanging banks, pools and cover for optimal habitat (Propst and Stefferud 1997, USFWS 2003). Spawning occurs mainly in April when temperatures are 43 to 46°F (Rinne 1980). More detailed life history and biology information can be found in USFWS (2003 and 2006), and is included herein by reference.

Distribution, Abundance, and Population Trends

Gila trout historically occupied streams in the upper Gila River and portions of the San Francisco River drainages in Arizona and New Mexico; in the Verde River, and possibly the Agua Fria River drainages in Arizona (Minckley 1973, Behnke 2002).

Arizona: The Arizona Gila trout populations were believed to have been extirpated by the time the species was described in 1950 (Propst *et al*. 1992). There have been several introductions efforts made with varying success in Gap Creek, Dude Creek, Raspberry Creek, Grapevine Spring, and the Pinaleno Mountains. Specific information about these sites is in our files. Information on Grapevine Spring is located on the Prescott NF and information about this site is included in the environmental baseline of this document for the Gila trout.

New Mexico: When the Gila trout was listed as endangered, it was thought that its range had been reduced to five streams within the Gila NF: Iron, McKenna, Spruce, Main Diamond, and South Diamond Creeks. Beginning in 1970, Gila trout from each of the five relict populations were translocated into 16 other streams. There are four confirmed relict populations known today (Main Diamond, South Diamond, Spruce, and Whiskey Creeks).

In 2012, the Whitewater-Baldy Fire in the Gila Mountains burned over 290,000 acres in Gila trout-occupied habitat. Seven of the 14 occupied Gila trout recovery streams were severely impacted. In response to the Whitewater-Baldy Fire in the Gila Mountains, Gila trout from Whiskey, Langstroth, and Spruce creeks were salvaged. Trout were transported to the Mora National Fish Hatchery or the New Mexico Fish and Wildlife Conservation Office. Trout from Spruce Creek were also taken to Ash Creek in Arizona, Arizona. Later, in 2012, 3,000 Gila trout were returned to the West Fork of the Gila River.

In 2013, the Silver Fire burned 139,000 acres in the Black Range in southwestern New Mexico. The Gila trout in McKnight Creek were eliminated; trout in Black Canyon were greatly reduced (D. Myers, USFWS, pers. comm. April 28, 2014).

Climate Change
Climate models predict not only temperature increases but also an increase in the frequency and severity of storm events, heat waves, and precipitation events. Temporal asynchronicity will exacerbate the impacts on aquatic habitats and organisms. Ultimately, climate change predicts regionally drier conditions for the Southwest and an increasing probability of drought. Assuming those predictions hold, we anticipate that fish species in the southwest will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature is likely to lead to increased water temperature, streams will become increasingly intermittent, and aquatic habitat will degrade.

Conservation, Consultation and Recovery Planning
Since listing in 1973, at least 19 Federal agency actions have undergone (or are currently under) formal section 7 consultation throughout the Gila trout's range. This list of consultations can be found in the administrative record for this consultation.

Apache Trout

Description and Legal Status
The Apache trout (*Oncorhynchus gilae apache*) was originally listed as endangered under the Federal Endangered Species Preservation Act of 1966 (USFWS 1967). It later became federally protected with passage of the ESA in 1973. It was down-listed to threatened under the ESA in 1975 (40 FR 29863) without critical habitat. Reclassification to threatened status included a 4(d) rule, allowing AGFD to regulate incidental take of the species and to establish sportfishing opportunities.

Distribution, Abundance, Population Trends
Historical distribution of Apache trout is unclear. Once Apache trout were recognized as a species separate from Gila trout (Miller 1972), their original distribution was described as the

upper Salt River drainage (Black and White Rivers) and headwaters of Little Colorado River in Arizona above 5,905 feet (Miller 1972).

Apache trout now exist primarily in headwater areas upstream from natural and artificial barriers (USFWS 2010). Apache trout generally require water temperatures below 77 degrees Fahrenheit (^{o}F) (USFWS 2010). Apache trout are largely opportunistic and feed on a variety of aquatic and terrestrial organisms. Apache trout require clean coarse gravel substrates for spawning. In White Mountain streams spawning occurs from March through mid-June, and varies with stream elevation. First spawning is usually at three years of age, with eggs hatching in approximately 30 days, and emergence occurring about 60 days after deposition (Harper 1978). Life-span is typically four years (maximum known is six years) (Behnke 2002). Additional biological information is available in the species' Recovery Plan (USFWS 2009).

The historical distribution of Apache trout included the upper Salt River drainage (Black and White Rivers), San Francisco River drainage (Blue River), and headwaters of Little Colorado River in Arizona (Miller 1972). Based on extensive sampling, analysis of physical characteristics and genetic material, and recent GIS mapping, it is generally accepted that Apache trout historically inhabited between approximately 600 miles (miles) and 820 miles of streams above 6,000 feet elevation in the upper White and Black Rivers and Little Colorado River basins of east central Arizona's White Mountains.

Two streams outside historical range have pure replicate populations: North Canyon Creek (Kaibab National Forest [KNF]; Ord Creek stock) and Coleman Creek (ASNF; Soldier Creek stock). North Canyon Creek will be maintained as a refuge population of Apache trout and a source of fish for population establishment or augmentation. Coleman Creek supports pure Apache trout (Soldier Creek stock, 1981 and 1983); however, it is now considered a candidate stream for Gila trout recovery. Fish from Coleman Creek will be used as a source population for establishing or augmenting other populations within the historical range of Apache trout. Once the fish are removed from Coleman Creek, the creek may be renovated and used for Gila trout recovery efforts (USFWS 2009).

Threats

Non-native species predation, competition, and hybridization

In the late 1800s, substantial harvest of trout was documented in the areas historically occupied by Apache trout. Introduction of non-native trout (i.e., brook, brown, rainbow, and cutthroat) species and degradation of habitat associated with modern day settlement rapidly eliminated or reduced most populations of Apache trout during a span of about 50 years (Behnke and Zarn 1976, Harper 1978). In addition, habitat alterations have occurred through timber harvest, grazing of domestic livestock, road construction, water diversions, reservoir construction, and to a lesser extent mining (sand and gravel operations). These alterations were identified as causes for reduction of Apache trout habitat in the White Mountains of Arizona (USFWS 1983). Such alterations damage riparian vegetation and streambank morphology and stability, which increase stream erosion and can ultimately result in higher sediment loads. These, in turn, increase the species' susceptibility to habitat damage from floods, decrease the quality and quantity of spawning and rearing areas, alter stream flow volume and temperatures, and alter stream productivity and food supply (e.g., stream dwelling insects). Collectively, these factors have varied in intensity, complexity, and damage depending on location, ultimately reducing the total occupied range and the ability of Apache trout to persist at all life stages. Non-native trout stocking still occurs today, although most often in reservoirs or small lakes. All AGFD and FWS fish stocking actions are conducted under auspices of section 7 intra-service consultation with compliance to applicable Federal laws (USFWS 1995 and 2008).

Introductions of non-native trout have led to hybridization with rainbow trout or cutthroat trout. Evidence of hybridization has been detected among some populations consisting of Apache, cutthroat, and rainbow trouts, with introgression from rainbow trout most prevalent (Carmichael *et al*. 1993, Wares *et al*. 2004). To detect hybridization among Apache, cutthroat, and rainbow trout, fish were collected from 31 streams on Fort Apache Indian Reservation (FAIR) and ASNF between 1987 and 1989 (Carmichael *et al*. 1993). Pure populations of Apache trout were found in 11 streams on the FAIR including East Fork White River, and Boggy/Lofer, Coyote, Crooked, Deep, Elk Canyon, Firebox, Flash, Hurricane, Ord, and Soldier Springs creeks (FAIR). Pure populations of Apache trout on the FAIR were also confirmed later in Big Bonito Creek (including its tributaries: Hurricane, Hughey, and Peasoup creeks), Little Bonito Creek, and Smith Creek. Samples were again collected in 2007. Five additional populations on the FAIR (Sun, Moon, Little Diamond, Rock, and Marshal Butte Creeks) are now considered pure. These pure populations comprise the 18 relict lineages of Apache trout known to exist on FAIR at present. On the ASNF, the genetic purity of Apache trout populations established through previous stockings was confirmed for Coyote, Hayground, Home, Mineral, Soldier, Stinky, and Wildcat creeks, and the West Fork Black River (Wares *et al*. 2004).

Climate Change

Climate models predict not only temperature increases but also an increase in the frequency and severity of storm events, heat waves, and precipitation events. Temporal asynchronicity will exacerbate the impacts on aquatic habitats and organisms. Ultimately, climate change predicts regionally drier conditions for the Southwest and an increasing probability of drought. Assuming those predictions hold, we anticipate that fish species in the southwest will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature is likely to lead to increased water temperature, streams will become increasingly intermittent, and aquatic habitat will degrade.

Conservation, Consultation and Recovery Planning

Conservation of Apache trout was first attempted by the White Mountain Apache Tribe (WMAT) in the late 1940s and 1950s when the only known populations existed on the FAIR. In 1955, WMAT closed most streams containing Apache trout within the FAIR boundaries to fishing (other FAIR streams deemed important to Apache trout conservation were closed to fishing in the early 1990s). Interest in Apache trout continued and substantially increased during the early 1960s, resulting in fishery surveys carried out by the FWS and AGFD in cooperation with WMAT to determine species status. In conjunction with these surveys, AGFD, again in cooperation with WMAT and FWS, entered into a captive propagation program. As part of the Federal and state Apache trout recovery effort, stocking of Apache trout into streams began in 1963 (USFWS 2009). At present, Apache trout propagated at the Williams Creek National Fish Hatchery (WCNFH) and AGFD Silver Creek Fish Hatchery (using eggs from WCNFH) are used to stock streams and lakes on tribal, state, and Federal lands for put-and-take and put-grow-take fisheries only.

Porath and Nielsen (2003) confirmed introgressed populations of Apache trout (with rainbow trout) in four Pinaleno Mountain streams (Ash, Big, Grant, and Marijilda Creeks on CNF) that are now considered outside of historical range for Apache trout. Grant and Big Creeks drain into the Willcox Playa, which is a closed basin (Minckley 1973); Ash and Marijilda Creeks are tributaries to the Gila River and now considered within historical range of Gila trout (USFWS 2003). In addition, Deadman Creek (CNF) was stocked with Apache trout in 1968 and 1969, and it is uncertain if hybridized trout still persist. Deadman Creek is now considered to be within historical range of Gila trout. KP and Grant creeks (ASNF), tributaries to the Blue River, currently contain hybridized populations of and are now considered within historical range of Gila trout (USFWS 2003). Horton Creek (Tonto National Forest) was stocked with hatchery Apache trout in 1971; however, at the time the stream also had rainbow, brook, and brown trout populations. It is likely that any remaining Apache trout are hybridized and would not contribute to recovery.

Our information indicates that, as of 2011 rangewide, 23 formal consultations have been completed or are underway for actions affecting Apache trout. Adverse effects to Apache trout have occurred due to these projects and many of these consultations have included reasonable and prudent measures to minimize effects to Apache trout. The FS, White Mountain Apache Tribe, FWS, AGFD, and other cooperators are currently implementing many projects and recovery actions that provide habitat improvement or protection for Apache trout. Until the recent Wallow Fire, overall, population trends were upward, with additional recovery populations in development. Fortunately, the Wallow Fire only affected two of the populations, and of the recovery streams on FS lands (streams on the WMAT were not affected). Most of the affected populations were either hybrids scheduled to be replaced with pure populations, were small and in streams with compromised barriers also due for remedial attention, or have been adversely affected by drought (Lopez 2011, S. Coleman, pers. comm. 2012). Continuing implementation of recovery actions to regain any ground lost is anticipated.

One objective of the 2009 Recovery Plan is to establish and/or maintain 30 self-sustaining discrete populations of pure Apache trout within its historical range. Many of the recovery and conservation actions implemented to date have resulted in the expansion of populations and habitat protection/restoration within Apache trout historical range.

Spikedace

Description and Legal Status

Spikedace is a small silvery fish whose common name alludes to the well-developed spine in the dorsal fin (Minckley 1973).

Spikedace (*Meda fulgida*) was originally listed as a threatened species on July 1, 1986 (USFWS 1986, 51 FR 23769) and reclassified as endangered on February 23, 2012 (USFWS 2012, 77 FR 10810). Critical habitat has been designated (USFWS 1994) and re-designated on April 25, 2000 (USFWS 2000, 65 FR 24328) and on March 21, 2007 (USFWS 2007, 72 FR 13356) in response to legal concerns and policy changes (see summary discussion at USFWS 2010). The current critical habitat designation was published simultaneously with the reclassification of spikedace to endangered status on February 23, 2012 (USFWS 2012, 77 FR 10810).

Life History and Habitat
Spikedace live in flowing water with slow to moderate velocities over sand, gravel, and cobble substrates (Propst *et al*. 1986, Rinne and Kroeger 1988). Specific habitat for this species consists of shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand/gravel bars, and eddies at the downstream riffle edges (Propst *et al*. 1986). Spikedace spawn from March through May with some yearly and geographic variation (Barber *et al*. 1970, Anderson 1978, Propst *et al*. 1986). Actual spawning has not been observed in the wild, but spawning behavior and captive studies indicate eggs are laid over gravel and cobble where they adhere to the substrate. Spikedace lives about two years with reproduction occurring primarily in one-year old fish (Barber *et al*. 1970, Anderson 1978, Propst *et al*. 1986). It feeds primarily on aquatic and terrestrial insects (Schreiber 1978, Barber and Minckley 1983, Marsh *et al*. 1989). Additional details on habitat preferences are provided in the 2012 critical habitat designation (USFWS 2012).

Distribution, Abundance, Population Trends
The spikedace was once common throughout much of the Gila River basin, including the mainstem Gila River upstream of Phoenix, and the Verde, Agua Fria, Salt, San Pedro, and San Francisco subbasins. Habitat destruction, competition, and predation by non-native aquatic species reduced its range and abundance (Miller 1961, Lachner *et al*. 1970, Ono *et al*. 1983, Moyle 1986, Moyle *et al*. 1986, Propst *et al*. 1986). Spikedace are now restricted to portions of the upper Gila River (Grant, Catron, and Hidalgo Counties, New Mexico); Aravaipa Creek (Graham and Pinal Counties, Arizona); Eagle Creek (Graham and Greenlee Counties, Arizona); and the Verde River (Yavapai County, Arizona) (Marsh *et al*. 1990, Brouder 2002, pers. comm., Stefferud and Reinthal 2005, Paroz *et al*. 2006, Propst 2007).

In 2007, spikedace were translocated into Hot Springs Canyon, in Cochise County, Arizona, and Redfield Canyon, in Cochise and Pima Counties, Arizona, and these streams were subsequently augmented (Robinson 2008a, Robinson 2008b, pers. comm., Orabutt 2009, pers. comm., Robinson 2009a, Robinson *et al*. 2010a, Robinson *et al*. 2010b, Robinson 2011a, pers. comm.). Both Hot Springs and Redfield canyons are tributaries to the San Pedro River. Augmentation efforts have been suspended in Redfield Canyon due to drought and a lack of adequate flowing water. Augmentation efforts have been suspended at Hot Springs Canyon to allow managers to better evaluate if recruitment of spikedace is persisting without need of further augmentation. Monitoring will continue at this site, and future augmentations may occur if needed.

Spikedace have also been translocated into Fossil Creek (tributary to the Verde River) and Bonita Creek (tributary to the Gila River). Spikedace were translocated into Fossil Creek in 2007, and were subsequently augmented in 2008 and 2011 (Carter 2007, Carter 2008, Robinson 2009b, Boyarski *et al*. 2010, Robinson 2011b). Survey efforts in 2013 indicate spikedace are persisting in lower Fossil Creek (C. Crowder, pers. comm. 2013). In 2008, spikedace were translocated into Bonita Creek (Blasius 2008, pers. comm., Robinson *et al*. 2009), and were repatriated to the upper San Francisco River in Catron County, New Mexico (Propst 2010, pers. comm.). Augmentations at Bonita Creek have been temporarily suspended due to re-invasion by non-native species above the fish barrier. Spikedace were also translocated to the Blue River in 2012 following construction of a native fish barrier there in 2012. Subsequent surveys have detected spikedace, and a population may be established there in the near future (Robinson and Love-Chezem 2015). We anticipate that augmentations with additional fish will occur for the next several years at all sites, if adequate numbers of fish are available and habitats remain suitable. Monitoring at each of these sites is ongoing; however, insufficient time has elapsed to allow us to determine if these translocation efforts will ultimately be successful and result in establishment of new populations of spikedace in these locations.

Spikedace is now common only in Aravaipa Creek in Arizona (Arizona State University (ASU) 2002, Reinthal 2008, Reinthal 2011, pers. comm.) and one section of the Gila River south of Cliff, New Mexico (New Mexico Department of Game and Fish [NMDGF] 2008, Propst *et al*. 2009). The Verde River is presumed occupied; however, the last captured fish from this river was from a 1999 survey (Brouder 2002, pers. comm., AGFD 2004). Spikedace from the Eagle Creek population have not been seen for over a decade (Marsh 1996), although they are still thought to exist in numbers too low for the sampling efforts to detect (Carter *et al*. 2007; see Minckley and Marsh 2009). The Middle Fork Gila River, Arizona, population is thought to be very small and has not been seen since 1991 (Jakle 1992), but sampling is localized and inadequate to detect a sparse population. For a current list of areas occupied by spikedace, see USFWS 2012.

Taxonomic and genetic work on spikedace indicates there are substantial differences in morphology and genetic makeup between remnant spikedace populations. Remnant populations occupy isolated fragments of the Gila basin and are isolated from each other. Anderson and Hendrickson (1994) found that spikedace from Aravaipa Creek are morphologically distinguishable from spikedace from the Verde River, while spikedace from the upper Gila River and Eagle Creek have intermediate measurements and partially overlap the Aravaipa and Verde populations. Mitochondrial DNA and allozyme analyses have found similar patterns of geographic variation within the species (Tibbets 1992, Tibbets 1993).

Threats

Climate Change

Climate models predict not only temperature increases but also an increase in the frequency and severity of storm events, heat waves, and precipitation events. Temporal asynchronicity will exacerbate the impacts on aquatic habitats and organisms. Ultimately, climate change predicts regionally drier conditions for the Southwest and an increasing probability of drought. Assuming those predictions hold, we anticipate that fish species in the southwest will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature is likely to lead to increased water temperature, streams will become increasingly intermittent, and aquatic habitat will degrade.

Conservation, Consultation and Recovery Planning
Our information indicates that, rangewide, more than 390 consultations have been completed or are underway for actions affecting spikedace and loach minnow, which often co-occur. The majority of these consultations concerned the effects of road and bridge construction and maintenance, grazing, water developments, fire, species control efforts, or recreation. There are a large number of consultations for urban development and utilities; however, these projects typically do not result in adverse effects to the species but are for technical assistance only. Small numbers of projects occur for timber, land acquisition, agriculture, sportfish stocking, flooding, habitat conservation planning, native fish restoration efforts, alternative energy development, and mining.

Critical Habitat
The spikedace critical habitat designation includes eight units based on river subbasins, including the Verde River, Salt River, San Pedro, Bonita Creek, Eagle Creek, San Francisco River, Blue River, and Gila River subbasins (see USFWS 2012 for additional detail on occupancy by subbasin). Critical habitat has been designated in each of these subbasins (see USFWS 2012 for additional detail).

Primary Constituent Elements of Critical Habitat
When critical habitat was designated in 2012, the FWS determined the PCEs for spikedace. PCEs include those habitat features required for the physiological, behavioral, and ecological needs of the species. The PCEs describe appropriate flow regimes, velocities, and depths; stream microhabitats; stream gradients; water temperatures; and acceptable pollutant and non-native species levels (see USFWS 2012). PCEs for the spikedace include:

- PCE 1: Habitat to support all egg, larval, juvenile, and adult spikedace, which includes:
  - Perennial flows with a stream depth generally less than 3.3 feet, and with slow to swift flow velocities between 1.9 and 31.5 inches per second.
  - Appropriate stream microhabitat types including glides, runs, riffles, and the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness.
  - Appropriate stream habitat with a low gradient of less than approximately 1.0 percent, at elevations below 6,890 feet, and
  - Water temperatures in the general range of 46.4 to 82.4 °F;
- PCE 2: An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies;
- PCE 3: Streams with no or no more than low levels of pollutants;
- PCE 4: Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted;

- PCE 5: No non-native aquatic species or levels of non-native aquatic species that are sufficiently low as to allow persistence of spikedace; and
- PCE 6: Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

Loach Minnow

Description and Legal Status
Loach minnow is a small fish from the minnow family Cyprinidae. The limited taxonomic and genetic data available for loach minnow indicate there are substantial differences in morphology and genetic makeup between remnant loach minnow populations. Tibbets (1993) concluded that variation for loach minnow follows drainage patterns, suggesting little gene flow among rivers. The levels of divergence present in the data set indicated that populations within rivers are unique, and represent evolutionarily independent lineages. Genetic difference between the mtDNA and allozyme data was that mtDNA suggest that the San Francisco/Blue and Gila groups of loach minnow are separate, while the allozyme data places the Gila group within the San Francisco/Blue group. Tibbets (1993) concluded that the level of divergence in both allozyme and mtDNA data indicated that all three main populations (Aravaipa Creek, Blue/San Francisco Rivers, and Gila River) were historically isolated and represent evolutionarily distinct lineages.

Loach minnow (*Tiaroga cobitis*) was originally listed as a threatened species on October 28, 1986 (USFWS 1986, 51 FR 39468) and reclassified as an endangered species on February 23, 2012 (USFWS 2012, 77 FR 10810). Critical habitat has been designated (USFWS 1994), and re-designated on April 25, 2000 (USFWS 2000, 65 FR 24328) and on March 21, 2007 (USFWS 2007, 72 FR 13356) in response to legal concerns and policy changes. The current critical habitat designation was published simultaneously with the reclassification of loach minnow to endangered status on February 23, 2012 (USFWS 2012, 77 FR 10810).

Life History and Habitat
Loach minnow is a bottom-dwelling inhabitant of shallow, swift water over gravel, cobble, and rubble substrates (Rinne 1989, Propst and Bestgen 1991). Loach minnow uses the spaces between, and in the lee of, larger substrate for resting and spawning (Propst *et al*. 1988, Propst and Bestgen 1991, Rinne 1989). It is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991). Some studies have indicated that the presence of filamentous algae may be an important component of loach minnow habitat (Barber and Minckley 1966). Loach minnow feeds exclusively on aquatic insects (Schreiber 1978, Abarca 1987). Spawning occurs March through May (Britt 1982, Propst *et al*. 1988); however, under certain circumstances loach minnow also spawn in the autumn (Vives and Minckley 1990). The eggs of loach minnow are attached to the underside of a rock that forms the roof of a small cavity in the substrate on the downstream side.

Distribution, Abundance, Population Trends
Loach minnow are believed to occupy approximately 15 to 20 percent of their historical range, and are now restricted to portions of the Gila River and its tributaries, the West, Middle, and East Fork Gila River (Grant, Catron, and Hidalgo Counties, New Mexico) (Paroz and Propst

2007, Propst 2007, Propst *et al*. 2009); the San Francisco and Tularosa rivers and their tributaries Negrito and Whitewater creeks (Catron County, New Mexico) (Propst *et al*. 1988, ASU 2002, Paroz and Propst 2007, Propst 2007); the Blue River and its tributaries Dry Blue, Campbell Blue, Pace, and Frieborn creeks (Greenlee County, Arizona and Catron County, New Mexico) (Miller 1998, ASU 2002, Carter 2005, Carter 2008a, pers. comm., Clarkson *et al*. 2008, Robinson 2009a); Aravaipa Creek and its tributaries Turkey and Deer creeks (Graham and Pinal Counties, Arizona) (Stefferud and Reinthal 2005); Eagle Creek (Graham and Greenlee Counties, Arizona) (Knowles 1994, Bahm and Robinson 2009); and the North Fork East Fork Black River (Apache and Greenlee Counties, Arizona) (Leon 1989, Robinson *et al*. 2009); and possibly the White River and its tributaries, the East and North Fork White River (Apache, Gila, and Navajo Counties, Arizona).

Loach minnow have recently been placed in additional streams as part of the recovery efforts for the species. In 2007, loach minnow were translocated into Hot Springs Canyon, in Cochise County, Arizona, and Redfield Canyon, in Cochise and Pima Counties, Arizona, and these streams were subsequently augmented (Robinson 2008a, Orabutt 2009, pers. comm., Robinson *et al*. 2010a, Robinson *et al*. 2010b, Robinson 2011a, pers. comm.). Both Hot Springs and Redfield canyons are tributaries to the San Pedro River. Augmentation efforts have been suspended in Redfield Canyon due to drought and a lack of adequate flowing water. Augmentation efforts have been suspended at Hot Springs Canyon to allow managers to better evaluate if recruitment of loach minnow is persisting without need of further augmentation. Monitoring will continue at this site, and future augmentations may occur if needed.

In 2007, loach minnow were translocated into Fossil Creek, within the Verde River subbasin (Carter 2007), with additional fish added in 2008 and 2011 (Carter 2007, Carter 2008b, Robinson 2009b, Boyarski *et al*. 2010, Robinson 2011b). Loach minnow do not appear to be persisting in Fossil Creek at this time. In 2008, loach minnow were translocated into Bonita Creek, a tributary to the Gila River in Graham County, Arizona (Blasius 2008, pers. comm., Robinson 2008b, pers. comm.). Augmentations at Bonita Creek have been temporarily suspended due to re-invasion by non-native species above the fish barrier. We anticipate that augmentations with additional fish will occur for the next several years at these sites, if adequate numbers of fish are available, and habitats remain suitable. Monitoring at each of these sites is ongoing; however, insufficient time has elapsed to allow us to determine if these translocation efforts will ultimately be successful and result in establishment of new populations of loach minnow in these locations.

Threats

Climate Change

Climate models predict not only temperature increases but also an increase in the frequency and severity of storm events, heat waves, and precipitation events. Temporal asynchronicity will exacerbate the impacts on aquatic habitats and organisms. Ultimately, climate change predicts regionally drier conditions for the Southwest and an increasing probability of drought. Assuming those predictions hold, we anticipate that fish species in the southwest will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and

- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature is likely to lead to increased water temperature, streams will become increasingly intermittent, and aquatic habitat will degrade.

Conservation, Consultation and Recovery Planning
Our information indicates that, rangewide, more than 390 consultations have been completed or are underway for actions affecting spikedace and loach minnow, which often co-occur. The majority of these opinions concerned the effects of road and bridge construction and maintenance, grazing, water developments, fire, species control efforts, or recreation. There are a high number of consultations for urban development and utilities, however, these projects typically do not result in adverse effects to the species but are for technical assistance only. Small numbers of projects occur for timber, land acquisition, agriculture, sportfish stocking, flooding, habitat conservation planning, native fish restoration efforts, alternative energy development, and mining.

Critical Habitat
The loach minnow critical habitat designation includes eight units based on river subbasins, including the Verde River, Salt River, San Pedro River, Bonita Creek, Eagle Creek, San Francisco River, Blue River, and Gila River subbasins. Occupancy within these units is described in USFWS 2012. Critical habitat has been designated in each of these subbasins (see USFWS 2012 for additional detail).

Primary Constituent Elements of Critical Habitat
When critical habitat was designated in 2012, FWS determined the PCEs for loach minnow. PCEs include those habitat features required for the physiological, behavioral, and ecological needs of the species. The PCEs describe appropriate flow regimes, velocities, and depths; stream microhabitats; stream gradients; water temperatures; and acceptable pollutant and non-native species levels (see USFWS 2012). PCEs for the loach minnow include:

- PCE 1: Habitat to support all egg, larval, juvenile, and adult loach minnow which includes:
    - Perennial flows with a stream depth generally less than 3.3 feet, and with slow to swift flow velocities between 0.0 and 31.5 inches per second;
    - Appropriate stream microhabitat types including pools, runs, riffles, and rapids over sand, gravel, cobble, and rubble substrates with low or moderate amounts of fine sediment and substrate embeddedness;
    - Appropriate stream habitat with a low gradient of less than approximately 2.5 percent, at elevations below 8,202 feet; and
    - Water temperatures in the general range of 46.4 to 77 °F;
- PCE 2: An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies;
- PCE 3: Streams with no or no more than low levels of pollutants;

- PCE 4: Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted;
- PCE 5: No non-native aquatic species or levels of non-native aquatic species that are sufficiently low as to allow persistence of loach minnow; and
- PCE 6: Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

Sonora Chub

Description and Legal Status

The Sonora chub is a stream-dwelling member of the minnow family (Cyprinidae). The Sonora chub is a tenacious, desert-adapted species that exploits small habitats (Hendrickson and Juarez-Romero 1990), and is able to survive under severe environmental conditions. This fish species can achieve total lengths of 7.8 inches (Hendrickson and Juarez- Romero 1990). In the U.S., it typically does not exceed 5.0 inches (Minckley 1973). The body is moderately chubby and dark-colored, with two prominent, black, lateral bands above the lateral line (whence the specific epithet, ditaenia) and a dark, oval basicaudal spot. Breeding individuals are brilliantly colored (Miller 1945).

The FWS listed the Sonora chub (*Gila ditaenia*) in U.S. and Mexico as threatened on April 30, 1986, with critical habitat (51 FR 16042) (USFWS 1986). Reasons for listing included possible introduction of exotic fishes and their parasites into its habitat, and potential mining activities. In addition, it is particularly sensitive to these threats because of its very limited range, and because of the intermittent nature of the stream.

Life History and Habitat

In Sycamore Creek, Sonora chub are found in the largest, deepest, most permanent pools (Carpenter 1992). Analysis of habitat use by Sonora chub showed this species preferring deep pools and some amount of floating cover (USFWS 1992). In Mexico, Sonora chub were not randomly distributed, but were concentrated in deeper areas and under cover. Preferred cover reportedly was fallen logs, areas of dense aquatic vegetation, and undercut root-masses (Miller 1945). These forms of cover were used if associated with intermediate to low current velocity.

Although Sonora chub is regularly confined to pools during arid periods, it prefers riverine habitats. In lotic (i.e., slow moving) waters in Mexico, Hendrickson and Juarez-Romero (1990) found it commonly in pools less than 2 feet deep, adjacent to or near areas with a fairly swift current, over sand and gravel substrates. It was less common in reaches where pools with low velocities and organic sediments were predominate. Sonora chub are adept at exploiting small marginal habitats, and they can survive under severe environmental conditions. It is also apparent that they can maneuver upstream past small waterfalls and other obstructions to colonize newly-wetted habitats (Carpenter and Maughan 1993).

The majority of habitat occupied by Sonora chub within the U.S. exists within the CNF, and about one-half of the drainage is within Pajarita Wilderness and Goodding Research Natural Area (RNA). The CNF contains six miles of habitat occupied by Sonora chub. Various agency staff (FS, FWS, and other entities) have reliably detected Sonora chub, though the upstream limits of the species' occurrence are variable, as discussed below.

Distribution, Abundance, Population Trends

It is difficult to determine if there have been appreciable changes in the species distribution because present-day distribution data are primarily anecdotal, as stated in the *Sonora chub/Charalito Sonorense (Gila ditaenia) 5-Year Review: Summary and Evaluation* (USFWS 2013). There is no existing survey protocol for Sonora chub, though development of a rigorous protocol was identified as a recovery task in the Sonora chub Recovery Plan. Despite these limitations, we believe that most of the Distribution and Abundance Information has not changed since the 2005 BO/CO so we hereby incorporate that information by reference. The 5-year Review for the Sonora chub states that there are no data to indicate that Sonora chub numbers are increasing or decreasing in abundance within the U.S., nor does it appear that threats have been appreciably ameliorated (USFWS 2013).

Within the U.S. and at the time of listing and recovery planning, Sonora chub was known to occur only in Sycamore Creek. The AGFD (1995) discovered that a second population of Sonora chub also occurs in California Gulch, a stream located approximately 3 miles west of Sycamore Canyon, and its tributary streams. Together, the populations in Sycamore Creek and California Gulch most likely comprise a metapopulation. California Gulch has been surveyed infrequently since the initial discovery, and Sonora chub are reliably present in suitable habitat from the International Boundary upstream to the tinaja (a deep, perennial pool situated just below a small dam).

In 2002, Sonora chub were detected in three new locations within the Sycamore Canyon watershed: one site was within an unnamed side canyon, one in Sycamore Canyon proper, and the third was in Atascosa Canyon (USFWS 2002).

Hendrickson and Juarez-Romero (1990) surveyed Sonora chub in the Río de La Concepción basin in Sonóra, México and posited that threatened status was appropriate for the peripheral and geographically isolated population of Sonora chub in Arizona while rangewide, the species' status was secure. The current status of Sonora chub in Mexico is unknown, but it is presumed that predatory and competitive non-native fishes noted by these authors are still present within the species' range there and that drought has affected Sonóra to an extent similar to Arizona.

In the agency's initial report documenting Sonora chub in California Gulch, AGFD (1995) recommended that other drainages in the Rios Altar and Magdalena watershed in the U.S. be investigated. To date, no additional populations of Sonora chub have been confirmed in these waters, though we note that drought conditions have likely reduced the extent of surface water in the region. In May 2006, FWS staff confirmed the continued presence of Sonora chub in the headwaters of the Río Cocóspera at Rancho el Aribabi in Sonora (Duncan 2006). It is presumed that predatory and competitive non-native fishes are still present there and the drought has also affected the region.

The absence of rigorous and repeatable species abundance surveys renders it difficult to definitively determine population trends either through direct measures of abundance or the surrogate of habitat availability. Like Sonora chub surveys in the historical record, the recent survey history is composed primarily of field notes from site visits, many of which were contained in information submitted by AGFD during the preparation of Sonora chub 5-Year Review (AGFD 2009, USFWS 2013). Notes from site visits conducted by USFS, FWS, and other entities' staffs indicate that Sonora chub are detected reliably when habitat is available, though the upstream limits of the species' occurrence in California Gulch appears to be variable based on the presence of non-native fish - largemouth bass (*Micropterus salmoides*) in particular (USFWS 2010).

The species evidently maintains a population through use of perennially watered reaches during droughts and is redistributed by dispersal of small individuals during periods of greater discharge (Hendrickson and Juarez-Romero 1990). For example, following periods of drought, Sonora chub recolonized California Gulch from permanent pools located downstream in Mexico, although the fish have dispersed from pools located further upstream in California Gulch.

Overall, the status of the Sonora chub and its designated critical habitat has not changed significantly rangewide (almost entirely on the CNF), based upon the information we have, since issuance of the 2012 LRMP BO.

Threats

Fire

Wildfire within the watersheds of Sycamore Canyon and/or California Gulch may intermittently affect Sonora chub through loss of ground cover (increased peak flow volumes and sediment yields) and mortality of riparian vegetation (loss of stream bank stability and shading). Specific wildfire incidents are discussed in greater detail in the species' Environmental Baseline section, below.

Non-native species

It should be noted also that there is a safety concern associated with surveying for this species. The canyons where it occurs (Sycamore and California Gulch/Warsaw Canyon) are known routes for drug traffickers and illegal border crossers; therefore, border security issues make it difficult to monitor Sonora chub populations. As a result, population surveys are only conducted in a major pool in the upper end of the canyon. These drainages are negatively impacted by the presence of non-native species, including green sunfish and bullfrogs. Despite the presence of a large population of bullfrogs, Sonora chub persists in good numbers in Sycamore Canyon. Surveys conducted in 2005, 2006, and 2009, indicate that there was no known net loss of populations detected during the reporting period, nor a reduction of pool or spring habitat (USFS 2008, 2013).

Climate Change

The potential effects of climate change on Sonora chub are briefly discussed in the Final 5-Year Review (USFWS 2013). Although a summary of that discussion is presented here, the reader is referred to the 2013 Final 5-Year Review for the full discussion and list of references.

The state of knowledge regarding climate and potential impacts on ecosystems has expanded greatly since Sonora chub was listed in 1986. For aquatic systems, changes in temperature and stream flow are anticipated to reduce the amount of habitat available within the U.S. and degrade habitat conditions throughout the species' range.

Intensified future droughts are anticipated in the American Southwest (Seager *et al*. 2007) with predictions that the region "…will dry in the 21st century and that the transition to a more arid climate should already be under way." Weiss and Overpeck (2005) state that multi-year or decade-scale changes in precipitation will be difficult to forecast and will affect how ecosystems and watersheds function. These changes will be hard to predict and are likely to occur nonlinearly.

Therefore, while it appears reasonable to assume that the species may be affected by climate change, there is a lack of certainty as to how climate change specifically will affect Sonora chub beyond loss, reduction, and degradation of habitat. There are no expectations of measurable changes in climate within the temporal bounds of this action.

Conservation, Consultation and Recovery Planning
The FWS determined the Sonora chub to be threatened on April 30, 1986 (51 FR 16042). The rule stated that the fish was threatened by the possible introduction of exotic fishes and their parasites into its habitat, and by potential mining activities. The rule also stated that it is particularly vulnerable to these threats because of its very limited range, and because of the intermittent nature of the streams it occupies.

According to the 1992 Recovery Plan for this species, distribution of Sonora chub in the U.S. is intact and should remain secure, barring major environmental change (C.O. Minckley 1983, Minckley 1985). The limited distribution of Sonora chub in the U.S. places inordinate importance on the quality of habitat in Sycamore Creek (USFWS 1992) and California Gulch. The Sycamore drainage has been highly modified by human activities, including grazing, mining, recreation, and the introduction of exotic taxa. It regularly sustains large floods and severe droughts. A series of environmental perturbations made worse by degraded watershed conditions could cumulatively result in extirpation of the species from the U.S.

Sycamore Creek is at the edge of the range of the species, is isolated from other populations of Sonora chub, and has marginal habitat (Hendrickson and Juarez-Romero 1990). Channel degradation, siltation, and water pollution caused primarily by livestock grazing, roads, and mining have probably affected the habitat of Sonora chub. Cattle regularly gain access to Sycamore Canyon through an un-maintained section of fence along the international border (USFWS 1999), and degrade the riparian vegetation in the lower 2.5 miles of the stream (Carpenter 1992). In 1981, exploration for uranium occurred along an approximate 7.5 miles stretch of the upper eastern slopes of the Sycamore drainage. According to the 1992 Recovery Plan for the Sonora chub, uranium was found and claims are being maintained; however, no active mining was planned at that time.

Native fishes appear adept at maintaining populations during severe conditions so long as their habitats are unaltered (Minckley and Meffe 1987). Thus, a single catastrophic event, such as severe flood, fire or drought, is unlikely to eliminate Sonora chub from the U.S.

Predation by non-native vertebrates is also a threat to populations of Sonora chub. Green sunfish (*Lepomis cyanellus*) is a known predator on native fishes in Arizona (Minkley 1973) and has been found in Sycamore Creek below the entrance of Penasco Canyon (Brooks 1982). Coincidental introductions of exotic parasites that infest native faunas are possible when non-native fishes are brought into a drainage. Although little information is available on parasites and diseases of Sonora chub, the effects of exotic parasites that infest native fish fauna is often adverse (USFWS 1992).

Roadways in Sycamore Canyon south of Ruby Road have been obliterated and closed to off-road vehicle traffic. In addition, livestock was eliminated from the riparian corridor of Sycamore Canyon, and in portions of the riparian corridor of California Gulch. Sonora chub are also now a primary consideration in the development of allotment management plans for grazing allotments in both Sycamore Canyon and California Gulch, south of Ruby Road. Sycamore Canyon and its tributaries are relatively stable; fuel loads upslope are not excessive, and the stream and its tributaries handle flood events well. California Gulch is more prone to drought, and has far less surface water. Both systems have non-native species. Bullfrogs have become extremely abundant in Sycamore Canyon (but the chub persists), and bullfrogs and warm water game fishes are found in California Gulch. The University of Arizona, FS, and AGFD have been eradicating bullfrogs in Sycamore Canyon. Because this canyon straddles the Mexican border, there are concerns that borderland security issues may inhibit surveys and conservation efforts (USFS 2013).

The FS continues to work with Customs and Border Patrol, FWS and others to address issues related to border fencing and livestock trespass on NFS land (USFS 2013).

Critical Habitat

Critical habitat was designated at the time of federal listing to include areas of land and water in the CNF, consisting of the following:

- Sycamore Creek, and a riparian zone 25 feet wide along each side of the creek, from Yank’s Spring downstream approximately 5 stream miles to the International Border with Mexico;
- Yank’s Spring;
- Penasco Creek, including a riparian zone 25 feet wide along each side of the creek, from its confluence with Sycamore Creek; and
- An unnamed tributary to Sycamore Creek, from its confluence with Sycamore Creek.

This riparian zone is believed essential to maintaining the creek ecosystem and stream channels, and to the conservation of the species (USFWS 1986). Primary constituent elements were not identified in the 1986 Final Rule. However, habitat characteristics important to this species of chub include clean permanent water with pools and intermediate riffle areas, and/or intermittent pools maintained by bedrock or by subsurface flow in areas shaded by canyon walls.

Desert Pupfish

Description and Legal Status

The desert pupfish is a small fish, less than three inches long, and a member of the Cyprinodontidae family (Minckley 1973). The body is thickened and laterally compressed; coloration is a silvery background with narrow dark vertical bars on the sides. The protruding mouth is equipped with tricuspid teeth and the desert pupfish has an opportunistic, omnivorous diet, consisting of invertebrates, plants, algae, and detritus (Cox 1966 and 1972, Naiman 1979). Males are larger than females and become bright blue with orange-tipped fins during the breeding season and exhibit aggressive, territorial behavior (USFWS 1993).

The desert pupfish (*Cyprinodon macularius*) was listed as an endangered species with critical habitat in 1986 (USFWS 1986, 51 FR 10842). A recovery plan was completed in 1993 (USFWS 1993). The reasons for decline of this fish include competition from exotic fishes, water pollution, ground-water pumping, agricultural pesticide drift, stream channelization and habitat modifications.

Life History and Habitat
Spawning occurs from spring through autumn, but reproduction may occur year-round depending on conditions (Constanz 1981). The desert pupfish appears to go through cycles of expansion and contraction in response to natural weather patterns (USFWS 1986, 1993, Weedman and Young 1997). In very wet years, populations can rapidly expand into new habitats (Hendrickson and Varela-Romero 1989). Historically, this scenario would have led to panmixia among populations over a very large geographic area (USFWS 1993).

The desert pupfish has a tolerance for high temperatures, high salinities, and low dissolved oxygen concentrations that exceed the levels known for many other freshwater fishes (Lowe *et al*. 1967, USFWS 1993). Habitats have included clear, shallow waters with soft substrates associated with cienegas, springs, streams, margins of larger lakes and rivers, shoreline pools, and irrigation drains and ditches below 5,200 feet in elevation (Minckley 1973, Hendrickson and Varela-Romero 1989). Historical collections occurred in Baja California and Sonora, Mexico, and in the United States in California and Arizona.

Distribution, Abundance, Population Trends
Although the desert pupfish does not occur on the CNF, it does occur downstream of the forest boundary. Historical collections occurred in Baja California and Sonora, Mexico, and in the United States in California and Arizona. Historical distribution of desert pupfish in Arizona included the Gila, San Pedro, Salt, and Santa Cruz rivers, and likely the Hassayampa, Verde, and Agua Fria rivers, although collections are lacking for the latter three. The desert pupfish was also found in the Lower Colorado River, Rio Sonoyta basin, Salton Sink basin, and Laguna Salada basin (Eigenmann and Eigenmann 1888, Garman 1895, Gilbert and Scofield 1898, Evermann 1916, Miller 1943, Minckley 1980, Black 1980, Turner 1983, Miller and Fuiman 1987). Additional life history information can be found in the recovery plan (USFWS 1993) and five-year review (USFWS 2010 and other references cited there).

In Arizona, the desert pupfish genus *Cyprinodon* was historically comprised of two recognized subspecies, (*C. m. macularius*) and (*C. m. eremus*), and an undescribed taxon, the Monkey Spring pupfish (USFWS 2010). They are still recognized as subspecies under the Act. The desert pupfish subspecies are now recognized as separate species, the desert pupfish and the Rio Sonoyta (Quitobaquito) pupfish (*C. eremus*) (Echelle *et al*. 2000), and the undescribed Monkey Spring form has since been described and renamed the Santa Cruz pupfish (*C. arcuatus*) (Minckley *et al*. 2002). The desert pupfish and Rio Sonoyta pupfish were listed as endangered (sub) species with critical habitat in 1986 (USFWS 1986). Critical habitat was designated in Arizona at Quitobaquito Springs on Organ Pipe Cactus National Monument in Pima County and in California along parts of San Felipe Creek, Carrizo Wash, and Fish Creek Wash. The Mexican government has also listed the desert pupfish as endangered.

Work on the genetics and taxonomy of *C. macularius* has led to the division of the taxon into three species. This has effectively reduced the historical range of *C. macularius*. However, because *C. arcuatus* is likely extinct and is also considered ecologically similar to *C. macularius*, the range of *C. arcuatus* in the Santa Cruz River basin will be stocked with *C. macularius*.

More recent work (Echelle *et al*. 2007, Koike *et al*. 2008) provided further evidence that *C. macularius* and *C. eremus* are separate species. Results from microsatellites assays attribute 23 percent of microsatellite diversity to differences between the two species (Echelle *et al*. 2007). There was a small, but statistically significant part of the microsatellite diversity attributed to variation among the Salton Sea populations and the Colorado River delta populations. For *C. eremus*, there were differences in microsatellites between the two populations, but they were not significant (Echelle *et al*. 2007). They found no genetic evidence of separate evolutionarily significant units for either species. However, they recommended the recognition of two management units for *C. eremus* (Quitobaquito and Rio Sonoyta) and five for *C. macularius*, three in the Colorado River delta (Laguna Salada, Cerro Prieto, and Cienega de Santa Clara/El Doctor) and two in the Salton Sea (San Felipe Creek/San Sebastian Marsh and Salton Sea). They state that the loss of any one of the management units would be a significant step toward extinction of the species (Echelle *et al*. 2007).

Naturally occurring populations of desert pupfish (*C. m. macularius* or *C. macularius*) are now restricted in the United States to two streams tributary to, in shoreline pools and irrigation drains of the Salton Sea, and in the Sea itself, in California (Lau and Boehm 1991, Keeney 2013). This species is found in Mexico at scattered localities along the Colorado River Delta and in the Laguna Salada basin (Hendrickson and Varela-Romero 1989, Minckley 2000). The Quitobaquito pupfish (*C. m. eremus* or *C. eremus*), considered to be a separate species, persists in only two natural populations: one near the United States – Mexico border at Quitobaquito Springs in Organ Pipe Cactus National Monument in Arizona, in the U.S., and the other at Rio Sonoyta in Sonora, Mexico. Collectively, there are 11 extant populations of desert pupfish known in the wild in the United States and Mexico (California = 5, Arizona = 1, and Mexico = 5; Tier 1 populations in the Recovery Plan) (Table DP-1). Although many reestablishments have been attempted, approximately 25 transplanted populations of the desert pupfish exist in the wild at present, though this number fluctuates due to the establishment (and failure) of populations (Moyle 2002) (Tier 2 populations in the Recovery Plan) (USFWS 1993, Voeltz and Bettaso 2003, USFWS files) (Table DP-2). There is a total of 47 captive or refuge desert pupfish populations (that do not qualify as Tier 3), comprised of 34 in Arizona, 8 in California, and 5 in Sonora, Mexico. The range-wide status of desert pupfish is poor but stable, although increasing in Arizona due to an active recovery program (Duncan and Clarkson 2013, Crowder and Robinson 2015, Robinson and Crowder 2015). The fate of the species depends heavily upon future developments in water management of the Salton Sea and Santa de Clara Cienega in Mexico.

Arizona

No natural populations of *C. m. macularius* remain in Arizona, although numerous captive and wild, reestablished populations currently exist (Table DP-2; AGFD & USFWS, unpublished data). These populations have been established on private, municipal, county, state, and Federal lands. Desert pupfish have been established at Mud Springs on the Tonto National Forest, and there are plans to stock them at several additional sites on that Forest. Desert pupfish have also been successfully established at several wild sites on the Muleshoe Cooperative Management Area, at Las Cienegas National Conservation Area, and at the San Pedro Riparian National Conservation Area. Additional sites in both National Conservation Area areas will also receive desert pupfish. Additional captive sites persist in southern Arizona, with a number of refuge and wild ponds having recently been created under a Safe Harbor Agreement (Table DP-3; AGFD 2015).

California
Five natural populations persist in California and no reestablished wild populations exist in California or Mexico. There are a total of 15 refuge populations in California (Table DP-3) (Keeney 2010, 2013, 2015). A total of six of the ponds have problems with non-native species, mainly mosquitofish. In addition, desert pupfish are likely extirpated at two more ponds, one of which is being restored (McCallum Pond, Coachella Valley Preserve) (Keeney 2010a).

Desert pupfish numbers in the Salton Sea are relatively low, but they are patchily distributed throughout (Parmenter *et al*. 2002, Keeney 2010b, 2013, 2015). While populations in irrigation drains entering the Sea can be abundant (Keeney 2010a, 2013, 2015), fish populations there are still dominated by non-native fish (Martin and Saiki 2005, Keeney 2010a, 2013, 2015). The desert pupfish population in Salt Creek is stable to increasing, and currently has few non-native species. San Felipe Creek also has a stable to increasing population, and no non-native fish have been found in recent surveys (Keeney 2010a, 2013, 2015).

Desert pupfish do occur in other areas of the Salton Sink when conditions are suitable, and currently do occur in a wash near Hot Mineral Spa. This population is basically a fifth natural population (Tier 1) of *C. m. macularius* in California. As part of the research surrounding Salton Sea restoration, a shallow water habitat was constructed near the Alamo River (USBR 2005). The project was designed to exclude fish (USBR 2005); however, desert pupfish got into the ponds and flourished (Roberts 2010). The pilot project is over, the site was decommissioned, and pupfish were salvaged. Over 1,000,000 desert pupfish were moved to existing and new refuges, and to irrigation drains and other habitats around the Salton Sea (Keeney 2010b).

Mexico
In Mexico, five natural populations remain; no reestablished populations persist there. One natural population of *C. m. eremus* persists in Sonora, Mexico, in the Rio Sonoyta. Four refuge populations have been established in the last few years (Table DP-3; Duncan and Tibbitts 2008).

Additionally, *C. m. eremus* was stocked into the Quitovac Spring and ponds at Ejido Quitovac in 2007. Quitovac is within the Rio Guadelupe drainage, rather than the Rio Sonoyta drainage, and thus is outside of known historical range. The Rio Guadelupe is the next drainage to the east of the Rio Sonoyta, and very rarely, if ever, flows to the Sea of Cortez. The springs at Quitovac are similar to the Rio Sonoyta, both contain the Rio Sonoyta mud turtle (*Kinosternon sonoriensis sonoytae*), which only occurs in the Rio Sonoyta and Rio Guadelupe drainages (Rosen 2003). The northern divide in the headwaters between the two watersheds is very subtle.

Threats
Many natural and reestablished desert pupfish populations are imperiled by one or more threats. Threats to the species relating to destruction or curtailment of habitat include loss and degradation of suitable habitat through ground water pumping or water diversion; contamination

from agricultural return flows, as well as other contaminants, and physical changes to water properties involving suitable water quality (71 FR 20714, USFWS 1986, 2010; Moyle 2002, Martin and Saiki 2005, Echelle *et al*. 2007, Minckley and Marsh 2009). On Federal lands, Endangered Species Act section 7 consultations have addressed effects of grazing, roads and bridges, agency planning, fire, flooding, recreation, pest control programs, irrigation drain maintenance, water transfers, and water development as potential threats to desert pupfish habitat. Although effects from these threats continue to be moderated for the desert pupfish, biologically, impacts from these threats individually and collectively can create fragmented populations in poorer quality habitat that are small and restricted in range, which can further endanger the desert pupfish.

The threats identified at the time of listing and in the recovery plan continue unabated. New non-native aquatic species continue to establish within the desert pupfish's range, and previously existing non-native species increase in numbers and distribution (Minckley and Marsh 2009). Human demands for water are unending, with the Salton Sea, Cienega de Santa Clara, and the Rio Sonoyta suffering water level declines and the associated threats to the desert pupfish from water depletion, such as habitat loss, fragmentation, and degradation of habitat quality still ongoing. Water availability for the desert pupfish will continue to suffer with predicted trends for warmer, drier, and more extreme hydrological conditions associated with climate change.

Habitat loss and modification
Groundwater extraction was considered a threat in the listing (51 FR 10842), recovery plan (USFWS 1993), and in the five-year review (USFWS 2010). It is still considered a threat; especially at Quitobaquito, Rio Sonoyta (Brown 1991), and El Doctor (P. Reinthal, University of Arizona, pers. comm.). Water extraction removes and degrades habitat, leaving higher concentrations of salts, toxic contaminants, and sediment in the remaining volumes of water and lower amounts of dissolved oxygen, and thus interacts with other compounding threats. Water reductions could lead to less shallow-water habitat preferred by the desert pupfish. Slight increases in salinity could benefit desert pupfish, by reducing populations of problematic non-native fishes. However, if salinity keeps increasing, wetland areas may become unsuitable even for pupfish. The proposed changes to the configuration of the Salton Sea will reduce pupfish habitat, but there will still be habitat for numerous populations to persist. Any change to the water budget at Cienega de Santa Clara could be detrimental to the desert pupfish there. Groundwater withdrawal in the Rio Sonoyta drainage has exceeded recharge for decades. In addition, the pumping capacity is about twice of what is withdrawn in an average year (Brown 1991, Pearson and Conner 2000).

Since the 19th century, desert pupfish habitat has been impacted by streambank erosion, the construction of water impoundments that dewatered downstream habitat, excessive groundwater pumping, the application of pesticides to nearby agricultural areas, and the introduction of non-native aquatic species as both predators and potential competitors (Matsui 1981, Hendrickson and Minckley 1984, Minckley 1985, Schoenherr 1988). The bullfrog is an opportunistic omnivore with a diet that includes fish (Frost 1935, Cohen and Howard 1958, Brooks 1964, McCoy 1967, Clarkson and deVos 1986). Introduced salt cedar (*Tamarisk* spp.) growing adjacent to desert pupfish habitat might cause a lack of water at critical times (Bolster 1990, R. Bransfield, USFWS, pers. comm. 1999); however, recent scientific information contradicts the long held belief that tamarisk consumes more water than native trees (Glenn and Nagler 2005).

Recreation and Grazing
Watershed condition has been and continues to be a concern over most of the Southwest. Recreational pursuits that have the potential to increase soil erosion (i.e. off-road vehicles are a concern for desert pupfish because of their impacts to watershed health, rather than any direct effects. Overgrazing and historically extensive logging combined with climatic events (drought followed by rain events), have led to increased erosion and deeper channelization (Miller 1961, Bahre 1991), which do not provide the more shallow, clear, and vegetatively complex wetlands preferred by the desert pupfish (Hanes 1996).

Extensive logging is no longer a threat to desert pupfish or their habitats. Improper grazing at a watershed level probably does not impact desert pupfish populations anymore, except at the Rio Sonoyta. Grazing of occupied sites still occurs in Mexico and the United States. However, grazing in the United States is better managed and much less of a concern for its impacts to desert pupfish habitat. Urbanization and other human activities can and continue to impact watershed health and functioning.

Environmental contaminants, such as heavy metals, accumulating in water sources were given as threats at the time of listing, particularly in the form of mercury. At this time, selenium seems to be the element of most concern for fishes in the Salton Sea (Saiki 1990, California Regional Water Quality Control Board 1991, McClurg 1994, Saiki *et al*. 2008). In addition to conditions of elevated salinity, contaminants are still present in irrigation drains entering the Salton Sea. These include problematic levels of heavy metals and organochlorines entering the Salton Sea, and effects to dissolved oxygen in the Salton Sea (Saiki 1990, Matsui *et al*. 1992). Salinity in the Salton Sea is expected to continue increasing (Saiki 1990, Matsui *et al*. 1992) to the point the Sea will be inhospitable for all fish (California Regional Water Quality Control Board 1991, McClurg 1994), unless planned restoration actions occur.

Livestock grazing was not mentioned as a threat in the final rule (51 FR 10842), although habitat modification from grazing was mentioned in the recovery plan (USFWS 1993). The small size and high physical tolerance of the desert pupfish allow it to exist in small amounts of water spanning a wide variety of extreme habitat and water quality conditions (USFWS 1993). Due to the scarcity of water in the desert pupfish's desert habitat and the tendency for cattle to congregate in watered areas, cattle are attracted to desert pupfish habitats that can lead to local impacts quickly. Low water conditions combined with congregations of cattle activity (grazing, watering, hoof action) can lead to additional reductions in water, physiological effects of reduced water quality, bank trampling, fragmentation of contiguous water, isolation/stranding and trampling of fish and eggs (Roberts and White 1992), and loss of habitat through de-watering. Long-term or seasonal drought can also exacerbate these conditions. Round-up of trespass cattle within these small enclosed areas could cause cattle congregations to increase their hoof action and cause movement into fish habitat. Cattle can cause disturbance, a decline in water quality, and mortality of fish and desert pupfish eggs, particularly at the perimeter of ponds, springs, wells, and shallow wetland areas, by reducing the distribution and abundance of water and isolating fish and eggs into inhospitable areas (Kauffman and Krueger 1984, Fleischner 1994, and Belsky *et al.* 1999). Carefully controlled grazing around some of the small pond habitats as a tool to manage problematic aquatic vegetation could actually be beneficial to the desert pupfish (Kodric-Brown and Brown 2008). Although impacts from livestock grazing have been problematic in some areas, as a result of consultations many of the impacts have been alleviated through fencing and grazing rotations.

Predation and Competition
Desert pupfish are susceptible to parasites and predation and competition from non-native fish and other species. Desert pupfish are known to suffer infestations of anchor worm (*Lernea* spp.) (51 FR 10842) (Robinson 2009). Miller and Fuiman (1987) noted a nematode parasite present in desert pupfish collected from Quitobaquito Springs in Organ Pipe Cactus National Monument and hypothesized, after Cox (1966) that the parasites resembled a nematode known from birds and that waterfowl or shorebirds were a possible vector for introduction to the desert pupfish. It is therefore conceivable that many desert pupfish populations are at risk of infestation by this parasite. However, the specific effects to individual desert pupfish or populations are unknown. *Lernea* can kill its host, although largely through secondary infections.

Predation and competition from non-native fish have been identified as main causes of the decline of the species (51 FR 10842; USFWS 1993, 2010). Non-native fish are still a major threat to the desert pupfish at this time. Martin and Saiki (2009) found the remains of *C. m. macularius* in the gastrointestinal contents of one longjaw mudsucker. In addition they found unidentifiable fish remains in the gastrointestinal contents of sailfin molly, porthole livebearer, longjaw mudsucker, redbelly tilapia, Mozambique tilapia, and western mosquitofish. In an earlier study (2005) they found the abundance of *C. m. macularius* to be inversely related to the abundance of non-native fish.

It has long been assumed that western mosquitofish have a negative impact on desert pupfish (Deacon and Minckley 1974, USFWS 1993), through similar mechanisms by which they affect other small fishes, such as competition for food and the predacious habits of mosquito fish upon young fish, as well as fin damage under crowded conditions (Meffe *et al*. 1983, Meffe 1985). Martin and Saiki (2009) found unidentifiable fish remains in western mosquitofish. They also believed there was significant dietary overlap between desert pupfish and western mosquitofish. To the contrary however, Martin and Saiki (2005) also found the abundance of desert pupfish was positively correlated with the presence of western mosquitofish. We surmise that this result stems from the high tolerance of both species to poor water quality and from competition with the many other non-native fish individuals present in shared habitats. Because non-native aquatic species are present in many occupied or potential desert pupfish habitats and non-native aquatic species are exceedingly difficult to get rid of once established, non-native aquatic species continue to be a major threat to the conservation of the desert pupfish.

These threats still occur today and continue to be impacted by increasing human development and demand for water, as well as interactions with predicted trends for warmer, drier, and more extreme hydrological conditions associated with climate change.

Climate Change
Climate models predict not only temperature increases but also an increase in the frequency and severity of storm events, heat waves, and precipitation events. Temporal asynchronicity will exacerbate the impacts on aquatic habitats and organisms. Ultimately, climate change predicts regionally drier conditions for the Southwest and an increasing probability of drought. Assuming those predictions hold, we anticipate that fish species in the southwest will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature is likely to lead to increased water temperature, streams will become increasingly intermittent, and aquatic habitat will degrade.

Conservation, Consultation and Recovery Planning
The recovery plan treats the two subspecies recognized at the time differently. Insoluble threats and limited habitat are stated as preventing delisting for either subspecies in the foreseeable future. There are downlisting criteria, but no delisting criteria for the subspecies desert pupfish (*C. m. macularius*). Downlisting or delisting of the single population of Quitobaquito pupfish (*C. m. eremus*), located in southern Arizona on the border, is not expected according to the recovery plan; therefore *C. m. eremus* is not discussed further in this section. A Desert Fishes Team report (2006) analyzes and rates recovery plan implementation for *C. m. macularius* in the Gila River basin.

Recovery criterion 1 has not been met. Currently, naturally-occurring populations are relatively secure only at San Felipe Creek, California. Table DP-1 shows the currently known natural populations of desert pupfish. Recovery criterion 1 addresses threat factor A, the present or threatened destruction, modification, or curtailment of the desert pupfish’s range, and seeks to minimize the impact of disease and predation (factor C) and other natural or manmade factors (factor E) on the population as a whole.

The number of natural and reestablished populations contained in the Task 2 specifications (USFWS 1993: Tables DP-1 and DP-2) has not been met in Arizona, California, Baja California, or Sonora (Varela-Romero *et al*. 2002, Voeltz and Bettaso 2003, Duncan and Tibbits 2008, USFWS files). Most of the reestablished populations are in human constructed environments (Table DP2). The United States refuge populations of Quitobaquito pupfish are all outside of the Rio Sonoyta drainage, and ostensibly outside of historical range. The Desert Fishes Team report (2006) rated the implementation of this task as “low,” though multiple reestablishments have occurred since the report (Table DP-2).

Based on their work on the natural populations and contrary to the recovery plan, Loftis (2007) and Echelle *et al*. (2007) recommended several management units. For *C. m. eremus* they recommended that the Rio Sonoyta and Quitobaquito populations be managed separately (Echelle *et al*. 2000). They recommended five management units for *C. m. macularius*: Laguna Salada, Cerro Prieto, Cienega de Santa Clara/El Doctor, San Felipe Creek, and the rest of the Salton Sea system (Echelle *et al*. 2007, Loftis *et al*. 2009). The recovery plan has three management units for California: San Felipe Creek, Salt Creek, and the Salton Sea (including the irrigation drains).

As stated above, the AGFD has conducted periodic and comprehensive status reviews of the desert pupfish in Arizona (Simons 1987, Bagley *et al*. 1991, Brown and Abarca 1992, Weedman and Young 1997, Voeltz and Bettaso 2003). The methodology used to assess the status of the desert pupfish in Arizona has been refined by these authors and currently exists as a de facto population monitoring protocol in Arizona. Quitobaquito is monitored regularly by Organ Pipe Cactus National Monument staff, following an established protocol (Douglas *et al*. 2001, Tibbitts 2009). The Rio Sonoyta is sampled annually; the Cienega de Santa Clara and El Doctor in Mexico are regularly surveyed by CEDES (State of Sonora resource agency) and CONANP (Mexican national parks agency). The California Department of Fish and Wildlife monitors all populations in California monthly or bi-monthly, following an established protocol (Black 1980). These monitoring protocols only partially meet the requirements of recovery criterion 4 and task 5 from the recovery plan. Genetic monitoring and population monitoring and maintenance were ranked as “moderate” implementation by the Desert Fishes Team (2006).

Yaqui Catfish

Description and Legal Status

The Yaqui catfish is a medium to large fish of the family Ictaluridae (Minckley 1973). The body is slender and streamlined with older (larger) fish appearing more thick bodied. The caudal fin is shallowly forked and the anal fin has a broadly rounded distal margin with 23-25 rays. The body is profusely speckled in young fish, while adults are more unicolored, dark gray to black dorsally, white to grayish beneath. Barbels are jet-black except on the immediate chin where they are gray to whitish.

The Yaqui catfish was originally described as *Villarius pricei* by Rutter (1896) from the Rio San Bernardino, Northwestern Sonora. The name *pricei* was transferred among a number of genera before being settled in *Ictalurus* (see Hendrickson *et al*. 1980). *Ictalurus meeki* (Regan 1906), described from the upper Rio Papigochic, may be a synonym of *I. pricei*.

The taxonomic status of Mexican catfishes in basins other than the Rios Yaqui-Casas Grandes basin remains unclear, although Hendrickson (1984) also referred to catfish from Rio San Lorenzo, Sinaloa, as this species and anticipated other localities from more southern Mexican rivers as collections become available. An undescribed catfish resembling *I. pricei* has been introduced and is established in the Gila River drainage, but its morphology, status, and overall distribution have yet to be determined (USFWS 1995). See Lundberg (1992) for a synthesis of recent work on the systematic relationships of Ictalurid catfishes.

The Yaqui catfish (*Ictalurus pricei*) was listed as a threatened species with critical habitat on August 31, 1984 (USFWS 1984, 49 FR 34490). A recovery plan was completed in 1995 (USFWS 1995). The reasons for decline of this fish include habitat modifications including arroyo cutting, water diversion, impoundment construction, development of canal systems and excessive pumping of underground aquifers.

Life History and Habitat

Little is known of the Yaqui catfish’s ecology and life history. Minckley (1985) suggested that the ecology of the Yaqui catfish and channel catfish are similar. Most commonly, the Yaqui catfish is caught in larger rivers in areas of medium to slow current over gravel/sand substrates (Hendrickson *et al*. 1980). The species grows rapidly and achieves large sizes in ponds at Dexter National Fish Hatchery & Technology Center (NFHTC) (Jensen 1992, 1993). Yaqui catfish are bottom feeding omnivores that feed on other fish, insects, larvae, crustaceans, plant matter, and detritus (Haynes and Schuetze 1997). Reilly and Lochmann (2000) conducted comparative diet analysis between Yaqui catfish and channel catfish and found that weight gain, protein efficiency ratio, specific growth, and feed conversion were lower for Yaqui catfish than channel catfish for the 12 week study.

The Yaqui catfish's historical range throughout the Yaqui River Basin consists of intermediate to low elevation warm-water creeks, cienegas, and moderate- to large-sized rivers. In the Rio Yaqui basin, the Yaqui catfish has been found in medium to large creeks and rivers with medium to slow current over sand or rock substrates (Hendrickson *et al*. 1980). In small streams they prefer clear quiet pools. Creeks typically have alternating riffles and pools in which heterogeneity is enhanced by undercut banks, boulders, and wood debris. Gravel bottoms in swift areas are vegetated with algae. Cienegas, streams and associated marshlands with low, emergent aquatic plants and hydric-adapted trees, were historically common but have suffered severe degradation since the arrival of Europeans (Hendrickson and Minckley 1985). Rivers vary from pool-riffle types with boulder and gravel bottoms to long, strongly flowing reaches over gravel and sand (Campoy-Favela *et al*. 1989). During the dry season, Yaqui catfish seek refuge in permanent spring-fed pools (Haynes and Schuetze 1997). Elevations in Arizona range from 3,730 to 4,620 feet.

Distribution, Abundance, Population Trends
The distribution and abundance information has not changed since the 2005 and 2012 BO/COs so we hereby incorporate that information by reference and provide a narrative summary below.

Yaqui catfish were extirpated from the U.S. in the 1950s and reintroduced into the Rio Yaqui basin within the San Bernardino National Wildlife Refuge (NWR) in Cochise County, Arizona in 1997 (USFWS 2010, AGFD 2001) and on El Coronado Ranch in 1999 (USFS 2004). Although Yaqui catfish were reintroduced into Twin Pond on the San Bernardino NWR using progeny of captive stocks held at Dexter National Fish Hatchery and Technology Center (NFHTC), the species has not been observed there since 2005. Due to reestablishment efforts in Arizona, however, Yaqui catfish are currently present only in House Pond on the Slaughter Ranch and Big Tank on the El Coronado Ranch where they were stocked under a Habitat Conservation Plan (USFWS 1998b), with a refuge population at Arizona-Sonora Desert Musuem (ASDM). El Coronado Ranch borders lands managed by the Douglas Ranger District of the CNF and lies within the West Turkey Creek watershed. Yaqui catfish are not believed to occur on NFS lands, although escape from the ponds on the El Coronado Ranch is possible (USFS 2004).

In Mexico, the Yaqui catfish is currently believed to be extirpated from the Rio Casa Grandes (Smith and Miller 1986, Propst and Stefferud 1994). The range of the Yaqui catfish is confined to the Rio Yaqui basin in Mexico, though taxonomic uncertainties make it unclear whether the range extends to other basins.

Threats
Habitat loss – water use, extraction, watershed degradation
Water development and pumping of underground aquifers constitute the greatest threat to the survival of Yaqui fishes, followed closely by introduction of non-native organisms (USFS 2011). The range of this species has been significantly reduced, primarily due to habitat destruction and

genetic introgression. Remaining populations are in danger of being subjected to intense competition and genetic swamping through the indiscriminate release of closely related non-native fishes (USFS 2011).

The Yaqui catfish is seriously affected by a variety of habitat modifications. This species existed in San Bernardino Creek, Arizona, until the spring flows supporting the creek diminished and the remaining aquatic habitat was destroyed by cattle. Arroyo cutting, diverting stream headwaters, construction of impoundments, and excessive pumping of underground aquifers are responsible for the reduction of permanent stream habitat and for failing springs. Many river systems in Mexico, especially in lowland areas, have been highly modified into canal systems for irrigation agriculture. These alterations destroy pool habitats and have adverse impacts on fish populations.

Geothermal energy exploration
The San Bernardino Valley is known to have potential geothermal energy resources (Hahman 1979), although the area is not a Known Geothermal Resource Area. The BLM has issued leases for geothermal resources on some of their lands adjacent to the San Bernardino NWR. Exploration and development of these leases could potentially cause depletion or pollution of the underground aquifers that supply water to the springs of the San Bernardino NWR, and could thereby result in loss or pollution of the flows of those springs. However, if exploration and development are properly designed and regulated, such effects are not expected (Cheremisinoff and Morresi 1976).

Predation – non-natives
Introduced predatory fishes, such as largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), black bullhead (*Ameirus melas*), channel catfish, and green sunfish (*Lepomis cyanellus*) are present in some portions of the remaining range of the Yaqui catfish, and prey on them. The threat of such predation is likely to increase in the remaining habitats of the Yaqui catfish in Mexico. This threat is minor at present in U.S. habitats, and steps have been taken to alleviate it.

Competition and genetic swamping – non-natives
Extant populations of the Yaqui catfish are seriously threatened by the introduction of closely related non-native species. Already established and expanding populations of channel catfish and blue catfish (*Ictalurus furcatus*) may reduce Yaqui catfish populations through competition or by genetic swamping. The introduction of non-native species has been shown to be detrimental to other native fishes, as illustrated by the rapid elimination of native Yaqui topminnow (listed as endangered and found in the same drainage) populations after introduction of the closely related western mosquito fish (*Gambusia affinis*) as documented by Minckley (1973), Schoenherr (1973), and others.

Livestock grazing, agriculture, mineral extraction
Most of the U.S.-Mexico borderlands (Gehlbach 1981, Humphrey 1986), including all of southeastern Arizona and southwestern New Mexico have been heavily used for cattle grazing and local farming. Mining and other activities also resulted in some detrimental habitat or landscape changes. Diversity of natural landscapes quickly diminished under grazing pressure, especially when ranges were overstocked (Wagoner 1960). Chihuahuan Desert scrub expanded, grasslands deteriorated or locally disappeared, and riparian and aquatic habitats were destroyed

or reduced to disturbed, disjunct remnants (USFWS 1995). Today's regional vegetation nonetheless remains a desert grassland, closely intermingled with Chihuahuan desert scrub on drier sites (Lanning 1981). Mesquite (*Prosopis glandulosa*) bosques are the predominant lowland communities, along with pockets of riparian broad-leafed woodlands and cienega habitats where water persists at or near the surface (Marrs-Smith 1983).

Physical and other impacts associated with watershed use and misuse led to dramatic reductions in aquatic habitats and biota. In the past, as today, water was a scarce and sought-after commodity. Relatively abundant supplies in the upper Rio Yaqui basin, especially after artesian wells were built in the later 1800's, led to large-scale cattle grazing and concentrated farming in the area. Severe grazing pressure (including trampling) eventually led to incision of stream channels that drained and desiccated cienegas, diversion and modification of stream channels themselves, and excessive exploitation of underground aquifers; all reduced the quantity and quality of natural surface waters.

Climate Change
Climate forecasts project not only temperature increases but also an increase in the frequency of hot extremes, heat waves, and heavy precipitation events. Ultimately, this may result in drier future conditions for the Southwest and an increasing probability of drought. Due to these projections, we anticipate that fish species including the Yaqui catfish will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature, due to climate change, is likely to lead to increased water temperature, which would allow other warm-water fishes (native and non-native) to expand their range into the limited habitat occupied by Yaqui catfish.

Despite the current limits of climate change effects analysis, the FS Southwestern Region has developed guidance for addressing climate change in NF LRMP revisions (USFS 2011), which are broad and general in scope and which rely on adaptive management as climate change science evolves. Therefore, as we better understand the potential effects of climate change on Yaqui catfish distribution, FWS expects that this increased knowledge will be incorporated into future CNF LRMPs revisions.

Conservation, Consultation and Recovery Planning
As stated above, the factors contributing to the listing of the Yaqui catfish include habitat destruction or modification, predation, inadequacy of existing regulatory mechanisms, and other factors (USFWS 1984).

Yaqui catfish are not found on the CNF and no critical habitat is designated on NFS lands (USFWS 2005). Therefore, direct actions to pursue recovery of Yaqui catfish on NFS lands do not exist; however, indirect effects may be considered through impacts to the aquifer and surface waters of the San Bernardino Valley, Sulphur Springs Valley, West Turkey Creek, and Whitewater Draw (USFS 2004).

Critical Habitat
Critical habitat for the Yaqui catfish includes all aquatic habitats of San Bernardino NWR, Cochise County, Arizona. Additionally, the aquatic habitats on San Bernardino NWR may provide expansion habitat for the Yaqui catfish. No critical habitat is designated on the CNF or any FS lands.

Primary Constituent Elements of Critical Habitat
PCEs include:

- PCE 1: Clean, small permanent streams and spring pools without any exotic fishes;
- PCE 2: The streams should have deep pool areas separated by riffles and flowing areas of moderate current; and
- PCE 3: Backwater areas of stream and springs with overgrown cut banks and accumulations of detritus are necessary for feeding and shelter.

Roundtail Chub

Description and Legal Status
Roundtail chub was first described by Baird and Girard (1853) from specimens collected in 1851 from the Zuni River (tributary to Little Colorado River) though that location may not be correct as Smith *et al*. (1979) reported the type locality was likely the mainstem Little Colorado River and Sublette *et al*. (1990) suggested the specimens may have been collected from the Rio Pescado (tributary to Zuni River) and incorrectly cited as the Zuni River. Roundtail chub has been recognized as a distinct species since the 1800s.

The roundtail chub is a large cyprinid fish (member of Cyprinidae, the minnow family). Roundtail chub are similar in appearance to Gila chub and headwater chub (two closely related species). The body is usually olive gray to silvery, with a lighter belly, and occasionally with dark blotches on the sides. When in spawning condition, roundtail chub may develop a red-orange coloration on the lower half of the cheek and along the fin bases. A deeply compressed body, flat head, slender caudal peduncle, and an angle along the anal fin base that continues into the caudal fin is characteristic of headwater and roundtail chub. Adult roundtail chubs are generally 9 to 14 in in length, but can reach 20 in (Minckley 1973, Sublette *et al*. 1990, Propst 1999, Minckley and DeMarais 2000, Voeltz 2002).

The roundtail chub (*Gila robusta*) was proposed for federal threatened status on October 7, 2015 (USFWS 2015, 80 FR 60754) with a Distinct Population Segment (DPS) that includes the Gila River Basin in Arizona and New Mexico, the Little Colorado River Basin in Arizona, and the Bill Williams River Basin in Arizona. Detailed information about the roundtail chub can be found in Voeltz (2002), Jones *et al*. (2014), and USFWS (2015).

Life History and Habitat
Roundtail chub average life span is 8-10 years or more in larger streams and less in smaller tributaries (Bezzerides and Bestgen 2002). Maturity occurs between ages 3-5 at 5.9-11.8 in

(Brouder *et al*. 2000, Bezzerides and Bestgen 2002). Growth rates and maximum size vary by streams. In the DPS, spawning occurs between April and May (Minckley 1981, Brouder *et al*. 2006, Bestgen 1985b, Bryan *et al*. 2000, Bryan and Robinson 2000). The smallest male in spawning condition was 6.1 in and the smallest female was 7.4 in (Brouder *et al*. 2000). Total fecundity ranged from 7,267 to 26,903 eggs per female with the number of eggs increasing with size of the female. Eggs are adhesive and ranged from 0.07-0.15 in in diameter with a mean of 0.11 in (Brouder *et al*. 2000). In the lab, eggs hatched after four to seven days at 66˚F (Muth *et al*. 1985).

Roundtail chubs are omnivores, consuming foods proportional to their availability, including aquatic and terrestrial invertebrates, aquatic plants, detritus, and fish and other vertebrates. Larvae feed on diatoms and filamentous algae (Neve 1976) with juveniles eating chironomid larvae and ephemeroptera nymphs (Vanicek and Kramer 1969) along with algae, tricopterans, and ostracods (Bestgen 1985). Larger juveniles and adults consume aquatic and terrestrial insects, crustaceans, fish, plant matter, and occasional small lizards (Bezzerides and Bestgen 2002).

Roundtail chubs are found in cool to warm waters of rivers and streams, and often occupy the deepest pools and eddies present in the stream (Minckley 1973, Brouder *et al*. 2000, Minckley and DeMarais 2000, Bezzerides and Bestgen 2002). Adult roundtail chub favor slow-moving, deep pools with access to feeding areas and containing cover such as large rocks, undercut banks, and woody debris (Bezzerides and Bestgen 2002, Brouder *et al*. 2000, Bryan and Hyatt 2004). Spawning occurs in pool, run, and riffle habitats, with slow to moderate water velocities (Propst 1999, Brouder *et al*. 2000, Voeltz 2002,). Roundtail chub larvae use low velocity backwaters (Ruppert *et al*. 1993). Young of the year roundtail chub occupy shallow (less than 19.7 in) and low velocity waters with vegetated shorelines (Brouder *et al*. 2000, Lanigan and Berry 1981). Juveniles use habitat similar to young of year but with depths less than 39.4 in. Although roundtail chubs are often associated with various cover features, such as boulders, vegetation, and undercut banks, they are less likely to use cover than other related species such as the headwater chub and Gila chub (Minckley and DeMarais 2000).

Distribution, Abundance, Population Trends

We used stream lengths to evaluate the historical and current range for the species. For the historical stream length, we included the entire stream length from the headwaters to the mouth, which included dry, intermittent, and perennial stream segments. We assume that historically chubs were able to use the entire length of the stream because streams were more connected in more mesic times, non-natives were not present, and manmade barriers were not present. It is important to understand that the historical stream length we present may not be indicative of the actual habitat available historically (watered stream length) or where the chubs were known to occur historically (surveys were limited in most streams). Consequently, this could overestimate the historical range of the species. However, the best available data does not allow us to be more precise in our evaluation of historical stream length.

For historical stream length data we primarily referenced Jones *et al*. (2014). Jones *et al*.'s (2014) estimation of historical stream length included dry and intermittent segments, and sections located on tribal lands. However, historical stream length data from Jones *et al*. (2014) was lacking for some streams length because they did not consider the streams to be within the historical or current range of the chubs. Where Jones *et al*. (2014) did not include data on historical stream length, we used The Nature Conservancy's streams database or Google Earth satellite imagery. There is a small amount of variation in measurements between sources but these are not significant to the analysis.

We selected perennial and interrupted perennial reaches during the driest time of year because this is likely the most limiting factor for chubs. A currently occupied stream is defined as a stream or stream reach documented by surveys to contain either roundtail chub as identified in Voeltz (2002) and most recently Jones *et al*. (2014). We recognize that the quality of this habitat in terms of the amount of the watered reach that is perennial versus interrupted perennial varies within each stream both temporally and spatially. We further recognize that using a more precise approach for current range than for historical range could overestimate the reduction in range. To address this possible overestimation we identify those stream miles that we know are extirpated and acknowledge the stream miles where there is uncertainty. Table RC-1 (pg 421) indicates the estimated historical and current range.

The roundtail chub DPS was and is only known from five primary river watersheds, the Bill Williams, Gila, Little Colorado, Salt, and Verde Rivers in Arizona and New Mexico (Figure RC-1).

Based on our assessment, the roundtail chub DPS historically occupied 48 streams with a total stream length of 3,041 miles. These streams are listed in Table RC-2 (pg 423), which identifies the historically occupied streams, the current status, the individual historical and current stream lengths, and citations to materials used to determine stream length.

As of 2015, roundtail chub are found in 35 streams with a total of 1,304 miles of available habitat; 1,291 miles from the historical streams and 13 miles from the newly discovered streams. This represents at least an estimated 43 percent of the historical range and no more than an estimated 57 percent reduction in range. Based on the stream lengths we used in the above table we document a loss of 1,158 miles from the seven extirpated streams listed in Table RC-2 below. This accounts for 88 percent of the stream loss. Approximately 145 miles of stream loss is not documented. This is 11 percent of the reduction in range not documented. The current range is estimated at 42 to 47 percent of the historic range, with a reduction in range of 53 to 58 percent reduction in range.

The quality of this habitat in terms of the amount of the watered reach that is perennial versus interrupted perennial varies within each stream. We also note that documented numbers are low for the large truly perennial streams considered currently occupied (Upper Gila River, Salt River, and Verde River, which total 618 miles). The upper Verde River is the only portion of these streams where Roundtail chub are reliably found and recruitment is documented. However, this reach of the Verde River receives augmentation of stocked fish by AGFD (Salt River Project 2013). Because we consider these streams to be occupied throughout, this could overestimate the stream length currently occupied.

Roundtail chub in the upper Gila River in Arizona above San Carlos Reservoir to the Forks Confluence in New Mexico are extremely rare, with no recent records in Arizona. The only two recent records in the upper Gila River are from New Mexico: the Riverside survey site in the Cliff-Gila Valley in 1991 (Paroz *et al*. 2006) and above the Arizona-New Mexico border in 1999 (Blasius 2012). We consider the upper Gila River in New Mexico to be currently occupied and the reach in Arizona above San Carlos Reservoir to the state line as not currently occupied. Further, we do not consider the reach from San Carlos Reservoir to state line to have been historically occupied. Our reasoning for considering the reach from San Carlos Reservoir to the state line as not occupied is that there are only two records of chub in this reach. One is a collection record from the late 1800s at Fort Thomas, which we are not considering a recent record. The second is a museum record from 1984 of a chub in a backwater near the confluence with Bonita Creek, a tributary to the Gila River in Arizona (Voeltz 2002). Since Gila chub are present in Bonita Creek, it is likely that this is a Gila chub record. There are few other surveys in the mainstem Gila River between Redrock, New Mexico (a town close to the Arizona-New Mexico border) and the San Francisco River in Arizona (flows into the Gila River just east of the Arizona-New Mexico border). Some of these surveys detected native fish, but not chub (Blasius 2015). Therefore, absent any data for this reach, we are not including the reach from San Carlos Reservoir to the state line as historically or currently occupied it as neither considered occupied or extirpated in the SSA Report.

There are also four newly established populations for the Roundtail chub DPS: Blue River (Gila River drainage), Ash Creek (Salt River drainage), Gap Creek, and Roundtree Creek (Verde River drainages) (Table RC-3, pg 425).

Information about roundtail chub indicates that historically there was greater connectivity and subsequent relatedness over the region and development of populations in isolation from other roundtail chub was not the normal condition across most of the historical range except in the Bill Williams River and Little Colorado River drainages. The roundtail chub's historical connectivity within the Gila, Salt, and Verde Rivers promoted less diversity over the range; however, the Bill Williams and Little Colorado Rivers are isolated and are more unique. Although the Analysis Unit (AU) boundaries were not generated to represent genetic differences, they do capture them in some cases and as they encompass the historical range of the two chubs. Consequently, the AUs provide a picture of representation of the genetic diversity among populations and the ecological diversity across the range of the two species. The drainage basins serve as a proxy for geographic variation that may represent natural variation in the species' genetic diversity as indicated by the genetic management units.

Threats

A number of the land management actions had their greatest effects on native fishes in the past when management actions were not focused at providing protection for non-target resources. This is particularly true of livestock grazing, roads management, channelization of streams, and forestry practices. There are legacy effects from these past management actions. However, new and future management directions are considering these risks. These legacy impacts are not likely having population level impacts to chubs. Where this is the case, we note in the summaries below.

Habitat Modification

Prior to the introduction, spread, and establishment of non-native predatory and competitive fishes, habitat modification (e.g., destruction and alteration) was the primary driver in the decline of native fishes throughout the lower Colorado River basin (Clarkson *et al*. 2005). It has now been shown that invasion by non-native fishes, now and in the future, is the most significant risk factor to the lower Colorado River fish fauna due to competition and predation (Minckley and Deacon 1991; Carlson and Muth 1989, Mueller 2005, Olden and Poff 2005) and are the primary impediment to their conservation (Minckley and Marsh 2009). Declines in native fish, including roundtail and headwater chubs, is largely attributable to predation, with early life stages (Minckley 1983) being the most vulnerable. Clarkson *et al*. (2005) noted that over 50 non-native species were introduced into the Southwest as either sportfish or baitfish. As an example, the lower West Clear Creek showed a reduction in roundtail chub after smallmouth bass (*Micropterus dolomieu*) became a significant part of the fish community (Brouder *et al*. 2000, Jones *et al*. 2014), and in the upper Salt River after flathead catfish (*Pylodictis olivaris*) were introduced (AGFD 1996) the decline in roundtail chub has been interpreted as resulting from those non-native expansions.

Non-native species predation and competition
Non-native species have the potential to impact roundtail chubs. Of these species, fathead minnow (*Pimephales promelas*), green sunfish (*Lepomis cyanellus*), red shiner (*Cyprinella lutrensis*), western mosquitofish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides),* flathead catfish (*Pylodictis olivaris*, Fuller 1999), and channel catfish are among the fastest expanding non-native fishes in the basin and are considered to be the most invasive in terms of their negative impacts on native fish communities (Olden and Poff 2005). Table RC-4 (pg 425) identifies the level of risk to chubs from the specific non-native species.

While there is little direct evidence of extirpation of chubs as a result of non-native species, extirpation has been documented for other native fish in Arizona and New Mexico. In addition, in Fossil Creek, non-native predators were removed and chub numbers increased 70 times over the pre-removal numbers due to the success of spawning and survival of young-of-the-year (Marks *et al*. 2009). However, there are streams where chubs have maintained populations in the presence of one or more of these non-native species. The mechanisms providing for that co-existence in any particular stream is unknown. The amount of preferred habitat available for the chub and the non-native species may play a role, as may the abundance of the non-native and its means of affecting the chub. In some cases, the non-native species may have only newly entered the stream and the full effects have not been realized. In other cases, the current habitat and population dynamics may not strongly favor either natives or non-natives allowing for persistence of both under those conditions. There is a wide range of chub and non-native species co-occurrence situations. While chubs co-exist with non-natives in several streams, this does not mean that non-natives are not impacting chubs or that exotics are not having population level impacts to chubs, as demonstrated by the removal of non-natives in Fossil Creek.

In addition, population persistence of native fishes is compromised during prolonged drought periods due to the combined loss of available habitat and heightened risk of competition with and predation by non-native fishes (Jaeger *et al*. 2014). Further decreases in streamflow continuity associated with more frequent and intensive channel drying during spring (spawning) and summer low-flow months will effectively reduce the amount of available habitat for reproduction and may eliminate critical summertime refuges. Native fishes in the remaining refuges will face extreme physicochemical stress (i.e., high temperature and low dissolved oxygen concentration) and increased species interactions with non-native species, increasing local extinction probabilities. The effects from non-natives can be worse during drought because of the synergistic impacts from the conditions described above.

Non-native species occupy all but three headwater chub streams and three roundtail chub DPS streams. In Arizona and New Mexico, the States still stock non-native sport fish for recreational fishing. However, only triploid rainbow trout (these are sterile and unable to reproduce) are stocked in streams occupied by chubs. In addition, there are six streams (three for headwater chub and three for roundtail chub DPS) that are currently free of non-natives into which non-natives could expand or be introduced. We expect that non-natives will continue to persist in most if not all of the streams they currently occupy and that non-native impacts will increase in a percentage of streams across the range of both species due to reduction in wetted perimeter to increased competition, predation, and harassment.

Climate Change

Climate models predict not only temperature increases but also an increase in the frequency and severity of storm events, heat waves, and precipitation events. Temporal asynchronicity will exacerbate the impacts on aquatic habitats and organisms. Ultimately, climate change predicts regionally drier conditions for the Southwest and an increasing probability of drought. Assuming those predictions hold, we anticipate that fish species in the southwest will face the following conditions as a result of climate change:

- Increased water temperature;
- Decreased stream flow;
- A change in the hydrograph; and
- An increased occurrence of extreme events (such as fire, drought, and floods)

Temperature is a key factor defining the gradients of performance and the absolute bounds of life for most aquatic organisms. It also affects rates of growth and timing of key life history events or transitions (Rieman and Isaak 2010). Increased temperature is likely to lead to increased water temperature, streams will become increasingly intermittent, and aquatic habitat will degrade.

Huachuca Water Umbel

Description and Legal Status

Huachuca water umbel is a semi-aquatic to fully aquatic herbaceous perennial plant of the carrot family (Apiaceae). Hollow linear leaves that taper to a point are produced singly or in clusters at the top of short rhizomes. The leaves vary greatly in length from 0.98 to 12.99 inches depending on their habitat, with shorter leaves typically found in dryer environments and longer when submerged in water (Coulter and Rose 1902, Affolter 1985, USFWS 2014a). Three to ten 0.04 to 0.08 inches wide flowers are borne on an umbel that is always shorter than the leaves. Fruits are spherical and dry, 0.6 to 0.09 inches long by 0.04 to 0.08 inches broad, with five distinct spongy ribs that make the seeds buoyant and easily dispersed by water (Affolter 1985).

Because this taxon is clonal in nature and it is not practicable to identify individuals, the term “occurrence” is used herein to denote concentrations of this taxon within a distinct locality that are relatively distant from other concentrations. Occurrences are more likely to share underground root systems, and are often separated from one another by morphological or hydrological features. Within occurrences, clusters of stems separated by areas without stems are denoted herein as “patches”. An occurrence can consist of one to many patches; patches can have one or a few stems or form carpets of stems.

On January 6, 1997, we listed the Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*) as an endangered species (USFWS 1997, 62 FR 665); on July 12, 1999, 51.7 miles of streams or rivers in Cochise and Santa Cruz Counties, Arizona, were designated as critical habitat (USFWS 1999a, 64 FR 37441). A Five-Year Review of the taxon was finalized in August, 2014, and recommended no change to the classification of the species as endangered (USFWS 2014c).

Life History and Habitat
Huachuca water umbel reproduces both asexually and sexually. Asexual reproduction, likely the primary form of reproduction in this taxon (Vernadero Group and the Desert Botanical Garden 2012), enable occurrences to rapidly expand or contract in size between years, seasons, or both, in response to local environmental conditions, including temperature and water availability (USFWS 1997, Vernadero Group 2011). Plants may also dislodge during flooding or other disturbance events, with clumps then possibly re-rooting in a different appropriate site along aquatic systems.

Flowering has been observed episodically between March and October, peaking in July and occurring with abundance irregularly (Warren *et al*. 1991). Germination occurs one to two weeks after seeds disperse (Gori 1995). Natural seed banks are important for the persistence of rare species, and observations in the field suggest Huachuca water umbel seed may remain viable for five to ten years, an important survival strategy during times of drought (Titus and Titus 2008a, Titus and Titus 2008b, Titus and Titus 2008c). Sexual reproduction may be important for maintaining genetic diversity, evolutionary potential, and persistence in the taxon. Recent work on sexual reproduction in captivity showed significantly higher fruit production in plants growing in flowing water, verses those in a terrestrial situation, indicating that the best habitat to increase genetic variation is flowing water (Morrow 2015).

Historical numbers of unique individuals represented in clonal occurrences for the taxon is unknown. Vernadero Group and Desert Botanical Garden (2012) found that occurrences currently exhibit relatively low variability, with occurrences having 6-17 distinct genetic types, and generally more within occurrence variability than between occurrence variability. Existing occurrences are generally not dominated by a single clone. Genetic diversity/number of individuals represented in such intermixed clones may be significant in population dynamics and conservation (Harper 1977). Vernadero Group and Desert Botanical Garden (2012) note that conservation efforts should emphasize preservation of existing genetic diversity in Huachuca water umbel occurrences and the promotion of factors that will contribute to the establishment of new clones and/or sexually-produced seedlings, maintain dispersal pathways, and reduce habitat fragmentation.

Huachuca water umbel is restricted to cienegas, rivers, streams, and springs in permanently wet (or nearly so) muddy or silty substrates with some organic content (USFWS 1999a). The taxon is generally found in shallow and slow-flowing waters that are relatively stable, or in active stream channels containing refugial sites where the plants can escape the effect of scouring floods (USFWS 1997; USFWS 1999a). In upper watersheds that generally do not experience scouring floods, Huachuca water umbel occurs in microsites where interspecific plant competition is low. At these sites, Huachuca water umbel occurs on wetted soils interspersed with other plants at low density, along the periphery of the wetted channel, or in small openings in the understory. In stream and river habitats, Huachuca water umbel can occur in backwaters, side channels, and nearby springs.

Distribution, Abundance, Population Trends
Found between 2,805 and 7,120 feet in elevation, the range of the taxon crosses the Sierra Madrean Region of southeastern Arizona and adjacent portions of Sonora, Mexico (Titus and Titus 2008c, Vernadero Group and the Desert Botanical Garden 2012). In the United States (U.S.), we are aware of 17 locations supporting extant occurrences of Huachuca water umbel, 8 locations where all Huachuca water umbel occurrences are considered extirpated, and 6 locations where no occurrences have been relocated in recent years. In the U.S., Huachuca water umbel occur on lands administered by the U.S. Army Fort Huachuca, the FS, the BLM, the Service, Arizona State Parks, Pima County, The Nature Conservancy, and private landowners. The majority of Huachuca water umbel occur along the San Pedro River, in the Huachuca Mountains, and along Cienega Creek in the San Pedro River and Santa Cruz River Watersheds. In Sonora, Mexico, we are aware of 21 locations supporting Huachuca water umbel occurrences, though most of these locations have not been revisited in recent years. In Mexico, most Huachuca water umbel occur on private lands of the San Pedro River and its tributaries in the San Pedro River Watershed (Anderson 2006). Huachuca water umbel also occurs within the Santa Cruz, Rio Yaqui, Rio Sonora, and Rio Concepcion watersheds in Mexico.

Although we now are aware of many more occurrences of Huachuca water umbel than at the time of listing in both the U.S. and in Mexico, there are no occurrences that appear to be increasing in size and many are reported from single patches among competing vegetation or in aquatic habitat that is in danger of being lost to groundwater pumping or drought. Other occurrences have not been relocated in many years and are believed extirpated due to changes in suitability of habitat.

Threats
Threats to the taxon identified through research and consultations that could potentially impact Huachuca water umbel include: aquatic habitat degradation; wildfire and resulting sedimentation; invasive, non-native plant competition; livestock grazing; and recreation (Factor A) and the effects of drought and climate change (Factor E).

Aquatic habitat degradation
Human activities such as groundwater overdrafts, surface water diversions, impoundments, channelization, improper livestock grazing, agriculture, mining, sand and gravel operations, road building, non-native species introductions, urbanization, wood cutting, wildfires, and recreation all contribute to aquatic habitat loss and degradation within the historical range of Huachuca water umbel (Hendrickson and Minckley 1984, Bahre 1991, Hereford 1993).

Wildfire and resulting sedimentation
Fire would generally not burn the wetland habitat of Huachuca water umbel due to high humidity; however it has the potential to burn adjacent upland habitats causing indirect effects on Huachuca water umbel and its habitat throughout the range of the taxon (USFWS 2009a). Effects include increased runoff of floodwaters, deposition of debris and sediment originating in the burned area, and potential for scouring of individual Huachuca water umbel plants and habitat (USFWS 2014b).

Invasive, non-native plants
Invasive non-native plants have increased their presence within aquatic habitat of southeastern Arizona, and this invasion and expansion of infestations are expected to continue in the future. Because Huachuca water umbel is sensitive to competition from both native and non-native herbaceous plants, the continued increase in non-native species will lead to a decrease in the presence of Huachuca water umbel throughout the range of the taxon.

Livestock grazing
Huachuca water umbel are affected by livestock grazing in the following ways: 1) trampling, 2) direct impacts from construction of range improvement projects, 3) changes in stream geomorphology that lead to erosion, sedimentation, and downcutting, 4) watershed degradation and resulting adverse effects to stream hydrology, and 5) consumption (USFWS 1999b, Anderson 2006). Observations of Huachuca water umbel response to grazing indicate the taxon is capable of experiencing light to moderate grazing with negligible impact (Edwards pers. comm. February 21, 2001, Anderson 2006, Simms pers. comm. October 26, 2011, Rorabaugh 2013). More intensive grazing or that during dry periods when cattle spend a disproportionate amount of their timein riparian areas, may result in harmful effects to Huachuca water umbel and other riparian obligates (Krueper 1996, Edwards pers. comm. February 21, 2001, USFWS 2002, Malcom and Radke 2008, USFWS 2014a).

Recreation
Riparian areas and cienegas offer important recreational opportunities for the residents of southern Arizona and northern Sonora (USFWS 1997). This visitation is expected to increase in the future with increases in human population, as well as drought conditions and the desire to be near water. Recreational activitiescan result in soil compaction, streambank destabilization, erosion and sedimentation, increases in the presence of invasive non-native plant species, and trampling of Huachuca water umbel and other riparian plant species, thus reducing habitat quality.

Drought and climate change
Huachuca water umbel evolved in the Southwest and has persisted in many locations throughout its range through historical droughts such as those of the 1950s, yet, given the severity and persistence of the present multi-decade drought (Bowers 2005, Garfin *et al*. 2013, CLIMAS 2014), it is unknown how long Huachuca water umbel will maintain viability in de-watered habitat. It has been suggested that seed from this taxon may persist for five to ten years in such situations (Titus and Titus 2008a, Titus and Titus 2008b, Titus and Titus 2008c). Projections for the southwestern U.S. are that precipitation will be less in the future (Seager *et al*. 2007, Karl *et al*. 2009) and that temperatures will rise (Karl *et al*. 2009, Overpeck *et al*. 2012). In addition, in a warmer environment, an enhanced (more extreme) hydrologic cycle is expected; rainfall events are to be less frequent, but more intense, and larger flood events more common (Karl *et al*. 2009). Such large floods can destroy Huachuca water umbel patches, and even entire occurrences, if no niches in backwaters are present to ensure recolonization.

Small occurrence size
Habitat degradation over historical time has resulted in decreased number and size of Huachuca water umbel occurrences, potentially decreasing viability and genetic diversity of these occurrences. Occurrences are in many cases isolated, which makes the chance of natural recolonization after extirpation less likely. The clonal nature of the taxon, combined with small

patch sizes, may result in less genetic diversity than in a non-clonal species, further aggravating vulnerability. The work of the Vernadero Group and the Desert Botanical Garden (2012) indicates that the taxon is more vulnerable to extinction as a result of stochastic events that are often exacerbated by habitat disturbance. For instance, the restriction of Huachuca water umbel to a relatively small area in southeastern Arizona and adjacent areas of Mexico increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought, could eliminate many occurrences or cause extinction.

Conservation, Consultation and Recovery Planning
There is a Draft Recovery Plan for the Huachuca water umbel (USFWS 2016), which underwent public and peer review ending on May 9, 2016. The plan will be finalized later in 2017, following any necessary revision. The Draft Recovery Plan identifies Recovery Criteria by which the species may be down-listed (from endangered to threatened) or delisted (recovered and no longer in need of the Act’s protections).

Critical Habitat
Seven Critical Habitat units have been designated for Huachuca water umbel; all are in Santa Cruz and Cochise counties, Arizona, and include stream courses and adjacent areas out to the beginning of upland vegetation. The Scotia, Sunnyside, and Bear canyon units (3, 4, and 6) are within the CNF. The remaining Units are in lands adjacent to CNF lands. The following general areas are designated as critical habitat (see legal descriptions for exact critical habitat boundaries):

- Approximately 1.25 mile of Sonoita Creek southwest of Sonoita;
- Approximately 2.7 miles of the Santa Cruz River on both sides of Forest Road 61, plus approximately 1.9 miles of an unnamed tributary to the east of the river;
- Approximately 3.4 miles of Scotia Canyon upstream from near Forest Road 48;
- Approximately 0.7 mile of Sunnyside Canyon near Forest Road 117 in the Huachuca Mountains;
- Approximately 3.8 miles of Garden Canyon near its confluence with Sawmill Canyon;
- Approximately 1.0 mile of Rattlesnake Canyon and 0.6 mile of an unnamed canyon, both of which are tributaries to Lone Mountain Canyon; approximately 1.0 mile of Lone Mountain Canyon; and approximately 1.0 mile of Bear Canyon; an approximate 0.6-mile reach of an unnamed tributary to Bear Canyon; and
- Approximately 33.7 miles of the San Pedro River from the perennial flow reach north of Fairbank (Arizona Department of Water Resources 1991) to 0.13 mile south of Hereford, San Pedro Riparian National Conservation Area.

Primary Constituent Elements of Critical Habitat
The primary constituent elements of critical habitat for Huachuca water umbel include, but are not limited to, the habitat components that provide:

- PCE 1: Sufficient perennial base flows to provide a permanently or nearly permanently wetted substrate for growth and reproduction of Huachuca water umbel;
- PCE 2: A stream channel that is relatively stable, but subject to periodic flooding that provides for rejuvenation of the riparian plant community and produces open microsites for Huachuca water umbel expansion;

- PCE 3: A riparian plant community that is relatively stable over time and in which non-native species do not exist or are at a density that has little or no adverse effect on resources available for Huachuca water umbel growth and reproduction; and
- PCE 4: In streams and rivers, refugial sites in each watershed and in each reach, including but not limited to springs or backwaters of mainstem rivers that allow each occurrence to survive catastrophic floods and recolonize larger areas.

Activities that may destroy or adversely modify critical habitat include those that alter the primary constituent elements to the extent that the value of critical habitat for both the survival and recovery of Huachuca water umbel is appreciably diminished. Such activities are also likely to jeopardize the continued existence of the species.

Pima Pineapple Cactus

Description and Legal Status
Pima pineapple cactus are small, hemispheric to cylindrical, stem succulent perennials of the Cactaceae (cactus family). Individual stems reach 1.9 to 18.1 inches (in) in height and 1.9 to 8.3 in in diameter, are comprised primarily of tough, fleshy pulp, and are protected by a leathery outer skin (Arizona Rare Plant Guide Committee 2001, unpaginated). Stems may be singular or form clumps. The surface of the stems are covered in 0.8 to 1.2 in long rounded projections called tubercles, each of which is grooved along the upper surface and containing one to several extra-floral nectaries (place that secretes nectar to attract pollinators) along the groove (Roller 1996, p. 9; Baker 2011, p. 17). At the tip of each tubercle, arising from small bumps called areoles, are groupings of 7 to 20 straw-colored spines that darken with age (Roller 1996, p. 9; Parfitt and Gibson 2004, p. 226).

Recent investigations of taxonomy and geographical distribution focused in part on assessing the validity of the taxon (see Baker 2004, Schmalzel *et al*. 2004, Baker 2005). Although there is evidence for a general pattern of clinal variation across the range of the species (Schmalzel *et al*. 2004), this does not preclude the recognition of taxonomic varieties within *C. sheeri* (= *C. robustispina*). Baker (2005) found that there are distinct geographical gaps between the distribution of this subspecies and the other subspecies, which occur in eastern Arizona, New Mexico, and Texas, and that the subspecies are morphologically coherent within their respective taxa (Baker 2004). His geographical and morphological work supports the idea that the subspecific groups within *C. robustispina* are distinct; they were shown to be geographically isolated (Baker 2005), significantly different morphologically (Baker 2003), and significantly different genetically (Butterworth 2010, Baker and Butterworth 2013), warranting subspecific designation.

The Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*) was listed as an endangered species without critical habitat on September 23, 1993 (USFWS 1993, 58 FR 49875). Factors that contributed to the listing include habitat loss and degradation, habitat modification and fragmentation, limited geographical distribution and species rareness, illegal collection, and difficulties in protecting areas large enough to maintain functioning populations. In 2005, a 5-year review was initiated for the Pima pineapple cactus (USFWS 2005, 70 FR 5460). This review was completed in 2007 and recommended no change to the cactus' classification as an endangered species (USFWS 2007). A draft recovery plan is currently being developed and will be finalized in 2017 or 2018.

Life History and Habitat

Pima pineapple cactus is a perennial shrub with succulent stems, which, along with the flowers and fruits, are apparently palatable to some degree to animals. Although individuals can have a longevity of 30 or more years (Roller 1996, pp. 38, 41; Schmalzel pers. comm. May 22, 2000), in some areas, such as the Buenos Aires National Wildlife Refuge, they have a much shorter lifespan, possibly due to competition with non-native grasses (Dan Cohan, pers. comm. 2015). Flower buds begin to appear in mid-May and the timing is related to photoperiod and rainfall (Roller 1996, p. 58). Flowering usually occurs in early to mid-July or 5 to 7 days after the first summer rains of at least 3 mm and continues through the monsoon season (Kearney and Peebles 1951, p. 577; Roller 1996, p. 58; Kidder 2014, entire). Flowers persist for a single day, yet the timing of flowering may assist with pollination, as there are few cacti species which bloom at this time, resulting in greater pollination success (McDonald and McPherson 2005, p. 531). Fruit and seed dispersal for the taxon is probably facilitated, for the most part, by rodents and, perhaps less so, by ants.

Generally, the Pima pineapple cactus grows on gentle slopes of less than 10 percent and along the tops (upland areas) of alluvial bajadas nearest to the basins coming down from steep rocky slopes. The plant is found at elevations between 2,362 to 4,724 feet (Roller and Halverson 1997, p. 267; Kidder 2015, p. 110), in vegetation characterized as either/or a combination of both the Arizona upland of the Sonoran desertscrub and semidesert grasslands (Roller and Halverson 1997, pp. 267-268).

Although Pima pineapple cactus have been located on early and late Quaternary alluviums, Holocene alluviums, and even limey alluvium with shallow layers of caliche, individuals appear to be more abundant on the younger alluvia and less abundant on older, nutrient-poor alluvia (SWCA 1999, p. 6). Individuals of the taxon are strongly associated with gravel and litter and less so with sand (McPherson 2002, p. 2). McPherson (2002, p. 2) also noted that individuals of Pima pineapple cactus are associated with coppice mounds (piles of fine surface materials) about 70 percent of the time and may be creating the mounds when small particles of silt, sand, and organic matter are blown into the spines of the cactus and drop to the base.

Distribution, Abundance, Population Trends

We have determined that Pima pineapple cactus individuals that are too isolated from each other may not be effectively pollinated. For example, the major pollinator of Pima pineapple cactus is thought to be *Diadasia rinconis*, a ground-nesting, solitary, native bee. McDonald (2005) determined that the minimum distance *D. rinconis* travelled between Pima pineapple cactus individuals was 2,953 feet. Based on this information, we have determined that Pima Pineapple cactus plants that are located at distances greater than 2,953 feet from one another become isolated with regard to meeting their life history requirements. The species is an obligate outcrosser (not selfpollinating), so it is important for plants to be within a certain distance to exchange pollen with each other. Also, the study found that pollination was more effective when other species of native cacti are near areas that support Pima pineapple cactus. The native bees pollinate a variety of cacti species and the sole presence of Pima pineapple cactus may not be enough to attract pollinators.

The Pima pineapple cactus occurs south of Tucson, in Pima and Santa Cruz counties, Arizona, as well as in adjacent northern Sonora, Mexico. In Arizona, it is distributed at very low densities throughout both the Altar and Santa Cruz valleys, and in low-lying areas connecting the two valleys. Paredes-Aguilar *et al*. (2000) reports the subspecies from oak woodlands in Sonora. Several attempts have been made to delineate habitat within the range of Pima pineapple cactus (McPherson 2002, RECON Environmental Inc. 2006, USFWS unpublished analysis) with limited success. As such, we are still unable to determine exact ecological characters to help us predict locations of Pima pineapple cactus or precisely delineate Pima pineapple cactus habitat (USFWS 2007), except perhaps in localized areas (USFWS 2005).

As a consequence of its general habitat requirements, considerable habitat for this species appears to exist in Pima and Santa Cruz Counties, much of which is unoccupied. Pima pineapple cactus occurs at low densities, widely scattered, sometimes in clumps, across the valley bottoms and bajadas. The species can be difficult to detect, especially in dense grass cover. For this reason, systematic surveys are expensive and have not been conducted extensively throughout the range of the Pima pineapple cactus. As a result, location information has been gathered opportunistically, either through small systematic surveys, usually associated with specific development projects, or larger surveys that are typically only conducted in areas that seem highly suited for the species. Furthermore, our knowledge of the distribution and status of this species is gathered primarily through the section 7 process; and we only see projects that require a Federal permit or have Federal funding. There are many projects that occur within the range of Pima pineapple cactus that do not undergo section 7 consultation, and we have no information regarding the status or loss of plants or habitat associated with those projects. For these reasons, it is difficult to address abundance and population trends for this species.

The AGFD maintains the Heritage Data Management System (HDMS), a database identifying elements of concern in Arizona and consolidating information about their distribution and status throughout the state. As of the autumn of 2015, the Arizona Natural Heritage Program database of individual plant locations for this taxon consisted of 7,558 records, of which 1,837 were known to be dead. Most of the dead plants were reported as a result of a handful of development and mining projects over several years. The database is dynamic, based on periodic entry of new information, as time and staffing allows. As such, the numbers used from one biological opinion to the next may vary and should be viewed as a snapshot in time at any given moment. We have not tracked loss of habitat because a limited number of biological assessments actually quantify habitat for Pima pineapple cactus.

We are aware of four instances where repeat measures of individual Pima pineapple cactus have been conducted. First, on fourteen occasions between 1995 and 2010, 45 individual Pima pineapple cactus were followed in an exclosure on CNF land in the Santa Cruz Valley. By the last check of these individuals in 2010, no living plants were found (USFS 2010). It should be noted, however, that in a partial survey of this area in 2015, some Pima pineapple cactus were found both within and outside of this exclosure (USFWS 2015b). Second, in 2003, a total of 260 individuals were located on six monitoring plots in the Altar Valley. These plants were evaluated on six additional occasions through 2012, when 93 of the original plants remained; new individuals were found in some years (Baker 2013). Third, on the Pima County Pima Pineapple Cactus Conservation Bank in 2006, 67 plants were located and mapped. These plants are monitored regularly and when last counted in 2014, 13 of the original plants remained alive and 11 new plants had been found (Pima County 2015). Fourth, on the Palo Alto Pima Pineapple Cactus Conservation Bank in 2001, 49 plants were located and mapped. These plants are monitored regularly and when last counted in 2015, 9 of the original individuals remained alive and 11 new plants were discovered (WestLand 2015). In all of these studies, factors such as drought and predation by rodents and insects were the primary causes of mortality (Schmalzel and McGibbon 2010, Baker 2013, USFWS 2015a).

Threats

Threats to Pima pineapple cactus include habitat loss and fragmentation due to urbanization and mining, competition with non-native species and altered fire regimes, climate change and drought, predation, small population size, livestock overuse, and inadequate regulatory mechanisms to protect this species. We believe residential and commercial development, and its infrastructure, is by far the greatest threat to Pima pineapple cactus and its habitat. However, we have only a limited ability to track the cumulative amount of development within the range of Pima pineapple cactus. What is known with certainty is that development pressure continues in Pima and Santa Cruz counties.

Non-native plant invasion and altered fire regimes

Pima pineapple cactus occurs in both the desert-grassland and desert-scrubland plant communities, especially in the ecotone of the two (Roller 1996a, p. 9). Historically, low severity fires that occured every 10 to 20 years in grasslands, or every 250 years in deserts, likely posed no threat to the long-term survival of Pima pineapple cactus individuals. When invaded by non-native grasses, fire frequency and intensity increase, leading to the deterioration of both natural grassland and desert communities (Olsson *et al*. 2012, p. 10; Steidel *et al*. 2013, p. 529). Non-native grasses produce more fine fuels than native vegetation, allowing for a more uniform and higher intensity burn compared with the discontinuous fuels of some native grasslands and deserts, thus reducing the number of microsite refuges safe from fire (58 FR 49875, p. 49876; McPherson and Weltzin 2000, p. 7; Brooks and Pyke 2002, p. 5). Pima pineapple cactus do not appear to be well-adapted to the more frequent and hotter fires more typical of today's invaded systems. Non-native grasses in both communities also compete with native plants for water and nutrients, and reduce community composition and structure.

Climate Change and Drought

The effects of climate change (i.e., decreased precipitation and water resources) are a threat to the long-term survival and distribution of native plant species, including the Pima pineapple cactus. For example, temperatures rose in the twentieth century and warming is predicted to continue throughout the twenty-first century. Although climate models are less certain about predicted trends, precipitation is expected to decrease in the southwestern United States, and many semi-arid regions will suffer a decrease in water resources from climate change as a result of less annual mean precipitation and reduced length of snow season and snow depth.

Southeastern Arizona and much of the American Southwest have experienced serious drought in recent decades (Bowers 2005, Overpeck *et al*. 2013, CLIMAS 2015). Plants already stressed from prolonged drought are more susceptible to insect attack and disease (Mattson and Haack 1987). In addition, adequate precipitation during Pima pineapple cactus seedling's first year of growth is essential for survival (Roller 1996). In addition, extreme temperatures can negatively impact seedling survival, and drought, coupled with high temperatures, lessens temperature tolerance in seedlings (Nobel 1984). These impacts will continue to affect the Pima pineapple cactus and its habitat throughout its range into the foreseeable future.

While efforts should primarily be focused on preventing the loss of existing Pima pineapple cactus and its habitat, when occupied or suitable Pima pineapple cactus habitat will be lost, modified, fragmented, or otherwise degraded as a result of the proposed action, the Service has established appropriate mitigation measures to address the impacts to Pima pineapple cacti. Acceptable mitigation includes the purchase of credits from an approved Pima pineapple cactus Conservation Bank, the establishment of project proponent-responsible mitigation lands, or the creation of third-party mitigation lands. The amount of mitigation bank credits purchased or the acres of mitigation lands preserved is determined by the quality of affected Pima pineapple cactus habitat. Typically, the Service requires a 1:1 ratio of the acres of Pima pineapple cactus habitat impacted to the acres preserved, but higher quality Pima pineapple cactus habitat, as determined by Pima pineapple cactus density and distribution, as well as site conditions (e.g. minimal disturbance or invasion by non-natives) may require a higher offset ratio. All mitigation should be approved by the Service and implemented prior to project initiation. The Service requires that all project proponent-responsible or third-party mitigation lands have a Service approved management plan, as well as real estate and funding assurances, to ensure that the lands are managed for the conservation of the species and its habitat in perpetuity.

Loss of individuals affects population viability incrementally into the future through the loss of reproductive capacity, productivity, and genetic variability. To offset this loss, the project proponent can secure, at a minimum, seeds of the individual cacti that will be impacted by the project. These seeds should be placed in a secure seed bank facility such as the Agricultural Research Service National Center for Genetic Resources Preservation in Fort Collins, Colorado for long-term storage and future use in restoration. Care should be taken to ensure that seed collection permits are in place prior to collection and that collection follow the protocols set forth by the Center for Plant Conservation.

Predation
Predation by mammals and insects occurs on both adult and seedling Pima pineapple cactus (Phillips *et al*. 1981, Mills 1991, Roller 1996, Schmalzel & McGibbon 2010, Baker 2011, USFWS 2015b). Primary insect predators of Pima pineapple cactus are the native cactus weevil (*Gerstaeckeria* sp.; Schmalzel 2002), the native cactus beetle (*Moneilema* sp.), and the native pyralid moth (*Cactobrosis* sp.; SWCA 1999). Harris' antelope squirrel (*Ammospermophilus harrisii*), antelope jackrabbit (*Lepus alleni*), and desert cottontail (*Sylvilagus audubonii*) are known to eat stem material of Pima pineapple cactus, especially when other food sources are scarce, such as in times of drought (Phillips *et al*. 1981, Mills 1991, Schmalzel & McGibbon 2010, Baker 2011, USFWS 2015a, USFWS 2015b). Many individual Pima pineapple cactus die or become disposed to death annually from predation which has been recorded on numerous occasions over the past decade.

Small Population Size
Pima pineapple cactus is a sparsely distributed plant that requires habitat connectivity and proximity to other plants for effective pollination. Current information indicates that roughly 98 percent of all known *C. scheeri* var. *robustispina* occur within 2,952.8 feet of one another. Should threats or stressors remove or cause the deterioration of corridors and connectivity, this could result in genetic isolation and inbreeding. For example, habitat fragmentation reduces the

likelihood of successful pollination as Pima pineapple cactus become more and more isolated from one another and plant community diversity is reduced. Locally, loss of individual cacti reduces the genetic diversity in the population. This decreases the adaptive potential to respond to changing conditions. In addition, the small number of individuals located in southern Arizona and northern Sonora makes Pima pineapple cactus vulnerable to catastrophic events, such as regional drought.

Urbanization
Urban and suburban development in the areas of Tucson, Green Valley, and Nogales, Arizona and mining in the Sierrita Mountains and Green Valley, were first recognized in the 1980s as threats to Pima pinapple cactus (Phillips *et al.* 1981, Reichenbacher 1985, Mills 1991, USFWS 2000). These threats are responsible for complete and permanent modification of lands that previously supported Pima pineapple cactus and its pollinators. By 2000, we estimated that 43 percent of the total habitat surveyed to date had been modified or destroyed due to urbanization (USFWS 2001). For example, 353 acres of habitat and 47 individual plants were lost to a single housing development project in 1998 (USFWS 1998). The trend continues; in 2014, 487 acres of suitable Pima pineapple cactus habitat and 99 individual plants were lost to a single infrastructure development project. In addition, mining has resulted in the loss of hundreds, if not thousands, of acres of potential habitat throughout the range of the plant.

Other threats and stressors
Other specific threats that have been previously documented (USFWS 1993), such as improper grazing and illegal collection have not yet been analyzed to determine the extent of effects to this species, however, improper grazing by livestock and illegal collection would negatively affect Pima pineapple cactus.

In summary, Pima pineapple cactus conservation efforts are currently hampered by a lack of information on the species. Specifically, we have not been able to determine exact ecological characters to help us predict locations of Pima pineapple cactus or precisely delineate its habitat, and considerable area within the Pima pineapple cactus range has not been surveyed. Further, there are still significant gaps in our knowledge of the life history of Pima pineapple cactus; for instance, we have yet to observe a good year for seed germination. From researcher observations and motion sensing cameras, we have learned that ants, Harris' antelope squirrels, and jackrabbits act as seed dispersal agents. Demographic plots have been only recently established, and information is just now beginning to be reported with regard to describing population dynamics for Pima pineapple cactus in the Altar Valley.

Development and associated loss of habitat remain important and continuing threats to this taxon. However, the expanding threat of non-native grasses and resulting altered fire regimes are a serious concern for the long-term viability of the species, as is ongoing drought. The full impact of drought and climate change on Pima pineapple cactus has yet to be studied, but, if recruitment occurs in punctuated events based on precipitation and temperature (Baker 2006), Pima pineapple cactus will be negatively affected by these forces. Already we have seen a nearly 25% loss of individuals across six study sites in the Altar Valley between 2010 and 2011; these deaths were attributed largely to drought and associated predation by native insects and rodents (Baker 2011). Conservation efforts that focus on habitat acquisition and protection, like those proposed by Pima County and the City of Tucson, are important steps in securing the long-term viability of this taxon. Regulatory mechanisms, such as the native plant protection ordinances, provide conservation direction for Pima pineapple cactus habitat protection within subdivisions, and may serve to reduce Pima pineapple cactus habitat fragmentation within areas of projected urban growth.

Conservation, Consultation and Recovery Planning
Since its listing in 1993, there have been 76 formal section 7 consultations under the Act involving Pima pineapple cactus in southern Arizona resulting in the direct mortality of more than one thousand individual Pima pineapple cactus, and 8,000 acres of suitable habitat, most of which were related to construction activities. We do know the number and fate of Pima pineapple cactus that have been detected during surveys for projects that have undergone section 7 consultation. Consultations under the Act only occur for projects with a Federal nexus, either occurring on Federal lands or using Federal dollars or needing a Federal permit. Therefore, many projects that occur within the range of Pima pineapple cactus do not undergo section 7 consultations, and the FWS does not typically receive information regarding the status or loss of plants or habitat associated with those projects.

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions that are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Description of the action area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment. The action area for this PBO/PCO is defined as all Forest Service-administered lands within the CNF's five ranger districts: Douglas, Nogales, Safford, Santa Catalina, and Sierra Vista, as well as all adjacent lands that could be directly or indirectly affected by the actions. The CNF is located in southeastern Arizona and southwestern New Mexico and is composed of approximately 1,780,000 acres ranging in elevation from 3,000 to 10,720 feet in twelve widely scattered mountain ranges referred to as "sky islands." Vegetative communities on the CNF range from Sonoran desert to spruce-fir forest.

Jaguar

A. Status of the species and critical habitat within the action area

The life history elements of the jaguar are generally similar throughout its range, and are discussed in the Status of the Species.

Jaguars use medium and large-size prey, with a trend toward use of larger prey as distance increases from the equator. Javelina and white-tailed deer are thought to be the mainstays in the diet of jaguars in the U.S. and Mexico borderlands including within the action area.

The home ranges of jaguars are highly variable and differ with sex, topography, available prey, and population dynamics. A small number of home range studies have been conducted in the northwestern recovery unit, ranging from an average of 16.4 ± 6.2 mi^2 for four females to 77 mi^2 for one adult male. Within the action area, one study used camera traps to estimate a 35 mi^2 minimum home range for one male jaguar in the Santa Rita Mountains in Arizona; however, this estimate should be used with caution, considering the small sample size and that the study was not designed to determine home range size. The home ranges of borderland jaguars are presumably as large as or larger than the home ranges of tropical jaguars, as jaguars in this area are at the northern limit of their range and the arid environment contains resources and environmental conditions that are more variable than those in the tropics. Therefore, jaguars require more space in arid areas to obtain essential resources such as food, water, and cover.

Few studies have been conducted on jaguar movements and dispersal distances within the northwestern recovery unit, and none have been conducted in the U.S. In the forests of Jalisco, jaguars can move up to 12 miles in a single night, and in Nácori Chico, Sonora, female jaguars returned to a given location approximately every 20 days and males every 30 days. One juvenile male was found to have dispersed about 43.5 miles to the north in coastal Jalisco.

Jaguars in Arizona and New Mexico predominantly use montane environments, probably because of more amiable temperatures and prey availability. Madrean evergreen woodland and semi-desert grasslands are important for jaguars in the U.S. and borderlands region.

There are seven, possibly eight (see Status of the Species for this information), confirmed individual jaguars have occurred in the U.S. since 1996; five of these individuals were documented within the proposed action area, including in the Atascosa, Tumacocori, Santa Rita, Whetstone, Huachuca, and Peloncillo Mountains. The detections in the Atascosa and Tumacocori Mountains of two jaguars ("Macho A" and Macho B") were from trail cameras in place from 2001 to 2009. The detections of one jaguar in the Santa Rita Mountains were from trail cameras in place from 2012 to 2015 (https://www.flickr.com/photos/usfws_southwest/sets/72157632294203147/). In the Whetstone Mountains, detections of one jaguar include photos taken in 2011 (this is the same jaguar that was later detected in the Santa Rita Mountains from 2012 to 2015). The detection of one jaguar in the Huachuca Mountains includes photos taken in 2016 and 2017. The detections of one jaguar in the Peloncillo Mountains include photos taken in 1996. All five detections were located on or in close proximity to lands administered by the CNF, and were within designated critical habitat (Units 2, 3, 4 and 5). Analysis by jaguar experts of the comparison of rosette patterns concluded that the photographs are of five individual male jaguars.

As described in the Status of the Species, the jaguar detected in the Santa Rita Mountains appears to be a resident. Although this jaguar hasn't been documented in over a year, the FS also hypothesizes that this single resident male jaguar has established a territory that includes most of the Santa Rita Mountains (which are in the proposed action area) and possibly the Whetstone Mountains, as well (from the Rosemont Project June 2012 BA and February 2013 Supplemental BA). To move between the Whetstone and Santa Rita mountains, the male jaguar would have had to cross a two-lane highway, possibly State Route 83, although its exact movement pattern is unknown.

In addition to the mountain ranges described above, all CNF lands south of Interstate 10 (including the Chiricahua and Dragoon Mountains, and the Canelo Hills) are within the U.S. portion of the Borderlands Secondary Area of the northwestern recovery unit for the jaguar.

Threats to the jaguar in the action area are generally similar to threats to the species throughout its range as described under "Status of the Species"; however, in the U.S., the threat of illegal killing is not currently believed to be a problem (USFWS 2016). Other threats to jaguars in this region are international border issues such as: (1) infrastructure along and near the U.S.-Mexico border, including pedestrian and vehicle barriers and towers and their associated roads and lighting; and (2) illegal crossers and U.S. Border Patrol law enforcement traffic (pedestrian and vehicle). Fences designed to prevent the passage of humans (i.e., pedestrian barriers) also prevent passage of jaguars. Other infrastructure (e.g., vehicle barriers, towers, roads, and lighting) and human activity may limit jaguar movement across the border, but it is uncertain if and how much this is affecting that movement. McCain and Childs (2008) identified open-pit mines as a threat to jaguars in the species core habitats in the southwestern U.S. specifically mentioning the Patagonia and Santa Rita mountains; this threat was reiterated in the BA.

Significant planning and conservation efforts have been made for the jaguar, including within the northwestern recovery unit and action area, as described above in the Status of the Species.

Within the 11,205 mi^2 U.S. portion of the Borderlands Secondary Area of the northwestern recovery unit, the CNF contains 1,730 mi^2, as shown in Table J-2 and Figure J-1.

Critical Habitat
The action area as defined by the FS encompasses the Atascosa Unit (Unit 2), the Patagonia Unit (Unit 3), the Whetstone Unit (Whetstone, Whetstone-Santa Rita, and Whetstone-Huachuca subunits) (Unit 4), and the Peloncillo Unit (Unit 5) of jaguar critical habitat (Figure J-2). These units are fully described in the final designation for jaguar critical habitat (USFWS 2014, 79 FR 12571), available here:
http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/Jaguar/2014-03485_Fed_Reg_Jag_fCH_2014-3-5.pdf. Within the action area, the amount of critical habitat available in each of these units in CNF is summarized in Table J-3. The CNF contains more than 70% of jaguar critical habitat distributed within the Atascosa, Patagonia, Whestone and Peloncillo critical habitat Units, 64% of the total jaguar critical habitat (Table J-3) and provides connectivity to Mexico (see Figure J-3).

For the purposes of critical habitat, the FWS considers all units within the action area to have been occupied at the time of listing based on historical and recent sightings (USFWS 2014), with the exception of Subunits 4b and 4c. These two subunits, are essential to providing connectivity to Subunit 4a (which is in the action area) to Mexico via Unit 3, although there are no records indicating that either of these subunits have been used by jaguars. The mountain ranges within these units contain all primary constituent elements essential to the conservation of the jaguar, including connectivity to the Mexico portion of the Borderlands Secondary Area (for Unit 4 through Subunits 4b and 4c, then through Unit 3), then south to the Sonora Core Area of the northwestern recovery unit.

B. Factors affecting the species and critical habitat within the action area

Primary factors affecting the jaguar in the action area include habitat loss and fragmentation due to, among other things, urban expansion, mining, roads, and border infrastructure. Connectivity among jaguar populations or colonization of new habitats is discouraged by all of these factors. Connectivity to Mexico is essential for habitat use by jaguars in the northwestern recovery unit, as well as in Arizona and New Mexico.

Primary factors affecting critical habitat within the action area include, but are not limited to: significant increases in border-related activities, both legal and illegal; widening or construction of roadways, power lines, or pipelines; construction or expansion of human developments; mineral extraction and mining operations; and human disturbance related to increased activities in or access to remote areas (USFWS 2012b, USFWS 2013).

Past and Ongoing Federal Actions in the Action Area

Five projects have undergone formal section 7 consultation for effects to jaguar in southern Arizona, including one for effects to jaguar critical habitat. Incidental take of two jaguars has been authorized and no jeopardy opinions have been issued. A summary of these consultations is below:

1. *Biological Opinion on Nationwide U.S. Department of Agriculture, Animal and Plant Health Inspection Service-Wildlife Services (USDA, APHIS-WS) Activities on the endangered Jaguar* (Consultation Number 000194RO issued on June 22, 1999).

This consultation analyzed the effects of USDA, APHIS-WS' national animal damage control activities on jaguars. Adverse effects to jaguars could occur from certain animal damage control methods, including the use of leg-hold and box traps, snares, M-44s, etc. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and anticipated that, due to animal damage control activities, there would be an undeterminable level of take as a result of harassment and injury, and the take of one jaguar as the result of direct injury or mortality. The anticipated level of take was considered to be exceeded if animal damage control activities are directed at jaguars, or if one jaguar is unintentionally trapped, injured, or killed. To minimize incidental take, a number of reasonable and prudent measures were included in the biological opinion. To date, no incidental take has been documented resulting from APHIS-WS' program.

2. *Biological Opinion on the Pedestrian Fence Proposed Along the U.S. and Mexico Border near Sasabe, Naco, and Douglas* (Consultation number 22410-2007-F-0416 issued August 29, 2007).

This consultation addressed the effects of Department Of Homeland Security's construction of a pedestrian fence (and other associated activities such as road construction and maintenance) along the U.S.-Mexico international border near Sasabe, Pima County; Nogales, Santa Cruz County; and near Naco and Douglas, Cochise County. Some pedestrian fence segments that were constructed in these three areas were included in this consultation, while others did not undergo section 7 consultation. Specifically, pedestrian fence segments were constructed in Sasabe (7 miles, all of which were included in this consultation), Nogales (about 6 miles, roughly 2 of which were included in this consultation), Naco (about 25 miles, 15 of which were in this consultation), and Douglas (about 17 miles, 7 of which were included in this consultation).

Adverse effects to jaguars were expected to occur from the proposed action by impeding jaguar movement between Mexico and the U.S., disturbing jaguars, and degrading their habitat. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and no incidental take was anticipated. Conservation measures, including funding for the implementation of jaguar recovery actions, were included to help offset the effects of the action on jaguars.

3. *Biological Opinion on Secure Border Initiative (SBInet) Tucson West Tower Project, Ajo, Tucson, Casa Grande, Nogales, and Sonoita Stations Area of Operation, U.S. Border Patrol, Tucson Sector, Arizona* (Consultation number 22410-2008-F-0373 issued September 4, 2008).

This consultation addressed the effects of the construction, operation, and maintenance of communication and sensor towers, roads, and mobile surveillance systems, as well as the deployment of unattended ground sensors. Adverse effects to jaguars were expected to occur from the proposed action by disturbing jaguars and degrading their habitat. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and no incidental take was anticipated. Conservation measures, including funding for jaguar monitoring, were included to help offset the effects of the action on jaguars.

4. *Biological Opinion and Conference Opinion for the Rosemont Copper Mine, Pima County, Arizona* (Consultation number 22410-2009-F-0389 issued October 30, 2013 and the reinitiated consultation, number 22410-2009-F-0389R1 issued April 22, 2016 and amended April 28, 2016).

The original biological opinion for this project was issued in 2013; however, consultation was reinitiated and the final revised opinion was issued in 2016. The 2016 consultation addressed the effects of construction and operations of the copper mine, including the mine pit, waste rock piles, tailings, access roads, utility corridors, and onsite facilities (i.e., the mine "footprint"). The project area acreage, expected to result in direct impacts owing to project activities, is 5,431 acres. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and anticipated that, due to construction and operation of the mine, jaguars could shift home range location and travel longer distances, and the take of one jaguar over the life of the project in the form of harassment. We also determined that the proposed action would directly and permanently affect 4,013 acres of jaguar critical habitat, with another 2,126 acres directly affected for up to the next 30 years, with some areas potentially becoming more suitable if vegetation reclamation is successful over the long-term. Some of this loss is offset by conservation lands (totaling 3,064 acres) that will be protected and managed in perpetuity within the northwestern recovery unit, including 1,857 acres of jaguar critical habitat. To date, this project has not been implemented; therefore no take has occurred.

5. *Biological Opinion on Ongoing and Future Military Operations and Activities at Fort Huachuca, Arizona* (Consultation number 22410-2013-F-0247 issued May 16, 2014).

This consultation addressed the effects of operations and activities to meet mission objectives of Fort Huachuca, including tenant-specific activities within Fort Huachuca training areas, air operations associated with Libby Army Air Field, recreational opportunities, resource management, realty actions, and programmed facilities development projects both on post and off post that are in the master plan. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and no incidental take was anticipated.

In addition to the aforementioned activities, Department of Homeland Security/Customs and Border Protection has constructed border infrastructure towers, vehicle barriers and pedestrian fences in the action area that have not undergone formal consultation for jaguars. Furthermore, Customs and Border Protection – Tucson Sector regularly conducts patrol activities within the action area that may affect jaguars and, with the exception of patrol activities associated with the Tucson West Towers Project, have not undergone formal consultation.

Ocelot

A. Status of the species within the action area

Generally, life history elements are similar throughout their range, although some, such as diet and vegetation community use vary by region (see Status of the Species). No home range studies have been done for ocelots in Arizona, recently, however, Culver (2016) estimated minimum observed ranges for ocelots in Arizona (two in the Huachuca Mountains and one in the Santa Rita Mountains). The average minimum observed range of the three Arizona ocelots was 11.62 miles^2, with minimum observed ranges ranging from 3.00 to 24.48 miles^2.

Although no habitat use studies have been conducted for ocelots in Arizona, based on limited records, Arizona ocelots appear to be associated with Madrean evergreen woodland (Culver 2016, Avila-Villegas and Jessica Lamberton-Moreno 2013), semi-desert grassland, and Great Basin grassland biotic communities (Culver 2016).

Ocelots are rare in Arizona. As discussed in the Status of the Species, since 2009, five ocelots have been documented in Arizona; four of these occurred in the action area, including in the Santa Rita, Patagonia, Huachuca, and Whetstone mountains.

Threats to ocelots in Arizona are similar to threats to the species throughout its range as described under “Status of the Species”.

Other threats to ocelots in this region are mining (such as the proposed Rosemont, Hermosa, and Sunnyside mines) and international border issues such as 1) infrastructure along and near the U.S. - Mexico border, including pedestrian and vehicle barriers and towers and their associated roads and lighting; and 2) illegal and U.S. Border Patrol traffic (pedestrian and vehicle). Fences designed to prevent the passage of humans (i.e., pedestrian barriers) likely also prevent passage of ocelots. Other infrastructure (e.g., vehicle barriers, towers, roads, and lighting) and human activity may limit ocelot movement across the border, but it is uncertain if and how much this is affecting movement. Connectivity to Mexico is likely essential for habitat use by ocelots in Arizona (the northern portion of the ASMU). As included in the recovery criteria for this species, delisting the species will require that habitat linkages to facilitate an ASMU metapopulation are identified and conserved for the foreseeable future.

Significant planning and conservation efforts have been made for the ocelot in certain parts of its range, such as Texas. As described above in “Status of the Species”, some planning and conservation efforts have also been made for the Sonora subspecies.

B. Factors affecting the species within the action area

The primary factors affecting the ocelot in the action area include habitat loss and fragmentation due to, among other things, urban expansion, mining, roads, and border infrastructure.

Fragmentation and habitat lose reduces connectivity among ocelot populations and may inhibit colonization of unoccupied habitats.

Past and Ongoing Federal Actions in the Action Area

Four projects have undergone formal section 7 consultation for effects to ocelot in southern Arizona. Incidental take of two ocelots has been authorized and no jeopardy opinions have been issued. A summary of these consultations is below:

1. *Biological Opinion on Acquisition of Wildlife Habitat Along the San Pedro River, Cochise County, Arizona* (Consultation Number 2-21-86-F-8issued on December 9, 1985).

This consultation analyzed the effects of USDI-BLMs acquisition of 35,000 acres to form a new national wildlife refuge. We determined that the proposed action was not likely to jeopardize the continued existence of ocelots, but will promote the conservation of the species.

2. *Biological Opinion on the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Nationwide Wildlife Damage Management Program* (Consultation number FWS/AES/DCHRS/BCH/045455, issued July 7, 2010).

This consultation addressed the effects of U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services' Nationwide Wildlife Damage Management Program on ocelots. We determined that the proposed action was not likely to jeopardize the continued existence of ocelots and anticipated incidental take of one ocelot in the form of harm, harass, wound, kill, trap, or capture.

3. *Biological Opinion and Conference Opinion for the Rosemont Copper Mine, Pima County, Arizona* (Consultation number 22410-2009-F-0389 issued October 30, 2013 and the reinitiated consultation, number 22410-2009-F-0389R1 issued April 22, 2016 and amended April 28, 2016).

The original biological opinion for this project was issued in 2013; however, consultation was reinitiated and the final revised opinion was issued in 2016. The 2016 consultation addressed the effects of construction and operations of the copper mine, including the mine pit, waste rock piles, tailings, access roads, utility corridors, and onsite facilities (i.e., the mine "footprint"). The project area acreage, expected to result in direct impacts owing to project activities, is 5,431 acres. We determined that the proposed action was not likely to jeopardize the continued existence of ocelots and anticipated that, due to construction and operation of the mine ocelots could shift home range location and travel longer distances, and the take of one ocelot over the life of the project in the form of harassment. To date, this project has not been implemented; therefore no take has occurred.

4. *Biological Opinion on Ongoing and Future Military Operations and Activities at Fort Huachuca, Arizona* (Consultation number 22410-2013-F-0247 issued May 16, 2014).

This consultation addressed the effects of operations and activities to meet mission objectives of Fort Huachuca, including tenant-specific activities within Fort Huachuca training areas, air operations associated with Libby Army Air Field, recreational opportunities, resource management, realty actions, and programmed facilities development projects both on post and off post that arein the master plan. We determined that the proposed action was not likely to jeopardize the continued existence of ocelots and anticipated that incidental take of one ocelot is reasonably certain to occur as a result of implementation of the proposed action in the form of harm and harassment.

In addition to the aforementioned activities, Department of Homeland Security/Customs and Border Protection has constructed border infrastructure including towers, vehicle barriers, and pedestrian fences, in the action area that have not undergone formal consultation for ocelots. Furthermore, Customs and Border Protection – Tucson Sector regularly conducts patrol activities within the action area that may affect ocelots and, with the exception of patrol activities associated with the Tucson West Towers Project, have not undergone formal consultation (although the Tucson West Towers Project did not undergo formal consultation for ocelots).

Mount Graham Red Squirrel

The action area means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). For purposes of the Mount Graham red squirrel analysis, we have determined the action area encompasses the entire Mount Graham red squirrel range and critical habitat located in the Pinaleño Mountains. The mixed-conifer forest within the action area mainly consists of Douglas-fir, southwestern white pine, ponderosa pine, corkbark fir, white fir, quaking aspen, and Engelmann spruce, and occurs at differing aspects and elevations from above 7,750 feet to approximately 10,000 feet. Much of the spruce-fir within the action area was damaged or destroyed by insect outbreaks and wildland fire.

A. Status of the species and critical habitat within the action area

Since the Mount Graham red squirrel exists entirely on Mount Graham within CNF, the environmental baseline within the action area is the same as the Status of the Species above and is incorporated by reference.

B. Factors affecting the species and critical habitat within the action area

Nine formal consultations on the Mount Graham red squirrel have been conducted on the CNF, and two are in process (See Table MGRS-1). The incidental take associated with the non-emergency projects was from traffic mortality, habitat alteration, and human disturbance. However, restoration projects such as the Pinaleño Ecosystem Restoration Project (PERP) on Mount Graham will have long-term beneficial effects to the Mount Graham red squirrel despite the project's potential to result in a 15 percent decline in abundance of Mount Graham red squirrel in treated areas during project implementation (through year 15). Since the 2012 LRMP BO/CO was issued, only one formal consultation (Captive Breeding Pilot Program and Issuance of Section 10(a)(1)(A) Enhancement of Survival Permit) has been completed for the Mount Graham red squirrel. Incidental take of Mount Graham red squirrels associated with wildland fire suppression activities is not part of the action under consultation in this BO, but is part of the environmental baseline. The CNF provided measures that would minimize the impacts to Mount Graham red squirrel in all formal consultations. All BOs for projects conducted on the CNF were determined not to jeopardize the species or result in adverse modification or destruction of critical habitat.

Most of the action area has supported significant recreational use by researchers, hikers, campers, birders, wildlife and plant collectors, fuel wood collectors, and hunters. Past and present research and monitoring activities (permitted under section 10(a) (1) (A) enhancement of survival permits) include pre-baiting, trapping, handling, marking, and using radio-telemetry to track Mount Graham red squirrel. Additionally, an annual mountain-wide survey is conducted each fall, during which a sample of middens are visited to determine Mount Graham red squirrel occupancy. Summerhome owners and sometimes their pets inhabit the action area near Old Columbine and Turkey Flat, and use the forest lands surrounding their cabins for a variety of activities. The forested lands surrounding Old Columbine and Turkey Flat are very steep and rough, and residents likely remain close to their respective summerhome area. Some residents (and likely a few of their visitors) may hike a short distance uphill on designated trails, but the elevation, steep and rugged terrain, and general age and abilities of the resident population make it unlikely these people use the trails extensively or leave the trail for the forest (A. Casey, U.S. Forest Service, pers. comm. 2007). Because no new summerhomes or additions will be permitted, the number of people using these portions of the action area is expected to remain at current levels (S. Wallace, U.S. Forest Service, pers. comm. 2007).

Other portions of the action area, as defined in the Environmental Baseline section above, are posted for speed limits on the roads and types of permitted activities at the sites. Bear-proof garbage containers are provided at public sites (especially picnic areas, camp sites, and Riggs Lake) and are serviced regularly by FS personnel. Surveys for Mount Graham red squirrel middens have documented active and inactive middens in the surrounding forest that supports denser, interlocking canopy and a cooler, moister climatic regime deeper into the forest than that found on the edge of roads and trails mountain-wide. A few middens are known to be visible from some portions of some hiking trails, and some are very close to the edges of CNF roads, but they remain relatively inconspicuous to the typical forest user. While roads and trails have a drying effect on the immediate forest edge, middens tend to be far enough away from these edges to remain active over time. Both active and inactive middens can be found on both sides of low, medium, and high traffic roads in the forest, all of which can pose barriers for Mount Graham red squirrel (Chen and Koprowski 2016).

In addition to the research mentioned previously, other conservation activities include the 2001 Pinaleño Ecosystem Management Demonstration Project (PEM), which was initiated to reduce heavy fuel loads on up to 1,100 acres roughly between Jesus Goudy Trailhead and Shannon Campground, and the 2011 PERP (mentioned above), which will treat 2,641 acres within Mount Graham red squirrel habitat to reduce fuel loading. Both projects were designed to encourage the return of the natural fire cycle, and, in the case of PERP, increase resiliency of mixed-conifer stands in the project area to insect and disease outbreaks, thereby improving squirrel habitat. Also, in 2013 we began a captive breeding pilot program for Mount Graham red squirrel involving trapping and transporting squirrels, holding them in captivity, and releasing progeny back into the wild. The program currently includes three males and two females being held at the Phoenix Zoo. Mating introductions were begun in 2014; to date, no young have been produced from these introductions, and no releases into the wild have occurred.

Lesser Long-Nosed Bat

A. Status of the species within the action area

Lesser long-nosed bat roosts have been documented on the CNF in both Arizona and New Mexico. Lesser long-nosed bat occurrence on the CNF coincides with the blooming of paniculate agaves between July and September. Although there are no known maternity roosts on the forest, there are several post-maternity roosts in the Patagonia, Catalina, Rincon, Santa Rita, Whetstone, Dragoon, Huachuca, Chiricahua, and Peloncillo mountain ranges. Over the past years there have been fifteen or more roost sites identified on CNF and there are also several post-maternity roost sites adjacent to CNF. It appears that known roosts are still being used, and new roosts continue to be documented on and around the CNF (USFS 2016a). Maternity roosts in Arizona are generally greater than 40 miles from the CNF; however, numerous post-maternity roosts are within the 40-mile foraging distance of the CNF. Foraging also occurs on the CNF.

Male and first-year female lesser long-nosed bats from scattered small roosts have been recorded in southeastern Arizona as early as May (T. Snow, AGFD, 2005, unpubl. data). Beginning in the mid-July lesser long-nosed bats move to their transitory roosts. Arizona Game and Fish Department conducts simultaneous counts in August each year. Because bats are known to forage long distances from their roosts, bats within any of these sites are most likely foraging on the CNF.

The CNF encompasses all of the major mountain ranges in the southeastern portion of Arizona and a small portion of the New Mexico boot heel area. Within the CNF, the sky island mountain ranges are divided into twelve Ecosystem Management Areas. Lesser long-nosed bat roosts are known from nearly every mountain range in southern Arizona. By way of general summary, there are four primary roost sites in the Chiricahua Ecosystem Management Area; two of these sites have greater than 1,000 bats and one has greater than 3,000 bats. Within the Dragoon Ecosystem Management Area, there are three known primary roost sites. In 2000, male lesser long-nosed bats were detected in the Galiuro Ecosystem Management Area, and in 2009, two roosts were found. There are also at least three large roosts in the Santa Rita Ecosystem Management Area. Within the Pajarito Mountains, one roost has been found within the Tumacacori Ecosystem Management Area. Foraging bats have been documented within the Pinaleno Ecosystem Management Area and the Peloncillo Ecosystem Management Area, but intensive surveys have not been conducted and only one minor roost is known Peloncillo Ecosystem Management Area. Furthermore, there in one known roost in the Santa Catalina Ecosystem Management Area, as well as roosts on neighboring Saguaro National Park, BLM, and State lands, and bats do forage within the Ecosystem Management Area (USFS 2004).

Lesser long-nosed bat numbers at post-maternity or transition roosts tend to fluctuate more than numbers at maternity roosts. This fluctuation is apparently based on local forage availability (agave blooms). Agave blooming is subject to climatic conditions and during the ongoing, extended drought, some portions of the action area have been subject to forage failures. Lesser long-nosed bats are highly mobile and will switch to areas and roosts where forage is available.

B. Factors Affecting the Species within the Action Area

Roost disturbance and deterioration, border activities, recreation, vandalism, fire, mine closures, and forage availability are all factors that affect the lesser long-nosed bat in the action area (USFWS 2007b).

The introduction of buffelgrass and other invasive species, fires and drought may affect some lesser long-nosed bat foraging habitat within the action area. In addition, high levels of illegal border activity and the associated damage resulting to the landscape from these activities, as well as activities of law enforcement is a threat to the bat. Lesser long-nosed bats appear to be more sensitive to bat gates than insectivorous bat species and their use of mines or caves equipped with gates may be affected. However, long-term effects should benefit the species range-wide if an effective gate design is developed.

A number of activities occur in the action area that could affect bats. Because of the extent of Federal lands in the action area, most activities that currently, or have recently, affected the lesser long-nosed bats or their habitat in the action area are Federal actions, many of which have undergone formal consultation. However, ongoing illegal border activities are an exception. Efforts are ongoing in the action area that contribute to the conservation and protection of lesser long-nosed bat populations and habitat within the action area. For example, the NPS and the CNF have constructed bat gates at two lesser long-nosed bat roosts in the Huachuca and Canelo Hills, respectively. The effectiveness of these efforts is being monitored. Research and monitoring activities funded by Customs and Border Protection on public and private lands within the action area are contributing to our knowledge of lesser long-nosed bat roost locations and developing appropriate protective measures for lesser long-nosed bat roost sites. In general, the lesser long-nosed bat populations within the action area are stable to increasing, but threats are ongoing, and in some cases may be increasing (climate change, invasive species, border activities, etc.). However, current monitoring seems to indicate that lesser long-nosed bats are able to adapt to changing conditions within their range.

Agaves flower only once and then die. Livestock and wild herbivores feed on young agave stalks, which preclude the plant from flowering. Agave stalks are rich in carbohydrates, and as they begin to bolt, are particularly palatable to domestic livestock and wild herbivores (Howell 1996). Bolting means rapid expansion of internodes, increased height, and formation of flowers in otherwise rosette plants in response to cold or hormone application. The desirability of these stalks in early spring is likely influenced by availability of quality forage in the area. Agaves are most numerous where they occur as large clones in steep, rocky habitats largely unsuitable for livestock grazing. In lower gradient areas frequented by livestock, plants are found in smaller clones or as individual plants. The individual plants are low density, scattered throughout the landscape, and extremely susceptible to livestock herbivory. Widmer and McClaran (2001) studied the effect of livestock grazing on *A. palmeri*. Their results indicated: 1) overall herbivory on agave stalks was 56 percent; 2) 1/3 of emerging inflorescence were grazed at 70 percent of the sites; and 3) herbivory on agave stalks was 29 percent greater on sites grazed by livestock during the agave bolting season. These plants likely provide connectivity for bats within and between mountain ranges. They also may provide an important mechanism that enables bats to effectively utilize and access high-density agave patches many miles from day roosts. Their presence may determine the amount of habitat available for bats and may be a key limiting factor in the recovery of populations (USFWS 1997). Properly managed livestock grazing will not adversely affect the abundance of agave flowers.

Based on research conducted by Ober *et al*. (2000) on the foraging ecology of lesser long-nosed bats on Fort Huachuca, the high energy demands of the bat coupled with the small amount of nectar per flower forces bats to visit many flowers per night. The daily expenditure of energy for lesser long-nosed bats may be 1.5-2 times as high as previously reported and thus the amount of food needed to support the bat population in southeastern Arizona may be greater than previously thought. Therefore, maintaining sufficient numbers of agaves as a food source appears to be very important. Ober *et al*. (2000) also found evidence that bats select areas with both high resource abundance and evidence of high resource abundance in previous years, suggesting that site fidelity may play a role in the bats' foraging behavior. A reduction in or fragmentation of *A. palmeri* populations could have serious effects on bat populations by increasing energy demands with resulting reductions in reproductive success and adult recruitment. It could also force them to roost in substandard areas or compete with one another for food at remaining plants. These negative effects would be even more noticeable during years of low flower production. The density of flowering agaves on their study areas on Ft. Huachuca varied from 3.5 (1988) to 0.8 (1999) plants/acre within the bats' home range (Ober *et al.* 2000).

Saguaros are dependent on nurse plants to provide cover during their sensitive seedling stage. Livestock grazing may affect the density and distribution of nurse plants, increasing the mortality of saguaro seedlings. Benson (1982) noted that grazing destroyed seedbeds of saguaros. Neiring *et al*. (1963) found that enhanced reproduction of saguaros on slopes was correlated with reduced localized levels of grazing.

Climate change impacts to the lesser long-nosed bat in this portion of its range may include loss of forage resources. Of particular concern is the prediction that saguaros, the primary lesser long-nosed bat forage resource in the Sonoran Desert, will decrease or even disappear within the current extent of the Sonoran Desert as climate change progresses (Weiss and Overpeck 2005). Shifts in flowering phenology of both saguaros and agaves as a result of climate change may have population effects on this migratory species. Monitoring of bats and their forage during drought years and in relation to changing temperatures is needed to better understand the effects of drought and climate change on this species.

Over the past 10 years, FWS has conducted several consultations within the action area that included anticipated adverse effects to the lesser long-nosed bat. These consultations included land use plans, border infrastructure projects, military operations, utility infrastructure project, and mine projects.

Mexican Spotted Owl

A. Status of the species and critical habitat within the action area

The CNF is located within the Basin and Range West (BRW) Ecological Management Unit (EMU) (see Figure MSO-1). The CNF is representative of basin and range topography often characterized as "sky islands." The CNF is organized as five Ranger Districts; each Ranger District administers several sky island mountain ranges. The sky islands form distinct mountain ranges located in southeastern Arizona and southwestern New Mexico, twelve of which make up the CNF. The mountain ranges offer a range of vegetative types and climates with tree-covered mountains rising from grassy savannas and the Sonoran and Chihuahuan Desert lowlands. In the BA provided for the LRMP consultation (USFS 2016a), the FS estimates 241,659 acres of protected habitat are present on the CNF outside of protected activity centers and 78,524 acres of recovery habitat (formerly referred to as restricted habitat). Surveys in protected and restricted habitat may reveal the presence of additional PACs.

Mexican spotted owls are widely distributed on the CNF, known to occur on all five ranger districts. Mexican spotted owls are most common in mixed-conifer forests dominated by Douglas-fir and/or white fir as well as Madrean encinal woodlands, ponderosa pine-oak, and canyons with varying degrees of forest cover including riparian. As of 2016, 108 Mexican spotted owlPACs were delineated within the boundaries of the CNF (USFS 2016a). The delineation of an additional 21 new protected activity centers (USFS 2016a) from previous surveys could result in up to 129 protected activity centers on CNF. Future surveys by the FS as part of their regular management within currently unoccupied Mexican spotted owlhabitat on the CNF may detect additional Mexican spotted owls.

Since our issuance of the 2012 LRMP BO/CO, 2 Mexican spotted owl protected activity centers within the action area have been impacted by wildfires greater than 50 acres. In addition, there have been 15 wildfires (greater than 50 acres) that have burned through portions of Mexican spotted owlcritical habitat. Fire has always been a major disturbance agent in southwestern forests (Swetnam 1990), and Mexican spotted owls co-evolved with this disturbance. However, the structure of southwestern forests, the frequency with which they experience fire, and the types of fires experienced have changed greatly following increased human settlement of these lands (Covington and Moore 1994).

The Revised Recovery Plan (USFWS 2012) provides a detailed review of the literature regarding the effects of high-severity fire on Mexican spotted owl. Based upon what we know, in many cases (but probably not all) adult Mexican spotted owls are able to fly to relative safety during fire and may survive the initial fire effects (Bond *et al.* 2002). However, it is unlikely that eggs or nestlings in a nest would survive moderate-to-high severity fire effects due to direct effects from burning or smoke inhalation (for nestlings). Fledgling Mexican spotted owls (juvenile owls that have left the nest but are still dependent upon their parents for care), are not likely to survive high-severity fire as they are not skilled at flying and may fly into the fire or become easy prey due to their weak flying skills.

Research indicates that spotted owls continued to occupy burned areas, even following relatively high-severity fires, except in the territory that experienced the highest burn severity (Bond *et al.* 2002). Results further suggest that survival rates and mate and site fidelity in these Mexican spotted owls were relatively high in the year following fire. Bond *et al.* (2009) monitored movements and habitat use of radio-marked California spotted owls from four territories in the southern Sierra Nevada, California for four years following a large wildfire. Mexican spotted owls nested in all four territories: two nests were located in moderate-severity burned mixed-conifer forest, one in low severity burned mixed-conifer forest, and one in unburned mixed-conifer-hardwood forest. One nesting pair in a moderate-severity burned area successfully fledged a single owl. The others were not successful. Mexican spotted owls roosted selectively in low-severity burned forest, avoided moderate severity and high-severity burned forest, and used unburned forest in proportion to availability. Within 1 km of their nest, Mexican spotted owls foraged selectively in all severities of burned forests and avoided unburned forests. These results collectively suggest that the post-fire landscapes studied contained enough suitable habitat to support pair occupancy and at least attempted nesting. They further suggest that burned areas may provide benefits to foraging Mexican spotted owls. Bond *et al.* (2009) concluded that assessments of fire impacts should not assume that all fires have negative impacts on spotted owls and recommended that burned forests within 0.9 miles of Mexican spotted owlroosts or nests not be salvage-logged.

In addition to the above studies, there are numerous anecdotal observations of Mexican spotted owls occupying territories following wildfires and prescribed burns (Paul Boucher, Gila National

Forest retired, pers. comm.; Shaula Hedwall, FWS, pers. comm.), as well as evidence of radio-marked Mexican spotted owls moving into and foraging in burned areas during winter (J. P. Ward, Jr. and J. L. Ganey, unpublished data). Most wildland fires burn in a patchy nature and leave pockets of useable habitat for Mexican spotted owls, and Mexican spotted owls appear able to locate and use these patches for nesting and roosting. Thus, Mexican spotted owls appear to be somewhat resilient to wildfire, at least in the short term. However, we have no data on long-term effects of these fires on occupancy patterns or on components of Mexican spotted owlfitness such as survival and reproduction. Therefore, it is unclear at this time how Mexican spotted owls respond to habitat modification resulting from wildfires and the associated suppression activities.

Critical Habitat
There are eleven critical habitat units that occur within the boundaries of the CNF and include the following: BRW-7 (18,126 acres of the Santa Teresa Wilderness), BRW-8 (44,587 acres within the Pinaleno Mountains, Mount Graham Wilderness), BRW-9 (63,419 acres of the Galiuro Wilderness), BRW-10 (13,427 acres of the Winchester Mountains), BRW-11 (241,851 acres of the Santa Catalina and Rincon Mountains), BRW-12 (55,157 acres of the Mount Wrightson Wilderness, Santa Rita Mountains), BRW-13 (54,881 acres of the Atascosa and Pajarito Mountains), BRW-14 (56,756 acres of the Patagonia Mountains), BRW-15 (53,844 acres of the Miller Peak Wilderness, Huachuca Mountains), BRW-16 (21,150 acres of the Whetstone Mountains), and BRW-18 (75,609 acres of the Chiricahua Mountains). Only areas identified as protected and restricted pursuant to the Recovery Plan (USFWS 2012) within the critical habitat units are considered critical habitat. The FS estimates 241,659 acres of protected habitat are present on the CNF outside of protected activity centers and 78,524 acres of restricted habitat within the critical habitat units. Surveys in protected and restricted habitat may reveal the presence of additional protected activity centers (USDA 2016a).

B. Factors affecting the species and critical habitat within the action area

The factors (i.e., Federal, State, tribal, local, and private actions) already affecting the Mexican spotted owland its designated critical habitat within the action area are discussed in this section. Since the action area consists of NFS lands, there are likely very few, if any, State, tribal, or private actions impacting the Mexican spotted owlor its critical habitat in the action area. Key factors that have affected the owl within the action area are vegetation removal activities associated with fire and fuels management and maintenance of vegetation along utility corridors. Formal consultations that have occurred from 2012 (last reinitiation consultation of the 1986 LRMP) to the present are summarized in Table MSO-1. None of the projects involved harm and/or harassment on the CNF. All BOs for projects conducted on the CNF were determined not to jeopardize the species or result in adverse modification or destruction of critical habitat.

According to the FS's 2015 Annual Report, the CNF monitors Mexican spotted owlPACs each year as funding allows with priority given to protected activity centers affected by project activities. Our information from BOs since 2012 state that actions implemented under the LRMP have resulted in no incidental take of Mexican spotted owls on the CNF. Though previous actions analyzed did result in adverse effects and incidental take of Mexican spotted owls, stand-replacing fire was likely the most important factor affecting the Mexican spotted owlon this forest.

Western Yellow-Billed Cuckoo

A. Status of the species and proposed critical habitat within the action area

Although data are insufficient to determine population trends for this species within the action area, cuckoo surveys and incidental detection data provide evidence of occupancy and likely breeding. Yellow-billed cuckoo numbers are difficult to determine without intensive surveying and monitoring. The yellow-billed cuckoo survey protocol is designed to document presence/absence during the breeding season, but is not designed to determine the number of breeding cuckoos (Halterman *et al*. 2011, 2015). Additional visits would be needed to determine cuckoo home ranges, occupancy throughout the breeding season, and to observe cuckoo nesting behavior. Because cuckoos have a very short nesting cycle, a pair may not remain in the area for the entire breeding season. However, we can infer breeding from observed behavioral cues. These include vocalizations between individuals, copulation, carrying food repeatedly to the same location, and feeding fledglings. If cuckoos are detected on more than one of the four required surveys, breeding season occupancy is assumed (Halterman *et al*. 2015).

Presence in Coronado National Forest

In addition to gallery riparian forest and mesquite woodlands, yellow-billed cuckoos are also using more xeroriparian drainages in the foothills and mountains of southeastern Arizona. This kind of habitat is typical of habitat where cuckoos are found in Sonora, Mexico. The discovery of breeding season cuckoos throughout CNF is relatively new, and it is expected that additional drainages and locations will be found in future years. Cuckoos have been detected within or just outside the boundaries of the CNF during the breeding season in the following locations (Corman and Magill 2000, WestLand Resources, Inc. 2011, 2013a, 2013b, 2013c, 2015a, 2015b, 2015c; American Birding Association 2014; Tucson Audubon 2015; MacFarland and Horst 2015, 2016; AGFD 2016; Cornell Laboratory of Ornithology 2016):

- Prison Camp, upper Mt. Lemmon along Radio Ridge Road, Ventana Canyon, Bear Canyon, Peppersauce Canyon in the Santa Catalina Mountains;
- Sabino Canyon, Tanque Verde Wash (just downstream of forest boundary), Tanque Verde Ridge, Tanque Verde Peak, and Paige Creek in the Rincon Mountains;
- Florida Canyon, Madera Canyon, Gardner Canyon, Chino Canyon, Montosa Canyon, Casa Blanca Canyon, Kentucky Camp, Box Canyon, Walker Canyon, Josephine Canyon, Wasp Canyon, McCleary Canyon, and Barrel Canyons in the Santa Rita Mountains;
- Scotia, Bear, Ida, Copper, Hunter, Carr, Ash, Garden, Ramsey, Miller, Bear, and Copper canyons in the Huachuca Mountains;
- Turkey Creek, Vaughn Canyon, O'Donnell Creek, Collins Canyon, Lyle Canyon, Merritt Canyon, Cherry Creek, Dove Canyon, and Korn Canyon in Canelo Hills;
- Puerto Canyon, Rock Corral Canyon, Arivaca Lake and tributaries, Pena Blanca Lake and Canyon, Walker Canyon, Sierra Canyon, Coches Ridge, Sycamore Canyon, Oro Blanco Mine, and California Gulch in the Atascosa/Pajarito/Tumacacori Mountains;
- Sycamore Canyon, Corral Canyon, Hermosa Creek, Harshaw Canyon, Goldbaum Canyon, Willow Springs Canyon, Washington Gulch, Finley and Adams Canyon, Bog Hole, Alum Gulch, and Paymaster Spring in the Patagonia Mountains;
- Middle, French Joe, and Guindani canyons in the Whetstone Mountains; and

- Cave Creek and tributaries, Whitetail Canyon, Pinery Canyon, the towns of Portal and Paradise in the Chiricahua Mountains.

Yellow-billed cuckoos are likely breeding in these locations, with nesting confirmed in Paige Creek, Peppersauce Canyon, Box Canyon, Montosa Canyon, Gardner Canyon, town of Portal adjacent to Cave Creek, Montosa Canyon, Sycamore Canyon in the Atascosa/Pajarito Mountains, and Pena Blanca Lake (American Birding Association 2014; Tucson Audubon 2015; MacFarland and Horst 2015, 2016; Cornell Lab of Ornithology 2016).

In July and August 2015 Tucson Audubon, in a contract with CNF, conducted protocol surveys (Halterman *et al*. 2015) in 8 mountain ranges within the 'sky islands' of the CNF (MacFarland and Horst 2015). In July and August 2016 Tucson Audubon again surveyed five mountain ranges (MacFarland and Horst 2016) where suitable habitat exists, many with previous and subsequent cuckoo detections (Cornell Lab of Ornithology 2016). Yellow-billed cuckoos were identified on seven of the eight units which included Nogales, Santa Catalina, Sierra Vista Ranger, and Douglas Ranger Districts. Survey locations and results (MacFarland and Horst 2015, 2016) included:

- Sabino Canyon, Tanque Verde Canyon, Pima Canyon, Ventana Canyon, Molino Creek, Bear Canyon, the Butterfly Trail and Sycamore Reservoir with negative results, and a pair on the north side in Peppersauce Campground proves positive results in the Santa Catalinas;
- Montosa Canyon, Proctor Creek, Florida Canyon, and Box Canyon with positive results in the Santa Rita Mountains;
- Finley Canyon, Adams Canyon, Paymaster Creek, Washington Gulch and Sycamore Canyon with positive results in the Patagonia Mountains;
- Cave Creek and tributaries with negative results in the Chiricahua Mountains, although at least one nesting pair in the town of Portal adjacent to Cave Creek;
- Miller Canyon and Hunter Canyon with positive results, and Ramsey Canyon and Carr Canyon with negative results in the Huachuca Mountains;
- French Joe Canyon and Guindani Canyon with positive results, and Dry Canyon and Middle Canyon with negative results in the Whetstone Mountains;
- Rock Corral Canyon, Sycamore Canyon, Pena Blanca Canyon, Pena Blanca Lake, and Arivaca Lake with positive results in the Pajarito/Atascosa/Tumacacori mountains; and
- Collins Canyon, Lyle Canyon, Korn Canyon and Merritt Canyon with positive results, and Sunnyside Canyon and Scotia Canyon with negative results in the Canelo Hills.
- Cherry Creek, and Dove Canyon with positive results, and Alamo Canyon with negative results in the Canelo Hills.
- Bear Canyon and Copper Canyon with positive results, and Ida Canyon with negative results in the Huachuca Mountains.
- Paige Creek North (downstream and upstream) with positive results, and Turkey Creek, Happy Valley Road, Ash Creek, and Miller Canyon with negative results in the Rincon Mountains.

Yellow-billed cuckoo protocol surveys (Halterman *et al.* 2011, 2015) were conducted during the breeding season in 2013, 2014, and 2015 in habitat within the proposed Rosemont Copper Mine perimeter fence (WestLand Resources, Inc. 2015a, 2015b, 2015c). Surveys indicate likely breeding in upper and lower Barrel Canyon based on repeated cuckoo detections during the breeding season in two years as well as evidence of pairs. Cuckoos are also using McCleary Canyon during the breeding season, based on detections during two surveys in 2015.

Yellow-billed cuckoos have been observed incidentally in the Pajarito/Atascosa Mountains in Sierra Canyon, Coches Ridge, Sycamore Canyon, and Fresnal Wash, in the Huachuca Mountains in Miller Canyon, Carr Canyon, Ash Canyon, and Hunter Canyon, in the Canelo Hills in Lyle Canyon, Vaughn Canyon, Korn Canyon, Collins Canyon, and Parker Canyon Lake, in the Chiricahuas in Cave Creek Canyon, in the Catalinas in Sabino Canyon, Ventana Canyon, Bear Canyon and Peppersauce Canyon, and in the Santa Ritas in Gardner Canyon, Montosa Canyon, Cave Canyon, Aliso Spring and Chino Canyon (AGFD 2016, Cornell Lab of Ornithology 2016 eBird data).

Yellow-billed cuckoos have been observed in Box Canyon during the breeding season in multiple years (Cornell Lab of Ornithology 2016, MacFarland and Horst 2015, 2016). Tucson Audubon detected cuckoos on 3 surveys in 2015, including the observation of a cuckoo carrying food (MacFarland and Horst 2015). Cuckoos were observed carrying food in 2013 and are often seen flying across Box Canyon Road (D. Sebesta, pers. comm. 2014). Other observations of cuckoos in Box Canyon have been reported by birders during the breeding season in more than one year (Cornell Lab of Ornithology 2016).

Yellow-billed cuckoos have been detected during the breeding season in Gardner Canyon, south of the proposed Rosemont mine, but this area has never been surveyed (AGFD 2015, Cornell Lab of Ornithology 2016). Yellow-billed cuckoos have been reported by birders during the breeding season 2 miles upstream from the confluence with Cienega Creek near artificial ponds and near the confluence of Sawmill Canyon, approximately 9 miles from the confluence with Cienega Creek (Cornell Lab of Ornithology 2016). Habitat within Gardner Canyon is patchy, but suitable habitat exists.

<u>Habitat Descriptions within Coronado National Forest</u>

Information below describes site specific habitat descriptions for known occupied locations within CNF:

Florida Wash; Pima County
This location provides a movement corridor between larger habitat patches. Overstory is primarily oak, hackberry, and mesquite, with some sycamore, ocotillo (*Fouquieria splendens*), and juniper (MacFarland and Horst 2015), with midstory consisting of coral bean, Arizona cotton, mesquite, desert broom (*Baccharis sarothroides*), catclaw acacia (*Senegalia greggi*), and skunkbush sumac (*Rhus trilobata*). Florida Wash is within the Santa Rita Mountains Important Bird Area (National Audubon Society 2016), providing habitat for the Sierra Madrean Occidental "sky island" bird community in Arizona. The Santa Rita Mountains IBA contains a number Species of Conservation Status of the Sierra Madre bird community that extends far south into central Mexico.

Huachuca Mountains: Huachuca Canyon; Cochise County
Western yellow-billed cuckoos have been detected in multiple years during the breeding season in Huachuca Canyon (Cornell Lab of Ornithology 2016). This location provides a movement

corridor and stop-over location to habitat farther north. The Huachuca Mountains are within the Huachuca Mountains IBA (National Audubon Society 2016). The Huachuca Mountains along with the Chiricahua Mountains, host the greatest diversity of Sierra Madrean neotropical birds in the United States. The highest elevations are mixed conifer forests dominated by Chihuahua pine, with lower slopes being occupied by Madrean evergreen woodland and savannahs. The riparian canyons are populated with large sycamore, ash, walnut, willow and alder trees mixed with Chihuahua pine (*Pinus leiophyllus*), apache pine (*Pinus englemannii*), alligator juniper (*Juniperus deppeanna*), and oak. Higher on canyon sides are oaks, junipers, and Mexican pinion pines (*Pinus cembroides*). Streambeds have perennial, seasonal, or intermittent water.

Huachuca Mountains: Ramsey, Carr, and Miller Canyons; Cochise County
Western yellow-billed cuckoos have been documented during the breeding season in previous years in Ramsey, Carr, and Miller canyons (Cornell Lab of Ornithology 2016). Overstory in these canyons consists primarily of mesquite or oak, with juniper, sycamore, pine, and madrone (MacFarland and Horst 2015), with midstory of manzanita, oak, skunkbush, juniper, maple, Arizona grape (Vitis arizonica), barberry, and desert broom. Understory includes cane beardgrass (*Polypogon* sp.), deergrass (*Muhlenbergia rigens*), sacaton (*Sporobolus* sp.), sideoats gramma, and Lehman's lovegrass (*Eragrostis lehmanniana*).

Huachuca Mountains: Bear and Copper Canyons; Cochise County
The habitat within these canyons consists of a lush drainage in Bear Canyon and trees of moderate size in Copper Canyon (MacFarland and Horst 2016).

Atascosa-Pajarito Mountains: California Gulch; Santa Cruz County
California Gulch is an Arizona Important Bird Area, with western yellow-billed cuckoos identified as one of the breeding birds (National Audubon Society 2016). The canyon is unique with its dense shrub layer on its steep sides, and a perennial spring-fed stream draining into Mexico (National Audubon Society 2016). The habitat consists of Sonoran desert scrub, Madrean evergreen woodland, semi-desert grassland, and low-elevation riparian.

Atascosa-Pajarito Mountains: Sycamore Canyon; Santa Cruz County
Sycamore Canyon is within the Sycamore Canyon/Pajarito Mountains Important Bird Area. The site also provides a movement corridor and stop-over location to habitat farther north. The canyon is relatively narrow with intermittent drainage and scattered permanent pools (National Audubon Society 2016). The drainage that flows through this canyon is lined with large trees of several species including several large Arizona cypress trees. Overstory includes ash, cottonwood, walnut, willow, juniper, oak, and mesquite (MacFarland and Horst 2015). Midstory includes seep willow (*Baccharis salicifolia*), mesquite, Arizona cypress (*Cupressus arizonica*), willow, and Arizona grape. Scattered sycamore trees also occur within this drainage (National Audubon Society 2016).

Santa Rita Mountains: Madera Canyon; Pima County
Madera Canyon is within the Santa Rita Mountains Important Bird Area (National Audubon Society 2016). Overstory in upper Madera Canyon is primarily large oaks and sycamores. Lower Madera Canyon consisting of primarily mesquite, with cottonwood, oak, hackberry, sycamore, and juniper, with midstory being is mesquite, oak, greythorn (*Ziziphus obtusifolia*), and hackberry (MacFarland and Horst 2015). Understory in occupied habitat in lower Madera

Canyon includes bunchgrasses and poison ivy (*Toxicodendron* sp.) ((MacFarland and Horst 2015).

Santa Rita Mountains: Montosa Canyon; Santa Cruz County
The site also provides a movement corridor and stop-over location to habitat farther north. This canyon contains dense vegetation along the creek that flows through the canyon and the sloping vegetated canyon walls provide additional foraging opportunities (MacFarland and Horst 2015). Overstory is primarily mesquite and oak, with hackberry, with some sycamore and catclaw acacia (MacFarland and Horst 2015). Midstory is primarily mesquite, desert broom, hackberry, desert cotton (*Gossypium thurberi*), Arizona ash, and skunkbush sumac (MacFarland and Horst 2015). Native understory in occupied habitat consists of sideoats gramma, bunchgrass, desert cotton, and *Asteracea* sp. (MacFarland and Horst 2015). Non-native vegetation includes Bermuda grass and Lehman's lovegrass. Montosa Canyon is within the Santa Rita Mountains Important Bird Area (National Audubon Society 2016), providing habitat for the Sierra Madrean Occidental "sky island" bird community in Arizona.

Patagonia Mountains: Harshaw Creek Complex, Santa Cruz County
Western yellow-billed cuckoos were largely associated with oak, juniper, and scattered sycamore vegetation along drainages, but they were also detected in upland areas dominated by nonriparian associated shrubs and oak trees (WestLand Resources, Inc. 2013a).

Canelo Hills: O'Donnell Canyon/Turkey Creek, Santa Cruz County
Canelo Hills are partly within the Appleton-Whittell Research Ranch IBA, located in a broad semi-desert grassland. The Canelo Hills are a long low ridge of rounded hills extending about 20 miles from northeast to southwest. Western yellow-billed cuckoos occupy the trees bordering creeks and cienega wetlands (Corman and Magill 2000, Cornell Lab of Ornithology 2016). O'Donnell and Turkey creeks are known for their unique cienegas (desert wetland that forms where a spring spreads out and flows slowly creating a broad marsh). These hills connect to other mountain ranges where western yellow-billed cuckoos are found during the breeding season: the Santa Rita Mountains to the northwest, Patagonia Mountains to the southwest and Huachuca Mountains to the southeast. The site also provides a movement corridor and stop-over location to habitat farther north.

Habitat consists of Madrean evergreen woodland and semidesert grassland (Brown 1994). Overstory consists of oak, juniper, sycamore, pine, ash, and mesquite (MacFarland and Horst 2015). Understory species include oak, juniper, manzanita, seep willow, catclaw acacia, Arizona grape, skunkbush sumac, ash, and mesquite (MacFarland and Horst 2015). The northern part of this area is semi-desert grassland with sparsely scattered trees in the drainages and the hillsides. The overstory is mainly large oak trees, although a small number of cottonwood is present; the understory is primarily oak, mesquite, and desert willow (Leonardini 2015).

Canelo Hills: Cherry Creek/Dove Canyon, Santa Cruz County
These areas have excellent yellow-billed cuckoo habitat with areas of standing water/intermittent flowing water and very large trees, along with native vegetation of the drainage. Excellent prey base with a thriving insect community for yellow-billed cuckoos was noted (MacFarland and Horst 2016).

Atascosa Mountains: Arivaca Lake, Pima County
Some FS land in tributaries from Arivaca Lake supports cuckoos. This location provides a movement corridor and stop-over location to habitat farther north. The overstory vegetation is composed of primarily mesquite, with willow, cottonwood, ash, hackberry, and oak (MacFarland and Horst 2015), with midstory consisting of mesquite, ash, hackberry, desert broom, catclaw acacia, and honeysuckle (*Lonicera* sp.) (MacFarland and Horst 2015). Understory consists of tall grass, forbs, and wildflowers (MacFarland and Horst 2015). Non-native Johnson grass is also present.

Santa Catalina Mountains: Peppersauce Canyon, Pinal County
Dominant overstory consists of oak, sycamore, cottonwood, mesquite, walnut, and ocotillo, with midstory consisting of catclaw acacia, mesquite, Arizona grape, prickly pear, and hackberry (MacFarland and Horst 2015). Understory consists of Bermuda grass (MacFarland and Horst 2015).

Atascosa-Pajarito Mountains: Pena Blanca Canyon, Santa Cruz County
Overstory is primarily oak and willow, with small amounts of juniper and ash (MacFarland and Horst 2015). Midstory is composed of willow, cattails, and hackberry and understory of tall grass, forbs, wildflowers, and woody stems are present (MacFarland and Horst 2015). Non-native species include Bermuda grass and tamarisk.

Santa Rita Mountains: Box Canyon, Pima County
Overstory habitat is primarily mesquite, ash, ocotillo, willow, oak, sycamore, and hackberry, juniper, with midstory consisting of desert cotton, walnut, coursetia (*Coursetia* sp.), mesquite, *Cercocarpus* sp., and sotol (*Dasylirion wheeleri*) (MacFarland and Horst 2015). Understory habitat includes, sideoats gramma, brickellia (*Brickellia* sp.), non-native Bermuda grass, Lehman's lovegrass, Johnson grass, and cocklebur (*Xanthium* sp.) (MacFarland and Horst 2015).

Tumacacori Mountains: Rock Corral Canyon, Santa Cruz County
This canyon is part of the Tumacacori Mountains, with high bird and plant diversity (MacFarland and Horst 2015). The site also provides a movement corridor and stop-over location to habitat farther north. The canyon vegetation was dense and green during the 2015 wet summer months (MacFarland and Horst 2015). Overstory vegetation is primarily mesquite, with some oak and cottonwood. Midstory is primarily mesquite, oak, and wolfberry (*Lycium* sp.) (MacFarland and Horst 2015).

Canelo Hills: Lyle Canyon, Santa Cruz and Cochise Counties
The site provides a movement corridor and stop-over location to habitat farther north. Occupied overstory habitat is dominated by oak and juniper, with some sycamore, ash, pinion pine, and walnut. Midstory is composed of juniper, pine, manzanita, skunkbush sumac (*Rhus trilobata*) and oak. Understory in occupied habitat is composed of bunchgrass, skunkbush sumac, juniper, and *Aristida* sp. (MacFarland and Horst 2015).

Canelo Hills: Parker Canyon Lake, Cochise County
The main drainage of Collins Canyon contains a high density of vegetation, with flowing water. The portion of Collins Canyon where western yellow-billed cuckoos were detected was on the west side along a tributary drainage with large oak and juniper trees (MacFarland and Horst 2015). This canyon is also notable for the complete lack of mesquite trees. Dominant overstory

consists of juniper and oak, with ash, pine, cottonwood, and walnut (MacFarland and Horst 2015). Dominant midstory consists of skunkbush sumac, deer grass, kidneywood (*Eysenhardtia texana),* manzanita, seepwillow, oak, and juniper (MacFarland and Horst 2015), with understory consisting of sprangletop (*Lepochloa dubia*), spike dropseed (*Sporobolus contractus*), and bee balm (*Monarda fistulosa*) (MacFarland and Horst 2015). Merritt Canyon, north of Parker Canyon Lake, is a shallow and wide drainage with large trees and flowing water (MacFarland and Horst 2015).

Santa Rita Mountains: Barrel, McCleary, and Wasp Canyons, Pima County
Given that western yellow-billed cuckoos have large home ranges, more than one canyon may occur within an individual's home range. The site also provides a movement corridor and stop over location to habitat farther north. Vegetation associated with these canyons includes Emory oak (*Quercus emoryi*), Arizona white oak (*Q. arizonica*), velvet mesquite, and desert willow, with an occasional Arizona sycamore, Arizona walnut and Goodding's willow and alligator juniper (WestLand Resources, Inc. 2015a, 2015b, 2015c).

Santa Rita Mountains: Gardner Canyon and Cave Creek; Santa Cruz County
The site provides a movement corridor and stop-over location to habitat farther north. This unit contains areas of riparian and Madrean evergreen woodland vegetation that are suitable as western yellow-billed cuckoo breeding habitat and connected areas of riparian and Madrean evergreen woodland vegetation that are suitable as foraging habitat. Habitat in Gardner Canyon is Madrean evergreen woodland with oak, desert willow, mesquite, and juniper. The drainage is intermittent with monsoonal rains (AGFD 2016).

Santa Catalina Mountains: Sabino Canyon; Pima County
Sabino Canyon is within the Tanque Verde Wash/Sabino Canyon IBA (National Audubon Society 2016). Upper Sabino Canyon in the CNF is a narrow riparian area in a deep canyon at the southern base of the Santa Catalina Mountains. The perennial stream is bordered by willow, cottonwood, ash, and sycamore. Tree species include Goodding's willow, cottonwood, velvet ash, and velvet mesquite, and an occasional sycamore and netleaf hackberry (AGFD 2016). Habitat is particularly wide where lower Bear Creek flows into Sabino Creek from the northeast. Tanque Verde Wash has not been channelized and is lined with native vegetation. In some areas, the wash is lined with rare large patches of mesquite bosque and large cottonwoods can be found along the wash, supported by high ground water levels. This area provides a wonderful habitat resource for native riparian birds and an oasis for migratory birds along with other wildlife and also acts as a corridor for wildlife to move through Tucson. Significant housing developments abut the lower stretches.

Rincon Mountains: Tanque Verde Wash; Pima County
Tanque Verde Wash is in eastern Tucson and is flanked by small agriculture and properties, golf courses, resorts, and housing developments. The wide wash remains intact and is bordered by native vegetation of mature cottonwood, willow, mesquite, ash, and hackberry. Mesquite borders the riparian vegetation. Large cottonwoods can be found along the wash, supported by high ground water levels. The native vegetation is especially intact on the eastern end of the wash (S. Sferra, pers. comm.).

Rincon Mountains: Paige Creek; Pima County
The lower portion of Paige Creek consists of flowing water, contiguous riparian habiat, and a combination of tall trees and thick mid-story providing quality habitat for the cuckoo. The upstream portion of Paige Creek consists of tall trees, surface water, and lush mid-story vegetation. The cuckoo habitat in this portion of Paige Creek is narrow along the creek corridor (MacFarland and Horst 2016).

Chiricahua Mountains: Cave Creek; Cochise County
Cave Creek is a riparian corridor in the Chiricahua Mountains within CNF. Adjacent habitat is semi-desert grassland, Chihuahuan desert scrub, and Madrean evergreen woodland (National Audubon Society 2016). Habitat in Cave Creek and the South Fork of Cave Creek is a varied mixture of sycamore, juniper, oak, walnut, willow, ponderosa pine, Douglas fir, mesquite, and acacia (MacFarland and Horst 2015). Cave Creek lies within the Chiricahua Mountains Important Bird Area. The Chiricahua Mountains along with the Huachuca Mountains, host the greatest diversity of Sierra Madrean neo-tropical birds in the United States.

Patagonia Mountains: Sycamore Canyon; Cochise County
Sycamore canyon is a well-vegetated riparian corridor in Madrean evergreen woodland in the Patagonia Mountains in CNF. Dominant overstory is primarily oak, ash, cottonwood, and mesquite and dominant midstory is mesquite, baccharis, ash, mimosa, grape, and skunkbush (*Rhus trilobata*) (MacFarland and Horst 2015).

Patagonia Mountains: Paymaster Creek; Cochise County
Paymaster Creek is a riparian corridor in Madrean evergreen woodland in the Patagonia Mountains in the CNF. Oak, juniper, and some pine are the most dominant tree species where occupied habitat occurs (MacFarland and Horst 2015). Juniper, manzanita, and oak are the most dominant midstory vegetation (MacFarland and Horst 2015).

Patagonia Mountains: Washington Gulch; Cochise County
Washington Gulch is a riparian corridor in Madrean evergreen woodland in the Patagonia Mountains in the CNF. This drainage contains an overstory of large oak trees, with some juniper and a midstory of manzanita and juniper (MacFarland and Horst 2015).

<u>Habitat Descriptions adjacent to Coronado National Forest within action area</u>

Information below describes site specific habitat descriptions for known occupied western yellow-billed cuckoo locations adjacent to CNF within action area:

Upper San Pedro River; Cochise County
Upper San Pedro River provides a movement corridor and migratory stop-over habitat for western yellow-billed cuckoos moving farther north. Cuckoos have been found nesting in mesquite woodland as far away as 0.3 miles from the adjacent upper San Pedro River (Halterman 2006, p. 31). This unit has one of the largest remaining breeding groups of the western yellow-billed cuckoo and contains a large number of breeding pairs. Much of this habitat consists of large, mature mesquite trees. Altered hydrology has contributed to the establishment of tamarisk. Tamarisk may provide habitat for the western yellow-billed cuckoo, although it is not as desirable as native habitat. This area lies within the San Pedro Riparian National

Conservation Area and the San Pedro Riparian National Conservation Area Important Bird Area (National Audubon Society 2016).

Sonoita Creek; Santa Cruz County
Sonoita Creek provides a movement corridor and migratory stop-over habitat for western yellow-billed cuckoos. The perennial flow in Sonoita Creek supports a diverse gallery of cottonwood and Goodding's willow forest that includes walnut, mesquite, ash, hackberry, and various willow species (National Audubon Society 2016). The Patagonia-Sonoita Creek Nature Conservancy Preserve Important Bird Area lies within this region (National Audubon Society 2016).

Upper Cienega Creek; Pima County
This area provides a movement corridor and migratory stop-over habitat for western yellow-billed cuckoos. This unit includes habitat considered essential for the western yellow-billed cuckoo.

Santa Cruz River, Santa Cruz County
Some portions of this area are considered disturbed and may not contain essential habitat needed for the species. However, western yellow-billed cuckoos are still using some of the disturbed habitat, including golf course properties. The Santa Cruz River provides a movement corridor and migratory stop-over habitat for western yellow-billed cuckoos nesting farther north. Altered hydrology has contributed to the establishment of tamarisk. Tamarisk may provide habitat for the western yellow-billed cuckoo, although it is not as desirable as native habitat. This area is within the Upper Santa Cruz Important Bird Area (National Audubon Society 2016).

Black Draw; Cochise County
Black Draw and surrounding area provides a movement corridor and migratory stop-over habitat for western yellow-billed cuckoos. Occupied habitat is primarily cottonwood, Goodding's willow, and some mesquite (Cajero 2016, entire).

Arivaca Wash and San Luis Wash; Pima County
This area provides a movement corridor and migratory stop-over habitat for western yellow-billed cuckoos. Western yellow-billed cuckoo habitat within the area includes suitable breeding habitat in mesquite woodland and Madrean evergreen woodland, sometimes far from mesic drainages, as well as cottonwood and willow riparian forest and woodland vegetation, sometimes with ash, hackberry, mesquite and a dense shrub understory (Griffin 2015, Cornell Lab of Ornithology 2016). This area lies within the Arivaca Cienega and Creek IBA on the Buenos Aires National Wildlife Refuge (National Audubon Society 2016).

Babocomari River, Cochise and Santa Cruz Counties
The area provides a movement corridor and stop-over location to habitat farther north. The Babocomari River contains the essential habitat features necessary for the conservation of the species, including areas of riparian vegetation and connected areas of riparian vegetation that are suitable as foraging habitat.

San Rafael Valley and Upper Santa Cruz River; Santa Cruz County
The San Rafael Valley extends over 90,000 acres and lies at the headwaters of the Santa Cruz River between the Patagonia Mountains, Huachuca Mountains, and the Canelo Hills. Marshy springs feed the river and the floodplain that includes several swampy stretches, containing

stands of cottonwoods. San Rafael Valley is an intact landscape, unfragmented and relatively undisturbed from the mountain ridges down to the valley bottom. The valley represents one of the best stands of native grassland in the Arizona. This unit is within the San Rafael Grasslands Important Bird Area (National Audubon Society 2016). The area also serves as a movement corridor and stop-over location to habitat farther north. This area contains riparian vegetation that is suitable as breeding habitat and connected areas of riparian vegetation suitable as foraging habitat, consisting of rolling hills, native grasses, and oak and cottonwood trees (National Audubon Society 2016).

Guadalupe Canyon; Cochise County
Guadalupe Canyon is in the southern Peloncillo Mountains in extreme southeastern Arizona. The area provides a movement corridor and stop-over location to habitat farther north. This area contains areas of riparian and Madrean evergreen woodland vegetation that are suitable as western yellow-billed cuckoo breeding habitat and connected areas of riparian and Madrean evergreen woodland vegetation that are suitable as foraging habitat. Habitat consists primarily of Madrean evergreen woodland, dominated by oak and grassland, with xeroriparian habitat in the drainages (BLM 2016).

Garden Canyon; Cochise County
Garden Canyon provides a movement corridor and stop-over location to habitat farther north. Garden Canyon includes areas of riparian and Madrean evergreen woodland vegetation that are suitable as western yellow-billed cuckoo breeding habitat and connected areas of riparian and Madrean evergreen woodland vegetation that are suitable as foraging habitat. Habitat is Madrean evergreen woodland with a mixture of cottonwood, willow, oak, desert willow, madrone, juniper, cypress, walnut, ash, big-toothed maple, pine, and fir (Stallcup 1991).

Critical Habitat

Within Cochise, Graham, Pima, Pinal and Santa Cruz Counties, Arizona, critical habitat has been proposed along Cienega Creek and Empire Gulch, Florida Canyon, lower San Pedro and Gila Rivers, upper San Pedro River, Hooker Hot Springs, Penitas Wash, Arivaca Wash and San Luis Wash, Santa Cruz River, Aravaipa Creek and Sonoita Creek (Table YBC-1). Florida Wash, Unit 45, is the only critical habitat unit proposed within the CNF. Proposed critical habitat unit 45 (AZ-37 Florida Wash) is 188 acres in extent and is a 4-miles-long segment in Pima County. Proposed critical habitat is under revision.

There are 66,475 acres of proposed critical habitat for the western yellow-billed cuckoo in the action area: 21,786 acres in unit 26, 375 acres in unit 27, 23,300 acres in unit 28, 5,765 acres in unit 31, 1,610 acres in unit 32, 5,204 acres in unit 33, 3,689 acres in unit 34, 890 acres in unit 35, 2,360 acres in unit 38, 1,209 acres in unit 41, and 188 acres in unit 45 (USFWS 2014a). The amount of proposed critical habitat in the action area is 12.2 percent of total proposed cuckoo critical habitat range-wide.

B. Factors affecting the species and proposed critical habitat within the action area

Actions on and off the CNF have influenced the condition of cuckoo habitat and their population distribution and abundance within the forest. Actions such as water diversion, groundwater pumping, habitat clearing, flood control, urban/agricultural development, dam building, and dam operations have changed surface and subsurface stream flows, and in combination with historical and current land uses such as livestock grazing, road developments, heavy off-road vehicle use, recreation, and mining have altered the quality distribution, abundance and longevity or riparian and Madrean evergreen woodland vegetation (USFWS 2002).

The primary factors affecting the yellow-billed cuckoo include effects resulting from municipal and rural development, livestock grazing, irrigated agriculture, recreation, and mining.

Sonoran Tiger Salamander

A. Status of the species within the action area

The status of the species within the action area is virtually identical to the status of the species across its range. Sonoran tiger salamander (*Ambystoma mavortium stebbinsi*) populations occupy stock ponds and ephemeral waters adjacent to drinkers on the CNF and private lands downstream of CNF, and are also known to occur at drinkers near areas of water leakage from the drinker and pipelines. Sonoran tiger salamander populations are not known to occur in any other types of aquatic habitats on the CNF, such as the drainages downstream of Parker Canyon Lake and Peterson Ranch Pond in Scotia Canyon. However, an unknown salamander was captured on private lands in the Santa Cruz River in 2014 (D. Duncan, pers. comm. 2014). CNF lands encompass about 73% of the range of the Sonoran tiger salamander in the US, all of which is within the Huachuca Ecosystem Management Area of the Sierra Vista Ranger District. The remaining range of the species in the US is surrounded by and downstream of the CNF. Approximately 80% of the sites with salamander records from 2004 to 2013 are located on the CNF (Hossack *et al*. 2016). Use of terrestrial habitat by metamorphosed adults is unknown throughout the range of the species.

B. Factors affecting the species within the action area

The range-wide threats addressed above are all applicable in the action area. The Sonoran tiger salamander has primarily been affected by loss and degradation of aquatic and cienega habitats as a result of dewatering and poorly managed of livestock grazing, predation by introduced non-native predators, and the potential for introgression with the barred tiger salamander.

The majority of lands occupied by the Sonoran tiger salamander are currently within FS livestock grazing allotments or on private lands that are grazed. A sustainable grazing system in these areas will "insure renewal of desired vegetative species for livestock forage, big and small game habitat, and to improve soil and water resources." These activities cannot supersede Forest-wide Standards and Guidelines which give preference to riparian-dependent resources and federally-listed species.

FS allotments within the San Rafael Valley and surrounding areas, shall comply with the "Stockpond Management and Maintenance Plan for the Sonoran Tiger Salamander" as part of their plan of operations under the guidance of the LRMP (USFS 2013). This is more specifically considered in relation to domestic livestock grazing where Standards and Guidelines should "maintain and restore riparian ecosystems."

Most of the FS allotments are largely in federal ownership (remaining lands are privately owned). Thus, management of grazing on most of the private inholdings within the allotments is likely affected by how the public lands are grazed, and as a result, grazing on the private lands within the allotments are likely interrelated and interdependent to grazing on the public lands. According to the definition of the “effects of the action” (which includes effects of interrelated and interdependent activities – 50 CFR 402.02), effects of grazing on both public and private portions of the FS allotments are considered herein as effects of the action.

The effects of grazing activities on the salamander has been the subject of several previous consultations and a conference, including: 1) August 14, 1995, letter from the FWS concurring that construction of 2.8 miles of electric fence on the San Rafael allotment is not likely to jeopardize the continued existence of the Sonoran tiger salamander (a conference, file 2-21-95-I-383); 2) September 18, 1995, letter from the FWS concurring that issuance of grazing permits on the Duquesne and Campini allotments are not likely to jeopardize the continued existence of the salamander (a conference, file 2-2-95-I-412); 3) June 17, 1997, concurrence that sediment removal from two tanks on the Lone Mountain allotment may affect, but is unlikely to adversely affect the salamander (file 2-21-97-I-296); 4) December 19, 1997, BO on Land and Resource Management Plans, as amended, for Eleven NFs and NGs in the Southwestern Region (U.S. Fish and Wildlife Service 1997b); 5) July 29, 1999, BO on the Coronado National Forest’s Ongoing and Longterm Grazing (U.S. Fish and Wildlife Service 1999a); 6) October 24, 2002, BO on the Continuation of Livestock Grazing (U.S. Fish and Wildlife Service 2002b); 7) January 7, 2005, BO on 10-year allotment management plans for Duquesne, Hayfield, and Lochiel Allotments; 8) May 11, 2006, BO on 10-year allotment management plans for HQ, Campini, and Blacktail grazing allotments; 9) January 14, 2009, BO for Peterson Ranch pond maintenance project in the Huachuca Mountains (file 22410-2009-F-0108); and 10) April 30, 2012, BO for the continued implementation of the LRMP for the CNF.

The December 19, 1997 and April 30, 2012 BOs addressed grazing at a plan level. The 1999 and 2002 opinions addressed grazing to the project level in batch consultations. And the 2005, 2006 and 2009 opinions addressed project level allotments and actions. All found that grazing and other activities proposed were not likely to jeopardize the continued existence of the salamander. The opinions provided several terms and conditions to minimize take, including detailed protocols on how to manage and maintain stock tanks where the salamander may occur. Salamander breeding occurs in livestock tanks, most of which are in FS allotments. These tanks require periodic maintenance to remain viable as both salamander breeding sites and as functional livestock waters. Thus, the survival of the salamander is currently intertwined with that of the CNF’s grazing program, and depends on management and periodic maintenance of livestock waters.

Prescribed fire across the Southwest has seen an increasing trend since the wildland urban interface initiative in 2000. On the CNF, which has a moderate to large prescribed fire program, hazardous fuels treatments annually average 8,600 acres (128,624 acres since 2003). While the FWS is not aware of any studies that evaluated the effects of fire on salamanders, fire could potentially result in direct death or injury of salamanders, and reduced habitat quality or quantity.

Degradation of watershed condition immediately after fires can result in dramatically increased runoff, sedimentation, and debris flow that can scour aquatic habitats in canyon bottoms or bury them in debris (DeBano and Neary 1996) and ash. In degraded watersheds, less precipitation is captured and stored, impacting perennial streams downstream, which may become ephemeral during dry seasons or drought (Rinne and Neary 1996). Fire could result in degradation of the immediate watershed around a pond, and result in erosion, sedimentation, and ash flow into the pond. Although effects on salamanders are unknown, in salmonid fish, ash and slurry flow into streams can be toxic and populations of macroinvertebrates (salamander prey species) can be drastically reduced after a fire (Rinne 1996), at least temporarily (Roby and Azuma 1995). Smoke diffusion into water and ash flow can result in high levels of phosphorus and nitrogen (Spencer and Hauer 1991) with unknown effects to salamanders.

Siltation of a pond due to erosion and runoff following a fire could virtually eliminate habitat. However, the effects of siltation may also be more subtle. Lefcort *et al.* (1997) examined the effects of silt on growth and metamorphosis of larval mole salamanders (*Ambystoma opaceum*) and *A. tigrinum tigrinum*. Salamanders in silty water grew more slowly, metamorphosed sooner, and were more susceptible to infection by a water mold (*Saprolegnia parasitica*) than salamanders in non-silty water.

Erosion and increased runoff could bury or flood burrows, burrow entrances, rock shelters, or other cover sites. Fire may also reduce surface cover such as logs and debris, resulting in reduced invertebrate populations and reduced prey densities for salamanders (USFWS 1999b). Reduced cover may also result in heating and dessication of moist cover sites that salamanders require.

Grazing immediately after a fire can retard recovery of grasses and other plants, and facilitate erosion of slopes through hoof action and reduced vegetation cover. Erosion in the watersheds of occupied breeding sites could contribute to sedimentation or erosion of tanks and loss of habitat. Dan Robinett (Natural Resource Conservation Service, Tucson, Arizona) recommends resting burned sites above 4,000 feet from grazing for a period of two years to facilitate recovery (USFWS 1999b). In line with these recommendations, the CNF proposed resting the burned areas in the Maverick Prescribed Fire, Peloncillo Mountains, for two growing seasons (July, August, and September) following the fire.

If aquatic populations of salamanders are eliminated due to disease, ash flow, increased turbidity, or collection, but the habitat remains suitable (i.e. the tank is not silted in or eroded away, and fish are not introduced), the tank is likely to be recolonized by terrestrial salamanders. As a result, effects of the action that result in destruction of breeding sites or introduction of non-native predators are much more serious to the viability of the species than death or injury of individuals.

Chiricahua Leopard Frog

A. Status of the species and critical habitat within the action area

The CNF occurs in four of the eight Recovery Units (RUs) identified in the Chiricahua leopard frog recovery plan.

Recovery Unit 1 has three breeding populations (Tumacacori-Atascosa-Pajarito Mountains, Arizona and Mexico) on the CNF. Sycamore Canyon is the only significant site with moving water in RU 1 to support breeding frogs. Most other sites are livestock tanks or impounded springs. The Sycamore Canyon site which includes the Bear Valley Ranch Tank, Rattlesnake Tank, and Atascosa Canyon downstream of Bear Valley Ranch were all occupied by frogs at the time of listing. Within Sycamore Canyon occupied tanks include the following: Yank Tank, North Mesa Tank, South Mesa Tank, and Bear Valley Ranch Tank. Bonita Tank and Mojonera Tank are considered occupied breeding sites. In wet years, Upper Turner Tank has been known to be occupied. Pena Blanca Lake/Spring and Associated Tanks is the third population area that includes Pena Blanca Lake, Pena Blanca Spring, Summit Reservoir, Tinker Tank, Thumb Butte Tank, and Coyote Tank. These sites were all occupied in 2009. Adult frogs and tadpoles were found in Pena Blanca Lake in 2009 and 2010, after the lake had been drained and then refilled, which eliminated the non-native predators. However, early in 2010, rainbow trout (*Oncorhynchus mykiss*) were restocked back into the lake by AGFD and they intend to reestablish warm water fishes as well. Three additional waters including Sierra Tank East, Sierra Tank West, and Sierra Well may have the potential to support breeding with habitat improvement.

In 2013, Chiricahua leopard frogs were observed at 18 sites, four of which were new sites due to natural dispersal and six that had documented breeding within the area (AGFD 2014). Although few frogs were tested for *Bd,* four out of five samples tested positive. Bullfrog removal efforts have been extremely successful in RU1 due to the efforts of Sky Island Alliance and University of Arizona. Bullfrog removal around Ruby have also proven to be effective (AGFD 2014).

During the 2014 survey season 89 surveys were conducted at 48 sites within Alamo-Peña Blanca-Peck Canyons Management Area & Pajarito Wilderness Management Area. Chiricahua leopard frogs were detected at 12 sites, with breeding detected at 6 sites. American bullfrogs (*Rana catesbeiana*) were detected at 7 sites (AGFD 2015). In 2015, Chiricahua leopard frog were detected at 10 sites of the 33 surveyed, with breeding observed at 5 sites. American bullfrogs were removed from 4 locations, including tanks east of Pena Blanca Lake, tanks near Arivaca Lake, Mineral Lake, and Noon Tank (AGFD 2016).

Recovery Unit 2 (Santa Rita-Huachuca-Ajos Bavispe, Arizona and Mexico) also contains several populations on the CNF. The Florida Canyon site was augmented with frogs from elsewhere in the Santa Rita Mountains in 2009. The site was enhanced in 2010, with the addition of a steel tank for breeding. The eastern slope of the Santa Rita Mountains is another population site which includes two metal troughs in Louisiana Gulch, Greaterville Tank, Los Posos Gulch Tank, and Granite Mountain Tank complex. The Granite Mountain Tank complex includes two impoundments and a well. All but Los Posos Gulch Tank are currently occupied breeding sites. More than 60 frogs were observed at Los Posos Gulch Tank in 2008 which was once thought to be a robust breeding site; however, it dried, and the frogs disappeared in 2009. Scotia Canyon is another population area where breeding habitat occurs at Peterson Ranch Pond and possibly at other perennial or nearly perennial pools. Frogs were reestablished in this canyon via a translocation in 2009; the last record of a frog in the canyon before that was 1986. A population of the Ramsey Canyon leopard frog was located at Carr Barn Pond. The CNF created and now maintains Carr Barn Pond consistent with the Ramsey Canyon (=Chiricahua) leopard frog conservation agreement, to which they are a signatory. This site was occupied in 2009, but the population has since been eliminated, probably by *Bd.* Brown and Ramsey Canyons have been intensively managed for the Ramsey Canyon (=Chiricahua) leopard frog since 1995. Places where frogs have bred and that still retain habitat needed for the leopard frog include Ramsey Canyon, Trout and Meadow Ponds on private lands owned by The Nature Conservancy, and the Ramsey Canyon Box; and in Brown Canyon, the Wild Duck Pond, House Pond, and the Brown Canyon Box.

In 2013 Chiricahua leopard frogs were detected at 14 sites with five sites showing signs of breeding, three of those sites were a result of natural dispersal. One of the natural dispersal sites was at the metal drinker at Tunnel Spring, which was the first sighting at this location in a number of years. Of five samples, none tested positive for *Bd*. Augmentation occurred at an unnamed tank between Hog and Fort canyons and at Bowman Tank which received toe-clipped frogs contributing to an immunogenetic study. A female Tarahumara frog was detected again in Gardner Canyon, which had originally dispersed from Big Casa Blanca Canyon (AGFD 2014).

Chiricahua leopard frogs were detected at seven sites with four showing evidence of breeding in the Huachuca Mountains / San Rafael Valley Area. Peterson Ranch Pond supports a robust breeding population. Beatty Guest Ranch habitat renovations are occurring because of negative impacts from the 2011 Monument Fire. In addition, Ramsey Canyon pond (the Nature Conservancy) didn't have die offs but post fire effects seems to be affecting the number of frogs in the upper reaches (AGFD 2014).

In the Santa Rita Mountains, bullfrog eradication efforts have been successful in the Empire Cienega Area in 2013, which could allow for future releases of Chiricahua leopard frogs to some locations. Surveys were conducted at 30 sites and Chiricahua leopard frogs were detected at 15 sites, with 5 breeding sites detected during 2014. In addition, non-native fish were removed from Sweetwater Dam. *Bd* die-offs at Gardner Canyon and Greaterville Tank were also reported. In the Empire Cienega Management Area Chiricahua leopard frogs were detected at 11 sites. Bullfrogs were eradicated from Cienega Creek and die-offs were observed in November at majority of ponds (AGFD 2015). In 2015, 37 sites were surveyed, with Chiricahua leopard frogs found at 13 sites. Perfect Tank (new site) was found to have Chiricahua leopard frog , while Chiricahua leopard frog appeared to be extirpated in West Tank. In addition, egg masses were put in Sweetwater Dam (new location) (AGFD 2016).

Thirty-three surveys were conducted at 17 sites in the Huachuca Mountains Management Area during 2014. Chiricahua leopard frogs were observed at 8 sites and breeding detected at 4 sites. Additionally, adult bullfrogs were removed from Peterson Ranch Pond in 2014 (AGFD 2015). In 2015, 39 locations were surveyed with 15 sites having Chiricahua leopard frog, of which 6 sites had breeding. American bullfrogs were found at 10 sites. Chiricahua leopard frogs were also released at 5 sites, 3 of which were new sites (Mud Springs, Antelope Tank and Bald Hill Tank) (AGFD 2016).

Recovery Unit 3 (Chiricahua Mountains-Malpai Borderlands-Sierra Madre, Arizona, New Mexico, and Mexico) includes the Peloncillo Mountains. Areas where frog populations occur or have occurred include Geronimo, Javelina, State Line, and Canoncito Ranch Tanks; Maverick Spring; and pools or ponds in the Cloverdale Cienega and along Cloverdale Creek below Canoncito Ranch Tank. Breeding occurs in State Line and Canoncito Ranch Tanks, and possibly other aquatic sites. In the Chiricahua Mountains, John Hands Pond (the type locality for the Chiricahua leopard frog) and a spring-fed pond at the Southwest Research Station are managed for frog recovery. However, no frogs have been observed at the site since 1977.

In 2014, 42 surveys were conducted at 15 sites in Northern Chiricahua Mountains Management Area, with Chiricahua leopard frogs detected at 6 sites (5 SHAs) and breeding detected at 4 sites. Release of Chiricahua leopard frogs occurred at 1 site (Cave Creek Ranch SHA) (AGFD 2015). In 2015, 28 sites were surveyed in the North and South Chiricahua Mountains Management

Areas. Only nine sites (seven breeding) were found to have Chiricahua leopard frogs in the north unit (AGFD 2016).

Peloncillo Mountains Ecosystem Management Area had 4 surveys at 2 sites in Arizona, with Chiricahua leopard frogs detected at 1 site. Three surveys were conducted at sites in New Mexico with Chiricahua leopard frogs and breeding detected at 1 site in 2014 (AGFD 2015). No Chiricahua leopard frogs were detected during the 3 surveys at 3 sites in the Southern Chiricahuas in 2014 (AGFD 2015). Swisshelms Management Area had 7 surveys conducted at 1 site (Leslie Canyon NWR), with Chiricahua leopard frogs observed on all surveys. In addition, 26 tadpoles from SWRS SHA released to only occupied site in Management Area (AGFD 2015).

In 2015, four sites were surveyed in the Peloncillo Mountains, one in Arizona and three in New Mexico. Chiricahua leopard frogs were detected at the Arizona site and two of the New Mexico sites (AGFD 2016).

Recovery Unit 4 (Pinaleno-Galiuro-Dragoon Mountains, Arizona) includes populations in Oak Spring and Oak Creek (Glaiuro Mountains) Shaw Tank, Tunnel Spring and until recently Halfmoon (Dragoon Mountains). The Galiuro and Dragoon mountains have been surveyed consistently over the last decade or more.

In 2013, Chiricahua leopard frogs were detected at ten sites with breeding occurring at seven locations in the Galiuro Mountains. Natural dispersal was documented at one site and two additional sites were reported as having dispersed Chiricahua leopard frogs but these have not been verified. Augmentation occurred at two sites with four egg masses and 20 frogs from Discovery Park and another 195 frogs from a wild site. Genetic samples were collected from one site to be analyzed by the Smithsonian Conservation Biology Institute (AGFD 2014). Also in 2013, Bull Tank received 303 Chiricahua leopard frogs and reported frogs dispersing from that location to Little Bull Tank. Interns seined Cave Tank and 400 salamanders were removed (AGFD 2014).

Chiricahua leopard frogs were detected at 11 sites and breeding was detected at 4 sites during 68 surveys at 32 sites within Galiuro Mountains during 2014. Chiricahua leopard frogs had dispersed naturally to 3 new sites and 6 egg masses from Discovery Park SHA released to 2 sites. Within the Dragoon Mountains, 31 surveys at 12 sites were conducted, with Chiricahua leopard frogs detected at 10 sites and breeding detected at 4 of these sites. Chiricahua leopard frogs were observed at 4 new sites, likely through natural dispersal. Additionally, non-native fish were removed at FS Half Moon (AGFD 2015).

In 2015, 45 sites were surveyed in the Galiuro Mountains and Chiricahua leopard frogs were detected at 25 locations, with 7 of these sites having breeding. This included 12 new locations (AGFD 2016). In the Dragoon Mountains, 20 sites were surveyed, with Chiricahua leopard frog found at 9 sites, 5 of which had evidence of breeding. There was one new site indentified at Black Diamond Spring (historical population) (AGFD 2016).

2016 survey information is not available at this time.

Critical Habitat

The information provided below describes the status of critical habitat on the CNF within recovery unit and critical habitat unit.

Recovery Unit 1 (Tumacacori-Atascosa-Pajarito Mountains, Arizona and Mexico)

Bonita, Upper Turner, and Mojonera Tanks critical habitat unit

This unit includes 201 acres of CNF lands in the Pajarito and Atascosa Mountains, Santa Cruz County, Arizona. Two breeding sites (Bonita Tank and Mojonera Tank), combined with a dispersal site or site where breeding and recruitment may occur in wet years (Upper Turner Tank), form the center of a future metapopulation. Three additional waters— Sierra Tank East, Sierra Tank West, and Sierra Well—may have the potential to support breeding with habitat improvement. Frogs currently occupy Bonita and Mojonera Tanks. Frogs were last found at Upper Turner Tank in 2004.

In this unit, bullfrogs are a continuing threat, and illegal border activity and associated law enforcement have resulted in watershed damage. A road on the berm of Upper Turner Tank is scheduled for improvement to access a surveillance tower operated by U.S. Customs and Border Protection. Frogs in this region have tested positive for *Bd*, but the disease appears to have little effect on population persistence.

Sycamore Canyon critical habitat unit
This unit includes 262 acres of CNF land and 7 acres of private lands along Atascosa Canyon through Bear Valley Ranch in the Pajarito and Atascosa Mountains, Santa Cruz County, Arizona Sycamore Canyon, Yank Tank, North Mesa tank, South Mesa Tank, and Bear Valley Ranch Tank are currently occupied. The current occupancy status of Rattlesnake Tank and Atascosa Canyon downstream of Bear Valley Ranch Tank is unknown. Sycamore Canyon from Ruby Road to the international border supports frogs and breeding, but in the driest months (May and June) the stream is reduced to intermittent pools.

Bullfrogs have been a continuing problem in this unit, although recent control efforts seem to have eliminated them from Sycamore Canyon. Non-native green sunfish (*Lepomis cyanellus*) have occasionally been found in Sycamore Canyon, as well. Pools critical to survival of frogs and tadpoles through the dry season, are sensitive to sedimentation and erosion upstream in the watershed of Sycamore Canyon. The earliest records of *Bd* in Arizona are from Sycamore Canyon (1972). A robust population of Chiricahua leopard frogs persists at this site despite the disease and periodic die-offs. Illegal border activity and associated law enforcement have resulted in many trails and new vehicle routes in the area, as well as trampling in the canyon.

Peña Blanca Lake and Spring, and Associated Tanks critical habitat unit
This unit includes 202 acres located on CNF lands, Santa Cruz County, Arizona. This unit is a metapopulation that includes Peña Blanca Lake, Peña Blanca Spring, Summit Reservoir, Tinker Tank, Thumb Butte Tank, and Coyote Tank. These sites were all occupied in 2009.

Chiricahua leopard frogs and tadpoles were found in Peña Blanca Lake in 2009 and 2010, after the lake had been drained and then refilled, which eliminated the non-native predators. However, early in 2010, rainbow trout (*Oncorhynchus mykiss*) were stocked back into the lake, and reestablishment of a variety of warm water fishes has occurred. Despite the stocking of rainbow trout, Peña Blanca Lake now boasts a robust population of Chiricahua leopard frogs; the largest single population throughout its range. Surveys of the lake in April 2011 confirmed that Chiricahua leopard frogs remained present. Surveys of the lake in September 2011 estimated the Chiricahua leopard frog population to number between 300-500 individuals which is likely a low estimate as only a single night survey was performed and the complex shoreline habitat made observation difficult. During that survey, Chiricahua leopard frogs were calling, indicating that fall breeding may have been occurring.

Non-native introduced predators, particularly bullfrogs and sportfish, remain a serious threat in this region. A concerted effort began in 2008 to remove bullfrogs. The effort appears to be successful, and Chiricahua leopard frogs have clearly benefited. However, there is a continuing threat of recolonization or purposeful introduction of bullfrogs, and management of this area will continue to concentrate on preventing bullfrogs from recolonizing the area and eliminating those that do. As discussed, warm water sportfish were stocked at Peña Blanca Lake which affects the suitability of the lake as Chiricahua leopard frog habitat. However, given the number of conservation measures which included managing against bullfrogs and ensuring the persistence of dense shoreline vegetation, the proposed stocking of warmwater fish should not result in adverse modification of this critical habitat unit. Frogs in this region have tested positive for *Bd*; however, the disease appears to have little effect on population persistence.

Recovery Unit 2 (Santa Rita-Huachuca-Ajos Bavispe, Arizona and Mexico)

The requisite number of metapopulations (two) and isolated, robust populations (one) have not been met (Criterion 1), although FWS is working toward metapopulations meeting the definition in the recovery plan on the eastern slope of the Santa Rita Mountains and on the southeastern slopes of the Huachuca Mountains. An isolated, robust population occurs at Beatty's Guest Ranch in the Huachuca Mountains and is the most stable, robust population in this RU. Several other isolated populations also occur scattered across the RU, and we are currently working with partners to build a metapopulation in the Las Cienegas area.

The appropriate protection and management of habitats for persistence of two metapopulations and connectivity have not been met (Criteria 2 and 3). However, dispersal sites and corridors for connectivity have been established in the Huachuca Mountains (e.g. Ramsey Canyon), and various conservation plans and Safe Harbor Agreements have been developed or are in development in this RU. Threats have not been eliminated (Criterion 4). American bullfrogs, crayfish, *Bd*, non-native fishes, illegal border activities and law enforcement response, and wildfire continue to threaten Chiricahua leopard frogs in this RU.

An isolated, robust population occurs at Beatty's Guest Ranch in the Huachuca Mountains and is the most stable, robust population in this RU. Several other isolated populations also occur scattered across the RU. American bullfrogs, crayfish, *Bd*, non-native fishes, illegal border activities and law enforcement response, and wildfire continue to threaten Chiricahua leopard frogs in this RU. The status of the Chiricahua leopard frog is relatively stable at this time, however threats are increasing.

Florida Canyon critical habitat unit
Florida Canyon includes 4 acres and is all on the CNF in the Santa Rita Mountains, Pima County, Arizona. Included in the designation of critical habitat is approximately 1,521 feet of Florida Canyon from a silted-in dam to the downstream end of the Florida Workstation property. Space for individual and population growth is present and was enhanced in 2010, with the addition of a another steel tank for breeding. Chiricahua leopard frogs currently occupy this site. This is considered an isolated population.

Water is a limiting factor in this system, particularly during drought. Fire in the watershed could result in scouring and sedimentation in the pools important as habitat for the frog. The addition of a steel tank will provide dependable water for breeding that is safe from erosion or sedimentation events. Introduced predators and *Bd* are potential threats, but neither has been recorded at this site.

Eastern Slope of the Santa Rita Mountains critical habitat unit
This unit includes 172 acres of CNF lands and 14 acres of private lands in the Greaterville area in Pima County, Arizona. Present in this unit are habitat for population growth and normal behavior, along with food, light, water, minerals, air and other nutritional and physiological requirements needed for conservation of the species. Included in the critical habitat designation are two metal troughs in Louisiana Gulch, Greaterville Tank, Los Posos Gulch Tank, and Granite Mountain Tank complex. The Granite Mountain Tank complex includes two impoundments and a well. All but Los Posos Gulch Tank are currently occupied breeding sites. More than 60 frogs were observed at Los Posos Gulch Tank in 2008. It was once a robust breeding site; however, it dried, and the frogs disappeared in 2009. These four sites collectively form a metapopulation.

Surface water is a primary limiting factor in this unit. The breeding habitat at Louisiana Gulch, although limited to two 6.0 feet diameter steel tanks, is dependable because it is fed by a well. The other tanks are filled by runoff and susceptible to drying during drought. Non-native predators and *Bd* are not known to be imminent threats in this area.

Scotia Canyon critical habitat unit
This unit includes 70 acres in Scotia Canyon, Huachuca Mountains, Cochise County, Arizona, and is entirely on CNF lands. Breeding habitat occurs at Peterson Ranch Pond and possibly at other perennial or nearly perennial pools. Chiricahua leopard frogs were reestablished in this canyon via a translocation in 2009; the last record of a Chiricahua leopard frog in the canyon before that was 1986. PCEs 1 and 2 are present. This site is managed as an isolated population, but there is some potential for creating connectivity to the metapopulation in Ramsey and Brown Canyons via population reestablishment in Garden Canyon at Fort Huachuca. Scotia Canyon, with its pond and stream habitats, has the potential to be a robust population.

Intensive bullfrog eradication and habitat enhancement work has been done in preparation for reestablishing the Chiricahua leopard frog. However, bullfrog reinvasion is a significant, continuing threat, and other non-native predators could potentially reach Scotia Canyon naturally or by human assisted releases. In addition, barred tiger salamanders from the Peterson Ranch Pond tested positive for *Bd*, but the frogs appeared to be persisting in that same pond. Further, heavy fuel loads could result in a catastrophic wildfire, which would have significant detrimental effects on the frog and its aquatic habitats. Finally, a road through the canyon is eroded in places and contributes sediment to the stream; it receives much use by recreationists and U.S. Customs and Border Protection.

Carr Barn Pond critical habitat unit
This unit includes 0.6 acres of CNF lands in the Huachuca Mountains, Cochise County, Arizona. This population is considered isolated. We believe PCE 1 is present. Carr Barn Pond is an impoundment with a small, lined pond with water provided from a well. During runoff events, the size of the pond expands considerably and then gradually shrinks back to the lined section. The population has since been eliminated, probably by *Bd*. The unit has a history of non-native predator problems and disease. The population has been eliminated after *Bd* dieoffs three times; twice the population has subsequently been reestablished through translocations. Largemouth bass (*Micropterus salmoides*) have been introduced illegally into the pond and then removed, and bullfrogs periodically invade the site but are promptly removed before they breed.

Ramsey and Brown Canyons critical habitat unit
This unit includes 49 acres of private lands in Ramsey Canyon and 58 acres of CNF in Brown and Ramsey Canyons, Huachuca Mountains, Cochise County, Arizona. PCEs 1 and 2 are present within this unit. This unit is managed as a metapopulation. Places where Chiricahua leopard frogs have bred and that still retain PCE 1 include Ramsey Canyon, Trout and Meadow Ponds on private lands owned by The Nature Conservancy, and the Ramsey Canyon Box; and in Brown Canyon, the Wild Duck Pond, House Pond, and the Brown Canyon Box (on CNF lands).

Ramsey Canyon and Brown Canyon are considered currently occupied, but although frogs have bred at the Box in Brown Canyon, the site is too small to support more than just a few frogs. In addition, recent die-offs associated with *Bd* have significantly reduced populations in both canyons. The House and Wild Duck ponds as well as Ramsey Canyon have a history of *Bd* outbreaks. The Ramsey Canyon population has been eliminated twice and then reestablished; the Wild Duck and House Ponds have also undergone repeated disease-related declines and extirpations followed by reestablishments. The populations tend to persist for months or years after reestablishment only to experience epizootic (an outbreak of disease affecting many animals of one kind at the same time) *Bd* outbreaks followed by declines or extirpation.

Additional threats in this unit include non-native species, drying, sedimentation, and fire. Non-native predators threaten populations at the House and Wild Duck Ponds, where bullfrogs have been found periodically and goldfish (*Carassius auratus auratus*) were once introduced. Those two ponds are buffered against drought and drying by a pipeline from a spring and a windmill. However, the Box in Brown Canyon is subject to low water and drying during drought. The latter population depends upon immigration or active reestablishment for long term persistence. The Trout and Meadow Ponds in Ramsey Canyon are fed by pipelines; thus the water supply is dependable. The Trout Pond could however be filled in with sediment during a flood. Further, a fire in the watershed could threaten aquatic breeding sites in both canyons.

Recovery Unit 3 (Chiricahua Mountains-Malpai Borderlands-Sierra Madre, Arizona, New Mexico, and Mexico)

Cave Creek critical habitat unit
This unit includes 234 acres of CNF lands in the Chiricahua Mountains, Cochise County, Arizona. Chiricahua leopard frogs and tadpoles were released during the fall of 2011 into a pond

on the Southwestern Research Station where they were initially reared in an on-site ranarium. Included in this unit is Cave Creek and associated ponds in or near the channel, from Herb Martyr Pond downstream to the eastern FS boundary. PCEs 1 and 2 are present. This site will be managed as a metapopulation.

Herb Martyr Pond is the type locality for the Chiricahua leopard frog; however, no frogs have been observed at the site since 1977. The pool behind the dam is entirely silted in, and pools at the base of the dam are probably not adequate for Chiricahua leopard frogsurvival or reproduction. However, with restoration this site could once again support Chiricahua leopard frogs. The pond below the dam at John Hands appears suitable for occupancy, but Chiricahua leopard frogs have not been recorded there since 1966. Chiricahua leopard frogs were occasionally seen in Cave Creek through 2002.

Scarcity of water can occur in drought years and bullfrogs occur to the east but have never been recorded in the unit. The current status and past history of *Bd* in this unit are unknown. Rainbow trout were present and occurred concurrently with Chiricahua leopard frogs at Herb Martyr Pond, but no trout are currently known in the unit.

Peloncillo Mountains critical habitat unit
This unit includes 366 acres of CNF lands in Hidalgo County, New Mexico. This unit is designated as critical habitat because it was occupied at the time of listing and currently contains PCEs 1 and 2 to support life-history functions essential for the conservation of the species. Cloverdale Cienega within this critical habitat unit is an ephemeral site that may serve as a dispersal corridor for Chiricahua leopard frogs in the Peloncillo Mountains. This does not contribute to the number of reproductive sites on the CNF.

Aquatic habitats in the Peloncillo Mountains critical habitat unit include Geronimo, Javelina, State Line Tanks; Maverick Spring; and pools or ponds in the Cloverdale Cienega and along Cloverdale Creek below Canoncito Ranch Tank. Breeding has occurred in State Line Tank, and possibly other aquatic sites in this unit. These tanks and Maverick Spring have recent records of Chiricahua leopard frogs (2007 to the present) and are considered currently occupied, with the exception of State Line Tank. State Line Tank was reported as dry in 2011 with no available habitat or refuge for Chiricahua leopard frogs and no Chiricahua leopard frogs observed. It is not known at this time if damage to the tank or drought caused it to dry in 2011. However, because Chiricahua leopard frogs disperse from Canoncito Ranch Tank into Cloverdale Cienega, Cloverdale Creek, and surrounding tanks when water is present, State Line Tank still contains PCEs 2. This unit is managed as a metapopulation.

Periodic drought dries most of the aquatic sites completely or to small pools, which limits population growth potential. Non-native sportfish are present at Geronimo Tank and may preclude successful recruitment. Occurrence of *Bd* in this area has not been investigated, but may also be a limiting factor.

Recovery Unit 4 (Pinaleno-Galiuro-Dragoon Mountains, Arizona)

Deer Creek critical habitat unit
This unit consists of 17 acres of CNF, 69 acres of Arizona State Land Department lands, and 34 acres of private lands in the Galiuro Mountains, Graham County, Arizona. Included in

designated critical habitat are Home Ranch, Clifford's, Vermont, and Middle Tanks, a series of 10 impoundments on the Penney Mine lease, and intervening drainages, primarily Deer Creek, and associated uplands and ephemeral tanks that provide corridors for movement among these tanks. Breeding has been confirmed on Deer Creek above Clifford's Tank, and in Home Ranch and Vermont Tanks, and is suspected in the other three sites named above when water is present long enough for tadpoles to metamorphose into adults (3 to 9 months). Home Ranch Tank supports a large population of Chiricahua leopard frogs. This unit functions as a metapopulation. The primary threat to Chiricahua leopard frogs and their habitats in this unit is periodic drought that results in breeding sites drying. During a severe drought in 2002, all but one of the waters in the unit dried. Frogs reportedly died for unknown reasons in the 1980s (Goforth 2005, p. 2), possibly indicative of *Bd*; however, no Chiricahua leopard frogs have tested positive for the disease from this unit. The only non-native aquatic predator recorded in this unit is the barred tiger salamander.

Recovery work has occurred in this unit, including head-starting of egg masses and reestablishment and augmentation of populations. The FWS, AGFD, Arizona State Land Department, and an agate miner (Penney Mine Tanks) have drafted a conservation plan for managing habitats on the mine lease, but funds are lacking to implement that plan.

Oak Spring and Oak Creek critical habitat unit
This unit consists of 27 acres of CNF lands in the Galiuro Mountains, Graham County, Arizona. The unit is currently occupied. This site is isolated and does not support enough frogs to be considered a robust population. The largest water, Cattail Pool, typically contains water and supports several breeding Chiricahua leopard frogs. The stream reach designated for critical habitat includes the area where Chiricahua leopard frogs occur.

The primary threat in this unit is extended drought during which all of the pools are subject to reduction or drying. Cattail Pool is spring-fed, and is likely the last pool to dry. Oak Spring is also used for water developments, which may limit the capability of the site to support frogs. Chiricahua leopard frogs have been headstarted and released at this site to augment the population.

Dragoon Mountains critical habitat unit
This unit includes 74 acres of CNF lands in Cochise County, Arizona. Shaw Tank and Tunnel Spring in Middlemarch Canyon are designated as critical habitat in this unit and are currently occupied breeding sites. The latter is a robust population that was occupied at the time of listing. Shaw Tank is a reestablishment site that was not known to be occupied in 2002. This is considered an isolated population. Also included is Halfmoon Tank, which supported a robust population of Chiricahua leopard frogs until 2002. Siltation and recent drought affect the amount and persistence of water. The tank is in need of renovation so that it may again dependably hold water and support breeding.

Threats to the Chiricahua leopard frog and its habitat are primarily scarcity of suitable breeding habitat and loss of that habitat during drought. Tunnel Spring is spring-fed and thus buffered against drought; however, Shaw and Halfmoon Tanks are filled by runoff. Neither non-native predators nor *Bd* have been noted in these populations and habitats, although if introduced they would constitute additional threats.

Recovery work, including headstarting of eggs collected from Tunnel Spring and establishment of a new population at Shaw Tank with reared tadpoles and frogs, has been accomplished in this unit, and the FS's livestock permittee has been a participant in those recovery activities.

B. Factors affecting the species and critical habitat within the action area

The factors affecting the Chiricahua leopard frog and its designated critical habitat within the action area are discussed in this section. Projects associated with formal consultations that evaluated adverse effects to the frog that occurred from 2012 (i.e., the year of the last consultation of the 1986 LRMP) to the present are summarized in Table CLF-2.

The environmental baseline for Chiricahua leopard frog within the CNF appears to be stable. Factoring in the three large wildfires in 2011, data do not show a declining population. The greatest threats to Chiricahua leopard frogs on the CNF are non-native species, drought, and disease. The CNF is actively participating in recovery actions that are benefiting the frog. A multi-year effort lead by herpetologists at the University of Arizona has nearly eliminated bullfrogs from Sycamore Canyon. Chytridiomycosis has been present in Sycamore Canyon since 1972, which is the earliest date for the disease in the U.S. (USFWS 2007). Although lowland leopard frogs and Tarahumara frogs have disappeared from Sycamore Canyon since the disease was first recorded, the Chiricahua leopard frog has persisted, despite periodic dieoffs. *Bd* and ranavirus are also known from the Altar Valley.

Northern Mexican Gartersnake

A. Status of the species and proposed critical habitat within the action area

Cienega Creek Subbasin Unit

Las Cienegas National Conservation Area and Cienega Creek Natural Preserve

Several records for the northern Mexican gartersnake in the Las Cienegas National Conservation Area and Cienega Creek Natural Preserve have been documented in the literature, predominantly from Cienega Creek, the first dating to 1986 (Table NMGS-2) (Rosen and Schwalbe 1988). Cienega Creek maintains perennial surface flow in two reaches; from its headwaters to just downstream of "the Narrows;" and from the confluence with Mescal Wash to just downstream of the Colossal Cave Road crossing in Vail, Arizona. The upper portion of the creek has historically been occupied by bullfrogs, but continues to support a native fish community, as well as both Chiricahua and lowland leopard frogs (Rosen *et al*. 2001). The lower perennial portion of Cienega Creek runs through Pima County's 3,979 acre Cienega Creek Natural Preserve for approximately 12 river miles. This reach supports a native fish community (Timmons *et al*. 2013), including Gila chub and longfin dace as well as lowland leopard frogs (Caldwell 2014), although there is a persistent threat of bullfrog invasion from a nearby house pond that continues to contribute immigrant bullfrogs to Cienega Creek. Despite this source, bullfrog numbers have remained somewhat low in recent years (Caldwell 2012, pers. comm.). In addition to Cienega Creek, the Las Cienegas National Conservation Area supports several tanks, springs, and wetlands that provide physically suitable northern Mexican gartersnake habitat and that may be used by northern Mexican gartersnakes sporadically as they emigrate from Cienega Creek and explore new foraging opportunities in the area. According to GIS analysis, Mattie Canyon, a tributary of Cienega Creek also supports suitable northern Mexican gartersnake habitat as well as a native prey base.

In 2007 and 2008, more than 2,300 trap-hours were required per snake captured in this area (Caldwell 2008a, pers. comm.; 2008b, pers. comm.; Servoss *et al*. 2007), compared with Rosen and Caldwell (2004) capture rates of 561 trap-hours per snake in this same area in 2002 and 2003; more than a four-fold increase in the effort needed to capture northern Mexican gartersnakes. In 2011, the capture rate was 3,167 trap-hours per capture (Hall 2012). These capture per unit data point to increasing rarity over time which historically mirrored area declines in leopard frogs. Thismay be exacerbated to some degree by continued bullfrog eradication efforts which may reduce the prey base for adult gartersnakes. As a recovery cooperator, the Arizona –Sonora Desert Museum (ASDM) has been successfully propagating northern Mexican gartersnakes in captivity since 2011 and releases of captive-bred snakes occurred in 2012, 2014, and 2015. Although no follow-up surveys have been conducted in areas where the releases occurred, one individual from the 2015 release was observed and captured several months later slightly downstream of its release point in Cienega Creek. Regardless, conservation and recovery efforts for native aquatic species in this area have reduced the influence of harmful non-native species and provide a net-positive effect on the areas aquatic communities. Bullfrog surveys in 2015 confirm their absence from the Las Cienegas National Conservation Area (Hall *et al*. 2015); crayfish persist in Cline Pond/Spring in the extreme southeastern portion of the Las Cienegas National Conservation Area. Mosquitofish, while not present in Cienega Creek, are frequently used as mosquito control on private property and are known to currently occur in the adjacent Santa Rita Mountains and Elgin/Sonoita regions and pose a consistent threat to Cienega Creek. Recent records and recovery efforts confirm the northern Mexican gartersnake still exists in Cienega Creek and surrounding lands, but existing information based on incidental observations without current surveys suggests the population exists as a low density population that appears to remain unstable.

<u>Status of Prey Communities in the Las Cienegas National Conservation Area: Ranid Frogs</u>

Numerous sites historically and currently support Chiricahua leopard frogs on the Las Cienegas National Conservation Area, including Cinco Well Wildlife Pond, Cottonwood Wildlife Pond, Empire Well Wildlife Pond, Gaucho Wildlife Pond, Maternity Well Wildlife Pond, Road Canyon Wildlife Pond, Spring Water Wetlands, and Cienega Creek at Cold Spring, which produced a large cohort of young leopard frogs in 2015 (Hall *et al*. 2015). These sites represent areas where frogs were introduced, re-established by dispersal, or in a single locale, naturally persisted. Chiricahua leopard frogs were also confirmed in 2015 within two reaches of Cienega Creek (headwaters reach and Mattie Canyon reach) where they naturally dispersed from other sites (Hall *et al*. 2015). Downstream of these reaches is the Narrows reach. Within this reach, a lowland leopard frog population persists and appears to be growing (Hall *et al*. 2015; Akins 2016). Survey information as of April 2016, show lowland leopard frogs continue to advance upstream in Cienega Creek, having moved approximately two stream miles from the Narrows reach into the Cold Spring reach and occur in slightly less than equal numbers as Chiricahua leopard frogs (Hall 2016).

Historically, the stable source population for the Chiricahua leopard frog metapopulation in the Las Cienegas National Conservation Area is at Empire Spring within upper Empire Gulch, about 4 miles upstream of Cienega Creek. This is a historic population that has persisted since at least the 1990's, and has increased in recent years, climbing from below 10 individuals to over 100 currently (Hall *et al*. 2015). Water temperatures at this site are remarkably stable throughout the year, which is thought to be the key variable in this population's ability to persist in the presence of the *Bd* disease pathogen (Hall *et al*. 2015).

Chiricahua leopard frog reproduction was confirmed in 2015 at many of the aforementioned sites in the Las Cienegas National Conservation Area. This led to significant dispersal activity to and within Cienega Creek, and several other sites within or adjacent to the Las Cienegas National Conservation Area (Hall *et al.* 2015). Outside of Cienega Creek, sites that received dispersed frogs include Rattlesnake Tank, Karen's Tank, Clyne Pond, Cieneguita Wetlands (all 3 ponds), Bill's Tank, HQ Corral Pond, Cinco Well Wildlife Drinker, Lane Tank, Road Grate above Empire Spring, Bills Turnoff Small Tank, Oil Well Tank, and Borrow Pit (Gaucho) (Hall *et al*. 2015).

Frog populations in the Las Cienegas National Conservation Area are vulnerable to disease-related die-offs. The latest mass mortality event related to *Bd* occurred during the 2014-2015 winter (Hall *et al*. 2015); winter months are often when *Bd* outbreaks are most significant in native ranid frogs (Hyman and Collins 2015). Specifically, severe Chiricahua frog die-offs were observed in November and December of 2014 in all populations except for those at Empire Spring, Cold Spring, and Headwaters Reach, where temperatures are stabilized by spring flow (Hall *et al*. 2015). Of these three sites, only frogs at Empire Spring experienced zero winter-disease mortality (Hall *et al*. 2015). Therefore, from a metapopulation persistence perspective, Empire Spring is critically important for Chiricahua leopard frogs in the Las Cienegas National Conservation Area as it is the only site that has been resistant to *Bd* die-offs in this area.

Four species of native fish are known from Cienega Creek: Gila chub, Gila topminnow, desert pupfish, and longfin dace (*Agosia chrysogaster*). Longfin dace will not be specifically addressed in this biological opinion although they are considered an important component to the northern Mexican gartersnake prey base within the action area, have similar ecology to the other native fish discussed, and will therefore be affected similarly by indirect effects of groundwater drawdown from the proposed action.

Of the five extant populations of Gila chub within the Santa Cruz watershed, only the Cienega Creek population is considered stable-secure. The other four populations are considered unstable-threatened. Within the Las Cienegas National Conservation Area, Gila chub are distributed and continue to be abundant throughout upper Cienega Creek (Rosen *et al*. 2013; Simms 2014d, Simms and Ehret 2014) and have made a steady comeback in lower Mattie Canyon after a failure of a gradecontrol structure resulted in heavy sedimentation and erosion. Where Gila chub occupy pool and backwater habitat, they provide an important source of prey for resident northern Mexican gartersnakes. Gila chub do not occur in upper Empire Gulch, nor in any stock tank or wildlife pond on the Las Cienegas National Conservation Area (Ehret and Simms *n.d.*, Simms 2013).

The population of Gila topminnow in the Las Cienegas National Conservation Area demonstrably represents the largest natural population in the United States and the only extant one on Federal land (Simms and Simms 1992, Bodner *et al*. 2007). The species continues to remain abundant within upper Cienega Creek (Rosen *et al*. 2013; Simms 2014d, Simms and Ehret 2014) and to a lesser extent, lower Cienega Creek (Bodner *et al*. 2007). Gila topminnow populations above and below the Spring Canyon confluence with Cienega Creek may face drastically different futures. Hatch (2015) found that above the Spring Canyon confluence, Gila topminnow have a 0.01 percent chance of extirpation at some point in the future, whereas downstream of the Spring Canyon confluence, Gila topminnow have a 96 percent chance of extirpation. Since 2013, several lentic sites have received Gila topminnow as part of an effort intended to create, enhance, and protect habitat for at-risk species within the Las Cienegas National Conservation Area, including Cottonwood Tank, Cieneguita Wetland, and Gaucho Tank. We have records documenting northern Mexican gartersnakes using these specific tanks, but there have not been any targeted surveys.

Desert pupfish are extant in the Las Cienegas National Conservation Area, but only in lentic habitat; they are not extant in Cienega Creek. Several releases of desert pupfish have occurred on the Las Cienegas National Conservation Area in recent years, the first occurring at Road Canyon Wildlife Pond in 2012, with the release of 656 individuals. Subsequent to that event there were seven releases in 2013, including at Cinco Canyon Wildlife Pond (n=250), Cottonwood Wildlife Pond (n=269), Empire Wildlife Pond (n=299), Cieneguita Wetland Pond #3 (n=290) and #4 (n=240), Antelope Wildlife Pond (n=257), and Bald Hill Wildlife Pond (n=263). Future releases at Gaucho Wildlife Pond, Maternity Wildlife Pond, Oil Well Wildlife Pond, Bill's Wildlife Pond, Clyne Pond, and Apache Spring Wildlife Pond are pending. To date, none of these populations have become extirpated and some are thriving. Only the populations in Cieneguita Wetland Ponds #3 and #4 are anticipated to be affected by the proposed action.

Several factors have affected, or could affect, native fish habitat within the action area including water use, the risk of illegal releases of harmful non-native species, livestock grazing, fire, and effects related to regional climate change. These factors are discussed in detail elsewhere in this biological opinion where addressed for native fish. For more detail on the status of native fish species within the action area and predicted effects to native fish populations as a result of the proposed action, we encourage further review of discussions under the species sub-headers, Gila chub and Gila topminnow.

Upper Santa Cruz River Subbasin Unit

San Rafael Valley

Several recent and historical records document the northern Mexican gartersnake (neonates and adults) from tanks and springs within the San Rafael Valley, as well as the upper Santa Cruz River, confirming that the northern Mexican gartersnake is using various wetland habitats in the San Rafael Valley, and that reproduction is occurring (Table NMGS-3). Recruitment rates within the population appear to be low and more study is required to confirm. In 2012, the capture rate was one snake every 378.75 trap hours (Lashway 2012). Additionally, low recapture rates of marked individuals could be cause for concern. Green sunfish and mosquitofish dominated fish sampling results in 2014 (Timmons 2014). Native fish, bullfrogs, and non-native fish inhabit several wetland areas in the San Rafael Valley, including the upper Santa Cruz River (Rosen *et al*. 2001). Sonoran tiger salamanders also contribute to the prey base of northern Mexican gartersnakes in this area. Photo-documentation from the years 1999, 2001, and 2005 from the upper Santa Cruz River depicted in Stingelin *et al*. (2006) reflect a trend of less water and more vegetation along the upper Santa Cruz River.

The foraging ecology of northern Mexican gartersnakes and past records suggest individuals move throughout the San Rafael Valley as they seek to explore regional wetland habitats for prey. The upper Santa Cruz River likely serves as a source for these individuals. We consider the upper Santa Cruz River, as well as tanks, springs, and wetlands with physically suitable northern Mexican gartersnake habitat, within the greater San Rafael Valley to be occupied by the northern Mexican gartersnake based on historical and recent records, as well as our understanding of the subspecies' foraging ecology. This population is considered likely viable.

Scotia Canyon

There are numerous records of the northern Mexican gartersnake from the Peterson Ranch Pond site in Scotia Canyon in the Huachuca Mountains from 1981 to 2009 (Table NMGS-4) (Rosen and Schwalbe 1988, Holm and Lowe 1995, Rosen *et al*. 2001, Holycross *et al*. 2006, Frederick 2008b pers. comm., J. Servoss 2009, pers. obs.). Data generated from comparative trapping and survey efforts from 1980-1982, 1993, and 2008 suggest a marked decline in this population over the last 30 years. In 2008, a multi-agency, multi-year effort was initiated within a five mile radius of Scotia Canyon, including the Peterson Ranch Ponds and vicinity, to eradicate bullfrogs and reestablish Chiricahua leopard frogs (Frederick 2008, pers. comm.; 2008b, pers. comm.). This effort included many surveys of herpetofauna (reptiles and amphibians) to identify the presence of bullfrogs for eradication and monitor the status of reintroduced Chiricahua leopard frogs. With the reintroduction of Chiricahua leopard frogs to the Peterson Ranch Ponds in 2009 and their subsequent reproduction in 2010, we expect the northern Mexican gartersnake population will persist, and possibly improve, due to improved availability of prey and reduced predation by non-native species.

Parker Canyon

Historical records for the northern Mexican gartersnake in Parker Canyon (Table NMGS-5) were from Parker Canyon Lake in 1967 (Holycross *et al*. 2006) and 1986 (Rosen and Schwalbe 1988) and from Parker Canyon in 1968 and 1979 (Holycross *et al*. 2006). We are not aware of any dedicated northern Mexican gartersnake survey effort in Parker Canyon. The only survey known for Parker Canyon Lake was the Rosen and Schwalbe (1988) effort in 1986 that consisted of 3 person-search hours. Parker Canyon Lake is managed as a put-and-take fishery for rainbow trout and channel catfish and also supports a self-sustaining warm water fishery including predatory species such as largemouth bass, bluegill, redear sunfish, green sunfish, black bullhead, and northern pike (USFWS 2011b). These non-native species may spill into the canyon proper below the dam or move up into pools above the lake where they contribute to the extant non-native fish population. Parker Canyon below Parker Canyon Lake dam is best described as a spatially intermittent stream with several pools. There is approximately one river mile of permanent water below the dam, and then the channel is ephemeral for approximately 4.5 river miles to another perennial reach approximately 0.25 river miles in length. It then, once again, becomes ephemeral until it joins the upper Santa Cruz River in the San Rafael Valley. The perennial reach below the Parker Canyon dam contains bullfrogs, crayfish, and non-native, predatory fish species. Lower Parker Canyon also maintained longfin dace as of 2003 (Stefferud and Stefferud 2004). Individual northern Mexican gartersnakes may migrate into Parker Canyon from populations that occur in Scotia Canyon or the San Rafael Valley which suggests the subspecies could be extant in Parker Canyon, likely as a low density population.

Redrock Canyon Unit

We know of two photo vouchers of northern Mexican gartersnakes from Redrock Canyon, a tributary of Sonoita Creek, found while conducting fish (Jones 2008, pers. comm.) and bullfrog (Jones, 2012, pers. comm.) surveys in 2008 (Table NMGS-6). One specimen was a juvenile and the other was an adult. Redrock Canyon has never been formally surveyed for northern Mexican gartersnakes according to our files. Perennial water sources are located throughout Redrock Canyon in the form of streams, springs, tanks, and cienegas (US Bureau of Reclamation 2008). Redrock Canyon supports four species of native fish, and Chiricahua leopard frogs and Sonoran tiger salamanders have been reported (USBOR 2008). Redrock Canyon has also been occupied historically by several species of non-native, spiny-rayed fish (the origin of which was traced to illegal releases into local stock tanks) and bullfrogs, but the most recent observations suggest only bullfrogs remain conspicuous throughout the subbasin (USBOR 2008). Recent records confirm the northern Mexican gartersnake remains extant in Redrock Canyon.

San Pedro River Subbasin Unit

Bear Creek

Three historical records exist for northern Mexican gartersnake in Bear Creek in the Huachuca Mountains: one from 1968 from "Bear Creek;" one from 1973 from "near Miller Peak," which is likely from or near Bear Spring at approximately 7,500 feet elevation; and the last from 1987 near the Montezuma Pass Road crossing (Holycross *et al*. 2006) (Table NMGS-7). We are not aware of the occurrence of any targeted surveys for northern Mexican gartersnakes in this drainage. Stefferud and Stefferud (2004) documented a native aquatic community based on their 2003 surveys, specifically noting longfin dace as abundant. They suggested this drainage as a place where native fish recovery projects are desirable based on the abundance of suitable habitat and absence of non-native species. A recent, but brief, visit to Bear Canyon by a Service employee confirmed the presence of native fish species. However, crayfish were also seen in large numbers in some pools, but bullfrogs were not observed in the drainage. Bear Creek is somewhat isolated from major perennial sources of non-native species, which may indicate why a largely native community persists. Based on 1) historical records; 2) the absence of any substantial, targeted survey effort; 3) the presence of a native fish community; and 4) the abundance of physically suitable habitat, we consider Bear Creek to be occupied by northern Mexican gartersnakes, possibly as a low-density population that remains threatened by crayfish.

San Pedro River—Numerous historical records document the occurrence of the northern Mexican gartersnake in the upper San Pedro River, upstream (south) of Interstate 10: Lewis Springs (1919; 1986, two records; 1996, photo-voucher in AGFD Heritage database), Hereford (1920, five records), "2 East Palimonas" (1959), and Arizona State Highway 90 crossing (1965; 1986, two records) (Rosen and Schwalbe 1988, Rosen *et al*. 2001, Holycross *et al*. 2006) (Table NMGS-8). Rosen *et al*. (2001) surveyed the upper San Pedro River in 1996, 1998, and 2000 at the Arizona State Highway 90 crossing, in 1998 at Lewis Springs, and 1996 at Curtis Flat, and documented crayfish, bullfrogs, non-native, spiny-rayed fish, as well as two species of native fish, all occurring at various densities along their survey routes. However, they did not detect any northern Mexican gartersnakes. Kesner and Marsh (2010) also found both native fish, as well as non-native, spiny-rayed fish, in the upper San Pedro River, although native fish or non-native, soft-rayed fish outnumbered harmful non-native fish species significantly. Jakle (1992) and Minckley (1987) also reported non-native, spiny-rayed species such as channel catfish, flathead catfish, and smallmouth bass in the San Pedro River. These survey efforts included approximately 12 cumulative person-search hours at Highway 90, five person-search hours at Lewis Springs, and three person-search hours at Curtis Flat (Rosen *et al*. 2001). Inman *et al*. (1998) reported crayfish from the San Pedro River.

The lower San Pedro River (north of I-10) was surveyed for northern Mexican gartersnakes from 1996–2000. Rosen *et al*. (2001) surveyed four locations along the lower San Pedro River: at Cascabel in 1996 (three person-search hours), at the San Manuel crossing in 1999 (45 minutes), at the Dudleyville crossing in 2000 (four person-search hours), and in the Bingham Cienega area, adjacent to and within the lower San Pedro River, in 1999 (20 minutes) and 2000 (three person-search hours). One bullfrog was seen at Cascabel and another at Bingham Cienega; one crayfish and one channel catfish were seen at the Dudleyville crossing (Rosen *et al*. 2001). Otherwise, robust populations of lowland leopard frogs and longfin dace were seen at nearly all survey locations (Rosen *et al*. 2001) which document a largely native prey species community for northern Mexican gartersnakes. Kesner and Marsh (2010) found native fish generally dominate over non-native, spiny-rayed fish in the lower San Pedro River. In total, approximately 11 person-search hours have been invested in surveying the entire lower San Pedro River, a large and structurally complex system, since 1996. The northern Mexican gartersnake is likely extant in low density populations along the San Pedro River from the International Border to its confluence with the Gila River.

Babocomari River Subbasin Unit

Babocomari River and Cienega—In the past, the Babocomari River and Cienega was considered by Rosen and Schwalbe (1988) as a possible regional stronghold for northern Mexican gartersnakes, based on personal communications with past investigators (Rosen *et al*. 2001). Consequently, several historical records for the species exist for this area (Table NMGS-9). The first species record is dated 1892, labeled “Babocomari,” and likely occurred at the cienega; subsequent records from 1958 and 1986 also document the species are there (Rosen and Schwalbe 1988). Other historical records from 1958 document the species at “Elgin” (Holycross *et al*. 2006) and we presume that to mean the upper Babocomari River. The last known record for the lower Babocomari River was from 1985 at the Sanders Road crossing, approximately 3.3 river miles upstream of the San Pedro River confluence (Rosen and Schwalbe 1988). Several surveys, of varying effort, of both the cienega and the river conducted in 2000 failed to detect the northern Mexican gartersnake (Rosen *et al*. 2001). The cienega was surveyed intensively in 2000, consisting of visual searches and trapping, which documented bullfrogs and non-native, spiny-rayed fish as abundant and crayfish as common. Surveys from the mid-1980s failed to detect bullfrogs at the cienega, but did detect several species of non-native, spiny-rayed fish. This suggests that, post-1986, bullfrogs either naturally colonized the Babocomari system in a regional dispersal event or they were artificially introduced. Despite the influence of harmful non-native predators in the Babocomari system, northern Mexican gartersnakes could immigrate from regional source populations along the San Pedro River or from the Canelo Hills-Sonoita Grasslands area and intermittently exist as low density populations.

Canelo Hills-Sonoita Grasslands Area—The Canelo Hills-Sonoita grasslands area encompasses several streams, cienegas, and wetlands owned or managed by the Appleton-Whittell Research Ranch, the Nature Conservancy (Canelo Hills Cienega Preserve), and the CNF. Rosen and Schwalbe (1988) and Holycross *et al*. (2006) report localities in this area where records for northern Mexican gartersnakes exist: Finley Tank (1985–1986, numerous), Turkey Creek (1 record from 1985, 11 records from 1986), and O’Donnell Creek (four records from 1974, three records from 1986) (Table NMGS-10). The last known significant survey effort for northern Mexican gartersnakes from this region is that of Rosen *et al*. (2001), which included Turkey Creek, O’Donnell Creek, Finley Tank, various tanks and springs connected to Post Canyon, and two tanks in the area of Elgin, Arizona in 1996 and 2000. Visual search surveys consisting of 10 person-search hours in Turkey Creek produced no records of riparian herpetofauna, largely because the creek was dry during part of that effort (Rosen *et al*. 2001). Thirteen person-search hours were invested in O'Donnell Creek in 2000, yielding observations of Chiricahua leopard frogs, crayfish, and non-native, spiny-rayed fish, but no northern Mexican gartersnakes (Rosen *et al*. 2001). Stefferud and Stefferud (2004) reported the presence of three species of native fish after renovation activities removed green sunfish from O'Donnell Creek. Finley Tank was surveyed with both visual searches and trap arrays in 1996 and 2000, which documented 27 northern Mexican gartersnakes and four bullfrogs (Rosen *et al*. 2001). Several tanks and springs associated with Post Canyon were surveyed in 2000 by visual searches and trap arrays, which documented several populations of Chiricahua leopard frogs, but no northern Mexican gartersnakes or non-native species of concern. Rosen *et al*. (2001) and Stefferud and Stefferud (2004) reported the presence of lowland leopard frogs from several pools within Post Canyon. d'Orgeix (2011) conducted a three-year field study (2007–2009) on the northern Mexican gartersnake populations at Finley Tank, Southwest Spring (immediately above Finley Tank), Post Canyon, O'Donnell Creek, and at two nearby tanks (Telles and Pronghorn). Visual searches, coverboard arrays, and trapping techniques were used, which documented 29 northern Mexican gartersnakes; 25 at Finely Tank, 2 at Southwest Spring, and 2 in Post Canyon (d'Orgeix 2011). Five more adult northern Mexican gartersnakes were observed in 2012 foraging in a flooded area of lower O'Donnell Canyon (d'Orgeix *et al*., In Prep.). Northern Mexican gartersnake are likely extant throughout this greater area exploiting seasonally available habitat and foraging opportunities, immigrating and emigrating from sites as necessary and available.

Buenos Aires National Wildlife Refuge Unit
Historical records document occurrence of the northern Mexican gartersnake at the Buenos Aires National Wildlife Refuge (BANWR) (Table NMGS-11). Five historical records for the northern Mexican gartersnake dated 1970 are from Arivaca Cienega; a large and heavily vegetated wetland. A June 13, 1985, survey failed to detect the species there, but noted that bullfrogs were "extremely abundant" at this location (Rosen and Schwalbe 1988). A significant survey effort consisting of trapping and visual searches occurred at the Arivaca Cienega in both 1993 and 2000, documenting that bullfrogs remained abundant, but also confirmed the presence a single juvenile northern Mexican gartersnake in 2000 (Rosen *et al*. 2001). The observation of this juvenile suggests reproduction had occurred and may still be occurring. The presence of dense cover probably helps any remaining northern Mexican gartersnakes to avoid predation. In recent years, there has been a concerted management effort on the BANWR to recover the Chiricahua leopard frog in an array of tanks (known as the "central tanks" which include Carpenter, Rock, State, Triangle, New Round Hill, Banado, Choffo, Barrel Cactus, Sufrido, Hito, Morley, McKay, and Chongo Tanks) and their associated drainages, all of which have been designated as critical habitat for the Chiricahua leopard frog. As a result, it is likely that any northern Mexican gartersnakes that successfully immigrate into the central tanks area of the BANWR have an increased chance of persistence because of improved available habitat and a stable prey base in an area that is likely free of non-native predators. We consider the northern Mexican gartersnake to be extant as a low-density population on the BANWR based on historical and recent records and the abundance of available habitat in the vicinity of the most recent record.

Kerwin Dewberry, Forest Supervisor

Rio Yaqui Subbasin Unit

San Bernardino National Wildlife Refuge—Numerous historical records for the northern Mexican gartersnake at the San Bernardino National Wildlife Refuge (SBNWR) (1939; 2 specimens), (1950; 2 specimens), (1954; 2 specimens), (1956; 1 specimen), (1957; 2 specimens), (1958; 3 specimens), (1959; 1 specimen), (1961; 9 specimens), (1985; 2 specimens), (1986; 8 specimens), (1993; 1 specimen), (1994; 1 specimen), (1995; 2 specimens), and (1997; 2 specimens), is evidence that the species formerly maintained a robust population there (Rosen and Schwalbe 1988, Holycross *et al*. 2006) (Table NMGS-12). USFWS (2012), an annual report compiled by the SBNWR, lists the northern Mexican gartersnake as a resident of the refuge with the last known record for the species occurring in Black Draw in 2005 (USFWS 2012). The SBNWR was the subject of intensive research and survey efforts for the northern Mexican gartersnake during the 1980s and 1990s. Approximately nine days (person-search hours not reported) were spent surveying the SBNWR in 1985 and 1986 (Rosen and Schwalbe 1988, Appendix I) resulting the capture of 10 large adults. Gartersnakes in general were studied at the SBNWR from 1985–1986 and 1992–1999 in a survey effort that totaled 58,560 trap-hours, resulting in the detection of 148 northern Mexican gartersnakes (Rosen *et al*. 2001). In 1999, approximately four person-search hours led to no detections of northern Mexican gartersnakes (Rosen *et al*. 2001). The last known record of northern Mexican gartersnakes from the SBNWR is from 1999 (Rosen *et al*. 2001). Although vast amounts of physically suitable northern Mexican gartersnake habitat exist within the SBNWR, bullfrogs, noted as “super abundant” during the mid-1980s, completely dominate the SBNWR today (Rosen and Schwalbe 1988, 1995, 1996, 1997, 2002b, 2002c, Rosen *et al*. 1995, 1996b, 2001). However, five species of native fish persist on the refuge and are likely important prey for northern Mexican gartersnakes on the refuge. There is also the possibility that northern Mexican gartersnakes occur in Mexico, downstream in the Rio Yaqui drainage, immediately adjacent to the SBNWR, but we have no records to confirm. We consider the northern Mexican gartersnake as extant on the San Bernardino National Wildlife Refuge, likely as a very low density population.

Santa Cruz River

Sonoita Creek

Three records from 1954 to 2013 document the northern Mexican gartersnake in Sonoita Creek (Table NMGS-13) (Rosen and Schwalbe 1988; Holycross et al. 2006; Bookwalter 2014, pers. comm.). Turner (2007) found no northern Mexican gartersnakes in a 204 person-search-hour, 5,472 trap-hour survey effort in the Sonoita Creek State Natural Area. Crayfish, bullfrogs, and non-native fish were observed by Turner (2007) which likely emigrate from Patagonia Lake which is fed by Sonoita Creek. The length of time since the last records for northern Mexican gartersnakes as well as the persistent influence of non-native species supported by Patagonia Lake suggest the subspecies likely occurs at a very low density in Sonoita Creek.

Lower Santa Cruz River

Several historical records from the lower Santa Cruz River exist: one in the vicinity of Tubac, Arizona dated 1942, another dated 1956 from near the Potrero Creek confluence, three from the Santa Cruz River at Tucson dated 1912, and several others simply labeled as “Tucson” from 1891–1893 (Rosen and Schwalbe 1988, Holycross et al. 2006) (Table NMGS-14). The Santa Cruz River headwaters are located in the San Rafael Valley where the river flows south into Mexico, bends to the west, and then flows due north, back into the United States just east of Nogales, Arizona. There are no obvious barriers to northern Mexican gartersnake movement along its course from the San Rafael Valley to north of Nogales. Rosen and Schwalbe (1988) performed northern Mexican gartersnake surveys of the lower Santa Cruz on three different days spanning the years of 1985 and 1986; no northern Mexican gartersnakes were found, but bullfrogs were noted as “super abundant.” Abbate et al. (2007) spent 90 person-search hours and approximately 935 trap-hours surveying for northern Mexican gartersnakes along the lower Santa Cruz River from the Trico-Marana Road Bridge downstream to the Arizona Army National Guard Training facility, but no northern Mexican gartersnakes were detected.

Several northern Mexican gartersnake records have been reported from areas near the Santa Cruz River in Mexico on two private ranches, Rancho El Arribabi and Rancho Los Fresnos from 2005–2011, although the Santa Cruz River itself was not surveyed (Rorabaugh et al. 2013). Records for the northern Mexican gartersnake from these ranches were reported from the Arroyo Los Fresnos, Los Fresnos Cienega (1990 record), and along the Río Cocospera (Rorabaugh et al. 2013). Currently, the lower Santa Cruz River upstream of (south of) Tucson only maintains perennial (effluent dependent) flow for approximately 14 river miles, from the Nogales International Wastewater Treatment Plant downstream to the Chavez Siding Road crossing. Research suggests that treated effluent from the plant contributes to hydrologic “clogging” (reduced hydraulic conductivity of the streambed) in this reach. Ultimately, such hydrologic clogging adversely affects the recruitment and maintenance of riparian plant species that are dependent on proper functioning of the hyporheic zone (zone where mixing of shallow groundwater and surface water occurs) and does not allow for the development of habitat for prey species. We do not consider the northern Mexican gartersnake to be extant in the lower Santa Cruz River, upstream of the International Border.

B. Factors affecting the species and critical habitat within the action area

The primary factors affecting the northern Mexican gartersnake on the CNF are the presence and introduction of non-native aquatic species (bullfrogs, crayfish, green sunfish, and other warm water sport fish) that compete with and prey upon both the northern Mexican gartersnake and its native prey species; as well as the loss and/or the decline of the gartersnake’s primary prey species. Native prey species for the gartersnake include the lowland leopard frog, (*Lithobates yavapaiensis*), Chiricahua leopard frog, juvenile and adult Gila topminnow, desert pupfish, roundtail chub and Gila chub. Several of its prey species are also endangered, threatened, or are proposed species for listing and have declined in waterways occupied by the gartersnake, contributing to its decline in distribution and density.

Other factors affecting the gartersnake include but are not limited to: heavy recreation such as unauthorized off-road vehicle use in riparian corridors; development of construction activities that trample, remove or degrade suitable stream bank habitat; drought that may exacerbate potential impacts of non-native species on native fish species; water diversions or other water-related actions that decrease water quantity and quality that would limit native fish needed in gartersnake diets; and improper livestock grazing levels if they reduce habitat quality for native fish or riparian habitat structure needed by gartersnakes.

Factors that may affect proposed critical habitat are competition with harmful non-native species, water diversions, flood-control projects, and development of areas adjacent to and within proposed critical habitat near CNF. In addition, the elimination or reduction of crayfish, bullfrogs, and non-native fish is needed as well as ensuring adequate flow is retained in the rivers and creeks.

New Mexico Ridge-Nosed Rattlesnake

A. Status of the species within the action area

The Peloncillo population of New Mexico ridge-nosed rattlesnake is one of three known populations; the Animas and Sierra San Luis Mountains contain the other two populations. The population of New Mexico ridge-nosed rattlesnake on the Peloncillo Mountains is the only population of the subspecies within the action area of the CNF. Occupied habitat area is managed by the FS and BLM. Specifically, occupied area managed by the FS is found in proposed roaded backcountry, wild backcountry and wilderness study areas. These areas on CNF within Peloncillo Mountains are composed of 88,083 acres located on the Douglas Ranger District of the CNF. Within the Peloncillo Mountains, a total of 27 New Mexico ridge-nosed rattlesnakes have been found in 13 general areas (USFWS 2002). The relatively low number (27 snakes) may be attributed to the difficulty in locating this subspecies in the Peloncillo Mountains. To date, there have been no effective methods developed for surveying the New Mexico ridge-nosed rattlesnake. Current methods take 30-50 person days to locate a single snake, so surveying and monitoring is not cost effective. No surveying or monitoring of New Mexico ridge-nosed rattlesnake populations has been conducted since the 2005 BO/CO (USFS 2009, 2010). However, the Forest has monitored New Mexico ridge-nosed rattlesnake habitat through its rangeland vegetation condition, trend and utilization analyses.

Holycross and Smith (2001) prepared a report and mapped New Mexico ridge-nosed rattlesnake habitat in the Peloncillo Mountains. Habitats were mapped as: 1) habitats probably or likely supporting (the FWS equates this to reasonably certain to be occupied) a deme of New Mexico ridge-nosed rattlesnake (habitats 3 and 4); 2) habitats very unlikely or unlikely to have New Mexico ridge-nosed rattlesnake occurring there (habitats 1 and 2); and 3) potential habitats that burned destructively in the Maverick prescribed fire and no longer contain habitat characteristics. A total of 275 habitat patches were identified in the Peloncillo Mountains; 233 patches were ranked as habitats 3 and 4, totaling 5,070 acres. The FWS considers this amount of acreage reasonably certain to be occupied. Holycross and Smith (2001) also provide a map of potential core habitat, based upon a comparison of the known occupied locations and the potential available habitat within the Peloncillo Mountains. This map does not include all habitats used by New Mexico ridge-nosed rattlesnake, but only core habitats found in canyon woodlands that are typically used during the active season. Designated critical habitat for the New Mexico ridge-nosed rattlesnake does not include FS lands, nor does it occur within the action area.

B. Factors affecting the species within the action area

Factors affecting the New Mexico ridge-nosed rattlesnake and its associated habitat within the Peloncillo Mountains include illegal collection, wildfires, prescribed fires, and low to moderate levels of recreational activities. Potential threats to the New Mexico ridge-nosed rattlesnake include fuel wood harvest, mining, improper grazing management, and development (USFWS 1985, 2002).

Collection and commercial exploitation of the New Mexico ridge-nosed rattlesnake has occurred in the past, and may still continue. During the 1960’s and 1970’s, as the taking of species in

Mexico and Arizona became more difficult, the collection of New Mexico ridge-nosed rattlesnakes increased. Increased poaching (collection) has been known to significantly impact New Mexico ridge-nosed rattlesnake populations (USFS 2004a).

Catastrophic, stand-replacing fire events are a serious threat to New Mexico ridge-nosed rattlesnake and its woodland habitat. Altered fire regimes in the southwestern U.S. have caused woody fuel loads to build up in woodland habitats, increasing the risk for high intensity stand-replacing fires (USFS 2004b). Such catastrophic fires can destroy habitat essential to the survival of the species and pose a serious threat to the New Mexico ridge-nosed rattlesnake (USFWS 2001). In 1997, the Maverick prescribed fire occurred in two of the 13 areas known to be occupied by New Mexico ridge-nosed rattlesnake in the Peloncillo Mountains. In 2003, the Baker II prescribed fire was successfully implemented. The perimeter of the burn encompassed approximately 47,000 acres. Post fire evaluation of the New Mexico ridge-nosed rattlesnake habitat as identified by Holycross and Smith (2001) showed that about 9 percent of the type 3 and 4 habitats within the burn were affected by high-intensity fire effects (Helbing 2004).

Since the Biological Assessment (USFS 2015) was written in May 2015, 2 large wildfires have occurred within the Peloncillo Mountains. The Guadalupe Fire began June 2, 2015 and burned through 5,974 acres. The Hog Fire began June 17, 2015 and burned through 8,057 acres. These 2 fires combined, burned through 5 of the 6 known New Mexico ridge-nosed rattlesnake locations within the Peloncillo Mountains.

In September of 2004, the CNF completed a BA for the Peloncillo Programmatic Fire Management Plan (USFS 2004b). Objectives of the fire plan consist of reducing catastrophic fires, developing mosaic habitat patterns, and promoting natural ecological processes (USFS 2004b). Activities associated with the implementation of this plan may kill or injure New Mexico ridge-nosed rattlesnakes through the use of heavy equipment and fire effects from back burns and prescribed burns. These activities may also contribute to an increase in snake predation due to loss of ground cover, potentially reduce prey species numbers, and alter suitable habitat as to significantly disrupt normal behavior patterns including, but not limited to, breeding, feeding, or sheltering.

On March 18, 2005, the FWS issued a BO on the FS's Peloncillo Programmatic Fire Management Plan (USFWS 2005b). The FWS concluded that the proposed action of the fire plan was "not likely to jeopardize" the continued existence of the New Mexico ridge-nosed rattlesnake. However, incidental take was anticipated as a result of the fire plan. This BO quantified take by the number of individuals for actions where it is relatively easy to detect individuals. For projects on a scale where detection of individuals is extremely unlikely, the FWS used potential core habitat ranked by Holycross and Smith (2001) as "habitats probably or likely supporting a deme of *C. w. obscurus*" (habitats 3 and 4) as a surrogate for take. The FWS anticipated the following incidental take for the New Mexico ridge-nosed rattlesnake as a result of the fire plan:

1. One New Mexico ridge-nosed rattlesnake will be killed or injured; or
2. Up to 10 percent of delineated core habitat ranked as 3 or 4 (Holycross and Smith 2001), in Fire Management Areas IV and V (Upper Cloverdale Creek Watershed) will be affected by high-intensity fire during the life of the fire plan. A high canopy consuming fire is one where 90 to 100 percent of the wooded overstory canopy is burned off; or

3. Up to 20 percent of delineated core habitat ranked as 3 or 4 (Holycross and Smith 2001), in the remaining Fire Management Areas will be affected by high-intensity fire during the life of the fire plan (USFWS 2005b).

The Incidental Take Statement for the New Mexico ridge-nosed rattlesnake from the Peloncillo Programmatic Fire Management Plan BO covers all effects of prescribed fire and related activities for a period of 10 years. Implementation of this project and the issuance of incidental take associated with it are both ongoing and are in addition to this BO.

Recreational activities and off-highway vehicles use have the potential to directly and indirectly affect the New Mexico ridge-nosed rattlesnake. In 2007, the CNF had 2.8 million visitors (USFS 2013b), and the capacity at developed recreation sites is approximately 15,000 visitors (USFS 2004a). Although the CNF restricts the use of motorized vehicles to existing trails and roadways, snake mortalities associated with vehicle use have been known to affect the New Mexico ridge-nosed rattlesnake (USFS 2004a).

The lands within proposed roaded backcountry, wild backcountry and wilderness study areas are suitable for livestock forage. The effects of livestock grazing on the New Mexico ridge-nosed rattlesnake are largely speculative and poorly studied. Potential impacts from livestock grazing to the New Mexico ridge-nosed rattlesnake may include trampling and habitat degradation. Improper livestock grazing is believed to reduce snake hiding and prey cover, and reduces available habitat (USFWS 1985, 1999). Although permitted, the recent drought has limited the grazing of livestock within these areas.

In 2002, the FWS issued a BO on the FS's On-going and Long-term Grazing Activities on the CNF (USFWS 2002). The 2002 BO addressed the continued grazing of domestic livestock on 190 allotments, as well as the effects of associated roads and other range projects. The FWS concluded that the proposed action of the continued grazing was not likely to jeopardize the continued existence of the New Mexico ridge-nosed rattlesnake. Yet, incidental take was anticipated as a result of the proposed grazing activities. The 2002 BO authorized the taking of two New Mexico ridge-nosed rattlesnake as a result of direct impacts, including trampling by cattle or horses associated with grazing, snakes run over by vehicles associated with livestock grazing, snakes killed by permittees or ranch hands, and construction and maintenance of range projects. Take was also authorized for two New Mexico ridge-nosed rattlesnake as a result of indirect effects of livestock grazing, including reduction of vegetation cover quantity or quality, which increases predation and lowers prey availability, reducing reproductive output and/or increases snake mortality (USFWS 2002). The Incidental Take Statement for the 2002 BO covers all effects associated with livestock grazing on the CNF for a period of 10 years. This consultation was originally conducted in 2002, but, since the 2005 BO/CO was issued, the CNF reinitiated the grazing consultation as described below.

Since the 2012 BO/CO, one consultation has occurred that may affect the New Mexico ridge-nosed rattlesnake. In 2012, we consulted on the reauthorization of the BLM Gila District Livestock Grazing Program (USFWS 2012). Our BO concluded that the action would neither jeopardize the continued existence of the New Mexico ridge-nosed rattlesnake, nor result in destruction or adverse modification of critical habitat. In the 2012 BO, FWS concluded that BLM will implement conservation measures to improve or maintain habitat conditions for the rattlesnake, including managing for the standards and guidelines, rattlesnake habitat on the BLM allotments represents a relatively minor percentage of habitat in the Peloncillo Mountains and the current range of the species, no New Mexico ridge-nosed rattlesnakes have been found on the BLM allotments, and no critical habitat occurs in the action area. Thus, the 2012 BO authorized the same level of incidental take, effects of the take, reasonable and prudent measures, and terms and conditions as authorized in the 1997 BO except the take was extended for the duration of the reissued grazing permits. Implementation of this ongoing project and the issuance of incidental take are covered under this programmatic opinion since it supersedes the 2005 LRMP BO/CO. We have reviewed this site-specific project to ensure that it will not further diminish the conservation contribution of critical habitat to the recovery of the New Mexico ridge-nosed rattlesnake.

Timber harvesting has been classified as unsuitable in all areas within proposed roaded backcountry, wild backcountry and wilderness study areas. However, the lands are suitable for fuel wood harvesting (USFS 2013). The harvesting of fuel wood has the potential to destroy or damage habitat essential to the survival of the New Mexico ridge-nosed rattlesnake.

Mineral operations and utility right-of-ways have the potential to directly and indirectly affect the New Mexico ridge-nosed rattlesnake through habitat destruction and disturbance (USFS 2004a). Access roads and the accompanying vehicle traffic are a necessary component of minerals activities. The use of heavy equipment along with surface occupancy causes direct habitat loss. In addition, human occupation increases the chances for harassment and displacement of the New Mexico ridge-nosed rattlesnake (USFS 2004a).

There have been no reported changes to designated critical habitat since the 2012 BO. No critical habitat occurs on or near the CNF.

Gila Chub

A. Status of the species and critical habitat within the action area

The action area for this PBO/PCO encompasses all lands under the jurisdiction of the CNF and all adjacent lands that could be directly or indirectly affected by the proposed action (USFS 2016a).

Although Gila chub have not been found in some of the localities listed in the final rule in recent years, these streams may still be occupied. The Gila chub is currently restricted to small isolated populations scattered throughout its historical range. Approximately half of all known Gila chub occupied habitat occur of NFS lands. Most populations on NFS lands are considered to be small, isolated and threatened. Populations of Gila chub are present on land managed by the CNF in Romero Creek (repatriated in 2005) and Sabino Creek on the Santa Catalina Ranger District and Turkey Creek and O'Donnell Creek on the Sierra Vista Ranger District. In 2015 Romero Canyon, O'Donnell Creek and Turkey Creek populations were considered small and Sabino Canyon population was considered medium size (USFWS 2015). Turkey Creek was classified as extirpated at the time of the designation of critical habitat, but a small population of chub was reestablished in November 2005.

Sampling by AGFD in 2012 and 2015 found no Gila chub in the Pima County Cienega Creek Natural Preserve (CCNP) (Timmons and Upton 2013, Timmons, pers. comm., October 13, 2015). Gila chub were last seen in the Pima County CCNP in 2014 (Caldwell 2014) and the population is considered low (USFWS 2015). These locations are within the action area.

Recent surveys suggest that Gila chub continue to be abundant in upper Cienega Creek (Rosen *et al*. 2013, Simms 2014d, Simms and Ehret 2014). Surveys in 2007 and later demonstrate that Gila chub have recolonized Mattie Canyon following heavy flooding and extreme sedimentation resulting from collapse of a grade control structure in 2001. No chub have ever been observed in Empire Gulch since BLM acquired Las Cienegas National Conservation Area in 1988, and no other records exist that indicate chub occur there.

Hatch (2015) analyzed fish counts conducted by the BLM from 2005 through 2012, and based on these counts estimated positive mean growth rates for this species in two populations in Cienega Creek. Positive mean growth rates indicate that this specific population on Cienega Creek is tending to increase, not shrink.

Sporadic capture records of Gila chub from small, poorly-watered tributaries to Hot Springs/Bass canyons (Double R and Wildcat canyons) are suggestive of transitory populations associated with the core metapopulation in Hot Springs/Bass canyons (USFWS 2015). The same situation holds for Gila chub captured in Mattie Canyon, Empire Gulch, and lowermost Cienega Creek, which we believe are sustained by the main population found in upper Cienega Creek (USFWS 2015). We also consider historical capture records of Gila chub from Post Canyon and Turkey Creek (Arizona) metapopulations dependent upon the major source population in O'Donnell Canyon for their persistence. Therefore, Double R Canyon, Post Canyon, Wildcat Canyon, lower Cienega Creek, and Mattie Canyon are not listed as independent populations.

The status of Gila chub populations within the action area is presented in Table GC-1; however, in most cases we do not have adequate population trend data to determine if a population is stable, increasing, or decreasing in abundance. Not all streams with recent records of Gila chub occupancy are considered self-sustaining populations independent of an adjacent, larger source population. Some of these records appear to reflect sporadic or transitory occupancy suggestive of interactions with a local source population. Without the presence of the larger source population, it is unlikely the species would be found there. This type of occupancy pattern fits a metapopulation model of population dynamics, defined as a set of local populations that interact via individuals moving among populations (Hanski and Gilpin 1991). Although these smaller metapopulation habitats may not be independently sustainable, that does not necessarily diminish their importance toward fulfilling certain life history functions of the species.

Critical habitat

There are two designated critical habitat areas on the CNF. Area 3 - Babocomari River, Santa Cruz County, Arizona includes O'Donnell Canyon and Turkey Creek (Arizona); Area 5 – Lower Santa Cruz River, Pima County, Arizona, includes Cienega Creek, Mattie Canyon, Empire Gulch, and Sabino Canyon. The following creeks are all within designated critical habitat on the CNF: Sabino Creek, Turkey Creek and O'Donnel Creek. CNF contains 8.7 miles of designated critical habitat for Gila chub. In addition, critical habitat Area 4 – Lower San Pedro River, Cochise and Graham counties, Arizona, which includes Bass Canyon, Hot Springs Canyon, and Redfield Canyon all have headwaters which originate on CNF, therefore would be within the action area.

B. Factors affecting the species and critical habitat within the action area

On the CNF, past and present federal, state, private, and other human activities that may affect Gila chub and their habitat include livestock grazing, wildfires, non-native species and any other habitat alterations. We describe activities that have occurred within the CNF to qualify the environmental baseline.

Livestock grazing
Historically improper livestock grazing and logging likely contributed to habitat modifications noted by Miller (1950). The historical occurrence of intensive grazing and resulting effects on the land are indicated in published reports dating back to the early 1900s (Rixon 1905, Rich 1911, Duce 1918, Leopold 1921, Leopold 1924). However, on NFS lands today, improper livestock grazing does not occur.

Improper livestock grazing has been shown to increase soil compaction, decrease water infiltration rates, increase runoff, change vegetative species composition, decrease riparian vegetation, increase stream sedimentation, increase stream water temperature, decrease fish populations and change channel form (Meehan and Platts 1978, Kauffman and Kruger 1984, Schulz and Leininger 1990, Platts 1991, Fleischner 1994, Ohmart 1996). Although direct impacts to the riparian zone and stream can be the most obvious sign of livestock grazing, upland watershed condition is also important because soil compaction, changes in percent cover, and vegetative type can influence the timing and amount of water delivered to stream channels (Platts 1991, Ohmart 1996, Belsky and Blumenthal 1997). As a consequence, streams are more likely to experience flood events that negatively affect the aquatic and riparian habitats and are more likely to become intermittent or dry in the fall (groundwater recharge is less when water runs off quickly) (Platts 1991, Ohmart 1996).

The emphasis of the rangeland management program on the CNF is to improve watershed condition and wildlife habitat. Livestock grazing is currently active in both occupied and designated critical habitat within the Turkey Creek watersheds.

Fire
Since 2002, there have been several fires that have burned over 150,000 acres in the CNF that are near or around both occupied and designated critical habitat for Gila chub. In May 2005, Gila chub were salvaged from Sabino Canyon during the Aspen Fire and were subsequently returned. The population is now thriving in Sabino Creek. Gila chub continue to persist post-fire in O'Donnel and possibly Turkey Creeks.

Because Gila chub are now found primarily in isolated, small streams, avoidance of ash flows may be impossible and opportunities for natural recolonization usually do not exist, as documented for Gila trout (Brown *et al*. 2001). Persistence of Gila chub in streams affected by fire and subsequent ash flows depend on management actions. In some instances, evacuation of Gila chub from streams in watersheds that have burned is deemed necessary and approprioate actions are taken, and in other cases populations are lost and must be replaced through stocking or translocation.

Non-native species
Non-native species that are problematic for Gila chub, including crayfish, green sunfish (*Lepomis cyanellus*), common carp (*Cyprinus carpio*), bluegill (*Lepomis macrochirus*), and largemouth bass (*Micropterus salmoides*) (Rosen *et al*. 2013; USFWS files), have been found in the Cienega Creek watershed at one time or another. At present, green sunfish, western mosquitofish (*Gambusia affinis*), and crayfish are known to be present in the watershed.

Climate change
Climate change predicts four major effects on the Gila chub habitat:

- increased water temperature;
- decreased streamflow;
- a change in the hydrograph; and
- an increased occurrence of extreme events (fire, drought, and floods).

Increased water temperature
Kundzewicz *et al*. (2007) state that of all ecosystems, freshwater ecosystems will have the highest proportion of species threatened with extinction due to climate change. Species with narrow temperature tolerances will likely experience the greatest effects from climate change and it is anticipated that populations located at the margins of species hydrologic and geographic distributions will be affected first (Meisner 1990). High temperatures suppress appetite and growth, foster disease, can influence behavioral interactions with other fish (Schrank *et al*. 2003), or be lethal (McCullough 1999). The temperature preferences and tolerances of Gila chub is less than 98.6 °F. However, increased stress from elevated temperatures could lead to greater susceptibility to disease, as well as reduced reproductive success and lower oxygen levels.

Decreased streamflow
Current models suggest a decrease in precipitation in the Southwest (Kundzewicz *et al*. 2007, Seager *et al*. 2007) which would lead to reduced streamflows and a reduced amount of habitat for Gila chub. Streamflow is predicted to decrease in the Southwest even if precipitation were to increase moderately (Nash and Gleick 1993, State of New Mexico 2005, Hoerling and Eischeid 2007). Winter and spring warming causes an increased fraction of precipitation to fall as rain, resulting in a reduced snow pack, an earlier snowmelt, and decreased summer base flow (Christensen *et al*. 2004, Stewart *et al*. 2005, Regonda *et al*. 2005). Earlier snowmelt and warmer air temperatures can lead to a longer dry season. Warmer air temperatures lead to increased evaporation, increased evapotranspiration, and decreased soil moisture. These three factors would lead to decreased streamflow even if precipitation increased moderately.

The effect of decreased streamflow is that streams become smaller, intermittent or dry, and thereby reduce the amount of habitat available for aquatic species. A smaller stream is affected more by air temperature than a larger one, exacerbating the effects of warm and cold air temperatures (Smith and Lavis 1975). In addition, fish isolated in pools may be subject to increased predation from terrestrial predators.

Change in the hydrograph
Another documented effect of climate change is a shift of the timing of spring snowmelt. Stewart *et al.* (2005) show that timing of spring streamflow in the western U.S. during the last 5 decades has shifted so that the major peak now arrives 1 to 4 weeks earlier, resulting in less flow

in the spring and summer. They conclude that almost everywhere in North America, a 10 to 50 percent decrease in spring-summer streamflow fractions will accentuate the seasonal summer dry period with important consequences for warm-season water supplies, ecosystems, and wildfire risks (Stewart *et al*. 2005). Rauscher *et al*. (2008) suggest that with air temperature increases from 37 to 41 °F, snowmelt driven runoff in the western U.S. could occur as much as 2 months earlier than present. Changes in the hydrograph could potentially alter fish assemblages. Variability in the hydrographs and greater flow volume has been shown to sustain native fishes (e.g., as seen for spikedace and loach minnow) over non-natives between periodic flood events (Rinne and Miller 2006).

Increased occurrence of extreme events
Extreme events such as drought, fires, and floods are predicted to occur more frequently because of climate change (IPCC 2007). It is anticipated that an increase in extreme events will most likely affect populations living at the edge of their physiological tolerances. The predicted increases in extreme temperature and precipitation events may lead to dramatic changes in the distribution of species or to their extirpation or extinction (Parmesan and Matthews 2006).

Drought
The Southwest U.S. is currently experiencing drought conditions (University of Nebraska-Lincoln 2010). Portions of New Mexico are also considered abnormally dry, but not in areas currently occupied by Gila chub (University of Nebraska-Lincoln 2010). Although Gila chub evolved in the Southwest and have survived drought in the past, it is anticipated that a prolonged, intense drought would affect many populations, in particular those occupying small headwater streams which are likely to dry or become intermittent. In addition, with streams drying there is a clear association between severe droughts and large fires in the Southwest (Swetnam and Baisan 1996) that can harm fish.

Fire
Since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period 1970 to 1986. The total area burned is more than six and a half time the previous level (Westerling *et al*. 2006). In addition, the average length of the fire season during 1987 to 2003 was 78 days longer compared to 1970 to 1986 and the average time between fire discovery and control increased from about 8 to 37 days for the same time frames (Westerling *et al*. 2006). McKenzie *et al.* (2004) suggest, based on models, that the length of the fire season will likely increase and fires in the western U.S. will be more frequent and severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming (McKenzie *et al*. 2004).

Severe wildfires capable of extirpating or decimating fish populations are a relatively recent phenomena and result from the cumulative effects of historical or ongoing grazing, which removes the fine fuels needed to carry fire and fire suppression (Madany and West 1983, Savage and Swetnam 1990, Swetnam 1990, Touchan *et al*. 1995, Swetnam and Baisan 1996, Belsky and Blumenthal 1997, Gresswell 1999). Historical wildfires were primarily cool-burning understory fires with return intervals of 3 to 7 years in ponderosa pine (Swetnam and Dieterich 1985). Cooper (1960) concluded that prior to the 1950s; crown fires were extremely rare or nonexistent in the region.

Effects of fire may be direct and immediate or indirect and sustained over time (Gresswell 1999). The cause of direct fire-related fish mortalities has not been clearly established. Fatalities are most likely during intense fires in small, headwater streams with low flows (less insulation and less water for dilution) (Gresswell 1999). In these situations, water temperatures can become elevated or changes in pH may cause immediate death (Cushing and Olson 1963). Spencer and Hauer (1991) documented 40-fold increases in ammonium concentrations during an intense fire in Montana. The inadvertent dropping of fire retardant in streams is another source of direct mortality during fires.

Indirect effects of fire include ash and debris flows, increases in water temperature, increased nutrient inputs, and sedimentation (Swanston 1991, Bozek and Young 1994, Gresswell 1999). Ash and debris flows can cause mortality months after fires occur when barren soils are eroded during monsoonal rain storms (Bozek and Young 1994, Brown *et al*. 2001). Fish can suffocate when their gills are coated with fine particulate matter, they can be physically injured by rocks and debris, or they can be displaced downstream below impassable barriers into habitat occupied by non-native fish. Ash and debris flows or severe flash flooding can also decimate aquatic invertebrate populations that fish may depend on for food (Molles 1985, Rinne 1996, Lytle 2000). In larger streams, refugia are typically available where fish can withstand the short-term adverse conditions; small headwater streams are usually more confined, concentrating the force of water and debris (Pearsons *et al*. 1992, Brown *et al*. 2001).

Floods
Floods that occur after intense wildfires that have denuded the watershed are also a threat. As described above, several streams occupied by Gila trout have had populations extirpated as a result of ash flows from floods after fire (Rinne 1996, Brown *et al*. 2001). Consequently, an increase in rain or snow events, intense precipitation that is unseasonable or heavy precipitation that occurs after fire, could extirpate affected Gila chub.

The conjunction of climate change with ongoing habitat loss and alteration; and non-native species competition has caused a general loss of resiliency in the ecosystem that has serious consequences for Gila chub.

Yaqui Chub

A. Status of the species and critical habitat within the action area

At the time of the 2005 consultation, it was believed that Yaqui chub occurred within the El Coronado Ranch, West Turkey Creek, and the CNF. Roughly 4 miles of potential Yaqui chub habitat exists within West Turkey Creek. Of this, about 2.5 miles are within the Turkey Creek Allotment on the CNF. However, Yaqui chub have not been found in West Turkey Creek since 2003 (USFS 2008) largely due to the ephemeral nature of the habitat and ongoing drought. Further, pool habitats within the CNF have likely diminished in quantity and quality due to drought and sediment flows following wildfires, although this has not been documented using a standardized habitat assessment methodology. Downstream of the CNF, however, healthy populations persist in private ponds and in perennial stream reaches at El Coronado Ranch.

Critical Habitat
There is no Yaqui chub critical habitat designated on the Forest. Critical habitat does exist about 10 miles away on the San Bernardino NWR.

On the San Bernardino/Leslie Canyon NWR, annual monitoring in 2009 showed that the percent habitat occupied for Yaqui chub was 50.8 percent for all impoundments, up from 35 percent in 2008, and at the Bar Boot Ranch, where Yaqui chub were stocked through implementation of a Safe Harbor Agreement, 58 percent of the habitat was occupied with many juveniles present (USFWS 2010).

B. Factors affecting the species and critical habitat within the action area

The following factors affecting the Yaqui chub are reiterated from the 2012 BO/CO. A Section 10(a)(1)(B) permit was issued in 1998 approving the Habitat Conservation Plan (HCP) for the El Coronado Ranch in Cochise County, Arizona (USFWS 1998). The HCP is effective for 25 years and covers 15,204 acres of the Turkey Creek basin occurring on the private lands of the El Coronado Ranch and several grazing allotments on the CNF. The goals of the HCP include watershed management, improved riparian condition, continued operation of the ranch, and conservation and recovery of native species. The Section 10(a)(1)(B) permit covers incidental take of Yaqui chub, Yaqui catfish, and the Yaqui form of longfin dace, should it ever be listed. Implementation of the HCP should lead to improved watershed and habitat conditions for native fish in the watershed.

Forest Road 41 more or less parallels Turkey Creek and ends in a trailhead at the Wilderness boundary. This is one of four trailheads that accesses wilderness recreation trails from West Turkey Creek. Along with the El Coronado Ranch, there are 14 recreational summer homes, two semi-developed campgrounds, and several dispersed camping sites in use within the canyon on the CNF. The West Turkey Creek Native Fish Habitat Renovation Project underwent formal consultation on February 4, 1999 (USFWS 1999). The goal of this project was to maintain West Turkey Creek as a native fishery and remove non-native fishes. Two treatments have been conducted so far and appear to have been successful.

In 1994, the Rattlesnake Fire, produced significant quantities of ash and other debris which were subsequently transported downstream into West Turkey Creek. Nevertheless, the resident non-native rainbow trout, native longfin dace, and Yaqui chub survived. However, the event did not impact the watershed equally. The majority of the debris flows affected the lower reaches of West Turkey Creek via Saulsbury and Ward Canyons.

In 2011, the Horseshoe 2 wildfire burned a total of 222,954 acres, including 192,647 acres of NFS lands (CNF, pers. comm. 2011). Suppression activities associated with this wildfire likely did not result in adverse effects to the Yaqui chub; however, it is likely that habitat and individuals were affected by ash and sediment flow following the wildfire. During the wildfire and prior to flooding, fish were salvaged from West Turkey Creek and placed in private ponds on El Coronado Ranch. No effects to the ponds or individuals in the ponds were identified from either the suppression activities or the wildfire.

Critical Habitat

Within this consultation the analysis of effects to Yaqui chub critical habitat considers only indirect effects of FS actions to San Bernardino NWR (10 miles downstream) because designated critical habitat does not occur within the CNF. Any activity which would lower the ground water level to the extent that the water flow from springs on San Bernardino NWR would be reduced could adversely impact the critical habitat. Such activities include, but are not limited to, pumping of ground water for agricultural purposes and drilling activities associated with geothermal exploration. Any activity which would significantly alter the water chemistry of springs on San Bernardino NWR could adversely impact the critical habitat. Such activities include, but are not limited to, release of chemical or biological pollutants into surface or underground waters at a point source or by dispersal release.

Gila Topminnow

A. Status of the species within the action area

The CNF population in Redrock Canyon (Sierra Vista Ranger District) was, until 2005, the only natural relict population (USFS 2004). The Redrock population appeared to be extirpated. In 2010 however, efforts were made to reestablish the Redrock population. Many occupied Gila topminnow sites' watersheds contained within or adjoin NFS lands (i.e. Redfield Canyon, Cienega Creek, Bass Canyon, O'Donnell Canyon, and Aravaipa Creek downstream from the CNF). Table GT-1 shows the reestablished populations of Gila topminnow. From 2006 – 2015, 13 wild and 23 captive populations have been established in Arizona (AGFD 2015).

On September 30, 2015 AGFD biologists confirmed the presence of Gila topminnow downstream of Parker Canyon Dam (AGFD 2015). In November 2015 surveys of Lower Santa Cruz River near Nogales found Gila topminnow for the first time in 10 years (AGFD 2015).

The natural population of Gila topminnow in Las Cienegas National Conservation Area continues to be the only extant one on public lands and it is by far the largest of all remaining natural populations in the United States (Simms and Simms 1992, Bodner *et al*. 2007). The only other public land population, Redrock Canyon on the CNF, was extirpated in 2008 (Duncan 2013). The first repatriation of Gila topminnow into the upper Cienega Creek watershed took place in October 2001 at Empire Gulch, followed with additional releases. However, reestablishment of Gila topminnow at Empire Gulch has failed (Simms 2010, USFWS files). This is likely due to high levels of aquatic vegetation and aquatic invertebrate predators of Gila topminnow in Empire Gulch (Bodner *et al*. 2007). The lower reaches (CC5 & CC7) of upper Cienega Creek appear to have a stable, although small, Gila topminnow population, but because of how data were collected, even that is uncertain (Bodner *et al.* 2007).

Sampling by AGFD in 2012 and 2015 found Gila topminnow in the Pima County CCNP at two sampling sites (Timmons and Upton 2013; Timmons, AGFD, pers. comm., October 13, 2015). Recent surveys suggest that Gila topminnow continue to be abundant in upper Cienega Creek (Rosen *et al*. 2013, Simms 2014d, Simms and Ehret 2014).

In June 1982, AGFD released 2000 Gila topminnow into Sabino Creek, but only two individuals were observed in the creek six months later (Weedman 1999). Flooding, recreational impacts, cold water temperatures and the presence of green sunfish may have caused this release effort to fail (Voeltz and Bettaso 2003). Sabino Creek was recommended for stocking in the draft revised Recovery Plan (Weedman 1999) and in August of 2015, 510 fish were released into the canyon above the last creek crossing (Mosher *et al*. 2016). An additional 985 Gila topminnow were stocked into Sabino Creek on August 30, 2016 (Mosher 2016b).

Surveys by AGFD in June 2016 recorded 72 Gila topminnow. No Gila topminnow were found in the stocking location, but they were found downstream of there to near tram stop 8 (Mosher

2016a). After reports of Gila topminnow in Bear Canyon in April, 2016, fish surveys found them there in May (Bonar *et al*. 2016), and June (Mosher 2016a).

B. Factors affecting the species within the action area:

The FWS transmitted a BO to the CNF regarding the release of Gila topminnow into Sabino Creek (22410-2009-F-0143) on August 12, 2009. The action consulted on was recreation, and how that would affect the topminnows once they were released. Gila topminnow were released in both 2015 and 2016.

In June 2008, the FWS transmitted a BO to the CNF regarding the application of piscicide in Redrock Canyon to remove non-native invasive fish and to re-establish populations of native species, including Gila topminnow. The Forest completed analysis of this proposal under the National Environmental Policy Act and authorized the project in 2011. However, AGFD has placed the project on hold pending statewide review of their piscicide program.

The Gila topminnow's status within the action area is not secure; the previously occupied sites in Redrock Canyon have not demonstrated occupancy since 2005. The reestablishment history of Gila topminnow illustrates that even sites that were thought to be secure may fail for various reasons. Gila topminnow on federal lands is widely dispersed and in some cases vulnerable to events beyond the respective land management agencies' control. Such actions would include invasions or unauthorized introductions of non-native fishes and stochastic events such as floods. Infrequent yet large floods have transported topminnow (Unnamed Drainage 68B) or destroyed structures intended to minimize the effects of livestock use (BLM's Tule Creek and Cienega Creek). The risk associated with maintaining Gila topminnow for the long-term across such a diversity of sites renders the species' status within the action area as tenuous as it is rangewide.

Gila Trout

A. Status of the species within the action area

Although the historical distribution of Gila trout is not known with certainty (Behnke 2002), based on the location of remnant populations, the Gila River drainage represents the core of the historical distribution. Frye Creek, Marijilda Creek and Ashe Creek currently have Gila trout within the action area. Frye Creek was stocked with South Diamond lineage in 2009 (500 fish), and again in February 2011. In addition, Ashe Creek was also stocked with Spruce Creek fish a few times. AGFD is planning restoration work at both Marijilda and Frye Creeks in 2019 and 2020.

B. Factors affecting the species within the action area

On the CNF, past and present federal, state, private, and other human activities that may affect Gila trout and their habitat include: livestock grazing, timber harvest, wildfire, recreational activities, and any other habitat alterations. In addition, the stocking of non-native trout by AGFD and private citizens in the early to mid-1900s is also included in the environmental baseline. We describe activities that have occurred within the CNF to qualify the environmental baseline.

Recreational activities
In 2005, the FWS published a 4(d) rule states that you may take Gila trout in accordance with applicable State fish and wildlife conservation laws and regulations to protect this species in the States of New Mexico or Arizona. Fishing is allowed in Arizona at Frye Mesa Reservoir.

Livestock grazing
In the late 1800s and early 1900s, livestock grazing was unregulated over many of the watersheds that contained Gila trout and much of the landscape was denuded of vegetation (Rixon 1905, Duce 1918, Leopold 1921, Leopold 1924, Ohmart 1996). Livestock grazing is carefully managed now, which has resulted in less impact to streams occupied by Gila trout. Cost-effective management systems and techniques, including fencing and water development, are designed and applied to obtain relatively uniform livestock distribution and use of forage and to maintain plant vigor. Improved management grazing practices (e.g., fencing) have reduced livestock access and impacts to streams. Frye and Marijilda Creeks are within Marijilda and the Hawk Hollow allotments, which are currently the only active grazing allotments within Gila trout occupied habitat on CNF.

Timber harvest
Logging activities in the early to mid-1900s likely caused major changes in watershed characteristics and stream morphology (Chamberlin *et al.* 1991). Early logging efforts were often concentrated along canyon bottoms with perennial streams. Tree removal along perennial streams within the historical range of Gila trout likely altered water temperature regimes, sediment loading, bank stability, and availability of large woody debris (Chamberlin *et al.* 1991). Timber harvest is not currently allowed in wilderness or primitive areas.

Fire
High-severity wildfires and subsequent floods and ash flows caused the extirpation of seven populations of Gila trout since 1989 including: Main Diamond Creek (1989), South Diamond Creek (1995), Burnt Canyon (1995), Trail Canyon (1996), Woodrow Canyon (1996), Sacaton Creek (1996), and Upper Little Creek (2003) (Propst *et al.* 1992, Brown *et al.* 2001, USFWS 2002). Gila trout in Frye Creek were introduced in November of 2009 and February 2011, and the most recent fire in this area was the Frye Mesa Fire in 2008 that burned more than 3,460 acres. This fire was downstream of Frye Creek and did not impact the introduction effort of Gila trout in 2009 and 2011.

Gila trout are now found primarily in isolated, small streams, avoidance of ash flows may be impossible and opportunities for natural recolonization usually do not exist (Brown *et al.* 2001). Persistence of Gila trout in streams affected by fire and subsequent ash flows depend on management actions. In some instances, evacuation of Gila trout from streams in watersheds that have burned is deemed necessary and actions are taken, and in other cases populations are lost and must be replaced through stocking (USFWS 2006b). There have been at least 7 different Gila trout evacuation due to fire. Evacuated Gila trout were used as broodstock for reintroduction efforts or reintroduced at a later time when both direct and indirect fire impacts are no longer a threat.

Non-native species
Perhaps the most serious threat to Gila trout is predation, competition and hybridization with non-native salmonids (i.e. brown and rainbow trout). The impacts of non-native trout species on

native fish including Gila trout or other trout species have been well documented (Miller 1950, Behnke and Zarn 1976, Sublette *et al*. 1990, Propst *et al*. 1992, Turner 1996). All non-native trout were eliminated from Frye Creek during flooding following the 2004 Nuttall-Gibson fire. The Forest is currently cooperating with FWS and AGFD to eliminate non-native trout from Ash Creek and Marijilda Creek.

Climate change
Four major effects on the Gila trout habitat are expected as a result of climate change:

- increased water temperature;
- decreased streamflow;
- a change in the hydrograph; and
- an increased occurrence of extreme events (fire, drought, and floods).

Increased water temperature
Kundzewicz *et al*. (2007) state that of all ecosystems, freshwater ecosystems will have the highest proportion of species threatened with extinction due to climate change (Kundzewicz *et al*. 2007). Species with narrow temperature tolerances will likely experience the greatest effects from climate change and it is anticipated that populations located at the margins of species hydrologic and geographic distributions will be affected first (Meisner 1990). Water temperature influences the survival of salmonids at all stages of their life cycle. Alterations in the temperature regime from natural background conditions negatively affect population viability, when considered at the scale of the watershed or individual stream (McCullough 1999). Salmonids are classified as coldwater fish with thermal preferences centered on 59 °F (Shuter and Meisner 1992). High temperatures suppress appetite and growth, foster disease, can influence behavioral interactions with other fish (Schrank *et al*. 2003), or be lethal (McCullough 1999). Salmonids inhabiting warm stream segments have higher probabilities of dying from stress (McCullough 1999). The temperature preferences and tolerances of Gila trout have not yet been determined. However, increased stress from elevated temperatures could lead to greater susceptibility to disease and reduced reproductive success.

Gila trout are found within small ranges with limited dispersal capabilities and narrow physiological tolerance (i.e., temperature) making them susceptible to extinction as the climate changes (Kennedy *et al*. 2009). Because Gila trout occur in the upper reaches of the watershed there is no suitable habitat to move to with increasing temperature. Based on the documented loss of occupied habitat, downstream temperatures may already be marginally suitable and in the future, they may become too warm to be suitable for Gila trout (Miller 1950). For example, by 1950, water temperature in the Gila River at Sapillo Creek was considered too warm to support any trout species (Miller 1950). Kennedy *et al*. (2009) determined that warm season habitat for Gila trout will be reduced by 70 percent, due to warmer temperature in combination with decreased precipitation in the summer, leading to increase in intensity and frequency of wildfires.

Decreased stream flow
Current models suggest a decrease in precipitation in the Southwest (Kundzewicz *et al*. 2007, Seager *et al*. 2007) which would lead to reduced stream flows and less habitat for Gila trout. Stream flow is predicted to decrease in the Southwest even if precipitation were to increase moderately (Nash and Gleick 1993, State of New Mexico 2005, Hoerling and Eischeid 2007).

Winter and spring warming causes an increased fraction of precipitation to fall as rain, resulting in a reduced snow pack, an earlier snowmelt, and decreased summer base flow (Christensen *et al*. 2004, Stewart *et al*. 2005, Regonda *et al*. 2005). Earlier snowmelt and warmer air temperatures can lead to a longer dry season. Warmer air temperatures lead to increased evaporation, increased evapotranspiration, and decreased soil moisture. These three factors would lead to decreased stream flow even if precipitation increased moderately.

The effect of decreased stream flow is that streams become smaller, intermittent or dry, and thereby reduce the amount of habitat available for aquatic species. A smaller stream is affected more by air temperature than a larger one, exacerbating the effects of warm and cold air temperatures (Smith and Lavis 1975). In addition, fish isolated in pools may be subject to increased predation from terrestrial predators.

Change in the hydrograph
Another documented effect of climate change is a shift of the timing of spring snowmelt. Stewart *et al.* (2005) show that timing of spring streamflow in the western U.S. during the last 5 decades has shifted so that the major peak now arrives 1 to 4 weeks earlier, resulting in diminished flow in the spring and summer. They conclude that almost everywhere in North America, a 10 to 50 percent decrease in spring-summer streamflow fractions will accentuate the seasonal summer dry period with important consequences for warm-season water supplies, ecosystems, and wildfire risks (Stewart *et al.* 2005). Rauscher *et al.* (2008) suggest that with air temperature increases from 37 to 41 °F, snowmelt driven runoff in the western U.S. could occur as much as two months earlier than present. The life history of salmonids is tied to the timing of runoff (Fausch *et al*. 2001). A change in timing or magnitude of floods can scour the streambed destroying eggs, or displace recently emerged fry downstream (Erman *et al*. 1988, Montgomery *et al*. 1999, Fausch *et al*. 2001).

Increased occurrence in extreme events
Extreme events such as drought, fires, and floods are predicted to occur more frequently because of climate change (IPCC 2007). It is anticipated that an increase in extreme events will most likely affect populations living at the edge of their physiological tolerances. The predicted increases in extreme temperature and precipitation events may lead to dramatic changes in the distribution of species or to their extirpation or extinction (Parmesan and Matthews 2006).

Drought
The Southwest U.S. is experiencing drought conditions (University of Nebraska- Lincoln 2010). Portions of New Mexico are also considered abnormally dry, but not in areas currently occupied by Gila trout (University of Nebraska-Lincoln 2010). Although Gila trout evolved in the Southwest and have survived drought in the past, it is anticipated that a prolonged, intense drought would affect many populations, in particular those occupying small headwater streams which are likely to dry or become intermittent. In addition to stream drying, there is a clear association between severe droughts and large fires in the Southwest (Swetnam and Baisan 1996).

Fire
Since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period 1970 to 1986. The total area burned is more than six and a half times the previous level (Westerling *et al*. 2006). In addition, the average length of the fire season

during 1987 to 2003 was 78 days longer compared to 1970 to 1986 and the average time between fire discovery and control increased from about 8 to 37 days for the same time frames (Westerling *et al*. 2006). McKenzie *et al.* (2004) suggest, based on models, that the length of the fire season will likely increase and fires in the western U.S. will be more frequent and severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming (McKenzie *et al*. 2004).

Severe wildfires capable of extirpating or decimating fish populations are a relatively recent phenomena and result from the cumulative effects of historical or ongoing grazing, which removes the fine fuels needed to carry fire and fire suppression (Madany and West 1983, Savage and Swetnam 1990, Swetnam 1990, Touchan *et al*. 1995, Swetnam and Baisan 1996, Belsky and Blumenthal 1997, Gresswell 1999). Historical wildfires were primarily cool-burning understory fires with return intervals of 3 to 7 years in ponderosa pine (Swetnam and Dieterich 1985). Cooper (1960) concluded that prior to the 1950s; crown fires were extremely rare or nonexistent in the region.

Effects of fire may be direct and immediate or indirect and sustained over time (Gresswell 1999). The cause of direct fire-related fish mortalities has not been clearly established. Fish fatalities are most likely during intense fires in small, headwater streams with low flows (less insulation and less water for dilution) (Gresswell 1999). In these situations, water temperatures can become elevated or changes in pH may cause immediate death (Cushing and Olson 1963). Spencer and Hauer (1991) documented 40-fold increases in ammonium concentrations during an intense fire in Montana. The inadvertent dropping of fire retardant in streams is another source of direct mortality during fires.

Indirect effects of fire include ash and debris flows, increases in water temperature, increased nutrient inputs, and sedimentation (Swanston 1991, Bozek and Young 1994, Gresswell 1999). Ash and debris flows can cause mortality months after fires occur when barren soils are eroded during monsoonal rain storms (Bozek and Young 1994, Brown *et al*. 2001). Fish can suffocate when their gills are coated with fine particulate matter, they can be physically injured by rocks and debris, or they can be displaced downstream below impassable barriers into habitat occupied by non-native trout. Ash and debris flows or severe flash flooding can also decimate aquatic invertebrate populations that trout may depend on for food (Molles 1985, Rinne 1996, Lytle 2000). In larger streams, refugia are typically available where fish can withstand the short-term adverse conditions; small headwater streams are usually more confined, concentrating the force of water and debris (Pearsons *et al*. 1992, Brown *et al*. 2001).

Increases in water temperature occur when the riparian canopy is eliminated by fire and the stream is exposed to increase solar insolation. After fires in Yellowstone National Park, Minshall *et al.* (1997) reported that maximum water temperatures were significantly greater in headwater streams affected by fire than in unburned streams and subsequent water temperatures often surpassed tolerance limits of salmonids. Warm water is stressful for salmonids and can lead to increases in disease and lowered reproductive potential (Bjornn and Reiser 1991). Salmonids need clean, loose gravel for spawning sites (Bjornn and Reiser 1991). Ash and fine particulate matter created by fire can fill the interstitial spaces between gravel particles eliminating spawning habitat or, depending on the timing, suffocating eggs that are in the gravel. Increases in water temperature and sedimentation can also impact aquatic invertebrates-changing species composition and reducing population numbers (Minshall 1984, Wiederholm 1984, Roy *et al.* 2003), consequently affecting the food supply of trout.

Floods
Floods that occur after intense wildfires that denuded the watershed are also a threat. As described above, several streams occupied by Gila trout have had populations extirpated as a result of ash flows after fire (Rinne 1996, Brown *et al*. 2001). Consequently, an increase in rain or snow events, intense precipitation that is unseasonable or heavy precipitation that occurs after fire, could extirpate local Gila trout populations.

The conjunction of climate change with ongoing habitat loss and alteration; and non-native species competition has caused a general loss of resiliency in the ecosystem that has serious consequences for Gila trout.

Apache Trout

A. Status of the species within the action area

Ash, Grant, Big, and Marijilda Creeks in the Pinaleno Mountains currently contain hybridized populations of Apache trout. Grant and Big Creeks drain into the Willcox Playa, which is a closed basin (Minckley 1973); Ash and Marijilda Creeks are tributaries to the Gila River and now considered within historical range of Gila trout (USFWS 2003). Deadman Creek was stocked with Apache trout in 1968 and 1969, and it is uncertain if hybridized trout still persist; Deadman Creek is now considered within the historical range of Gila trout.

B. Factors affecting the species within the action area

Many watersheds formerly inhabited by Apache trout have been routinely stocked for nearly 100 years with non-native rainbow trout, cutthroat trout, brook trout, and/or brown trout. Hatchery and management records from WCNFH, the USFWS Arizona Fish and Wildlife Conservation Office (AZFWCO), and AGFD indicate that cutthroat trout were stocked from at least 1920 to 1942. Cutthroat trout are believed to have also been stocked by mule train in the late 1800s (USFWS 1983).

Apache trout have been found to hybridize with rainbow trout and cutthroat trout in several streams in eastern Arizona (Loudenslager *et al*. 1986, Dowling and Childs 1992, Carmichael *et al*. 1993, Porath and Nielsen 2003). Although non-native salmonids were dispersed extensively by stocking over the entire range of Apache trout, natural fish barriers prevented mixing in some locations. Isolation of Apache trout above natural barriers may have prevented the species extinction.

Within the action area, competition from non-native species is a concern as well. As a result the Forest has coordinated with AGFD on the chemical treatment of several streams to remove non-native species. Drought is having an impact on this species where it exists on the Forest, particularly because of the species restriction to small streams that restrict population growth.

In addition to hybridization, non-native salmonids tend to be predatory and out-compete Apache trout for food and space. Such competition with brown trout and brook trout has been identified as a cause of the decline of Apache trout (Rinne and Minckley 1985). Wada (1991) suggested that if there is a selective advantage of more permanent use of cover, Apache trout may be at a competitive disadvantage because brown trout use cover more frequently than Apache trout. Apache trout co-occurred with brown trout in pools with cover only when they were larger than the brown trout. Thus, brown trout may not completely eliminate adult Apache trout because habitat use is not identical (Wada 1991), but they would likely influence factors such as recruitment, population structure, and condition. Similarly, Mesick (1988) found that Apache trout were displaced from cover slightly easier than brown trout within artificial streams when starved.

Drought and climate change could eventually exacerbate existing threats to streams in the Southwestern U.S. Increased and prolonged drought associated with changing climatic patterns could adversely affect streams by reducing water availability, and altering food availability and predation rates. Drying or warming of streams is of particular concern because Apache trout depend on permanent flowing water of appropriate water quality for survival. Long term climate change could exacerbate the effects of drought. Therefore we conclude that drought is negatively affecting the species now, and is likely to continue into the foreseeable future.

Spikedace

A. Status of the species and critical habitat within the action area

On the CNF, there are no streams occupied by spikedace. Redfield and Hot Springs Canyons were stocked with spikedace during 2007, and have received subsequent stockings and are considered occupied by the FWS. Occupied habitat is also located in Aravaipa Creek which is 3.6 miles from the Forest boundary. At the request of the FS, the applicable Standards and Guidelineswere analyzed for their effects on the spikedace in the event this species were to become established on the CNF or it is present but currently undetected. Were the spikedace in fact currently present on the CNF, most of the Standards and Guidelineswould maintain habitat and provide for recovery of this species. There were several Standards and Guidelinesthat are beneficial in the long-term, but would likely have some short-term adverse effects. As it stands, no applicable Standards and Guidelinesare likely to result in either direct or indirect downstream effects to the spikedace because the species is not known to occur on the CNF. Critical habitat in Redfield Canyon is less than 1 miles from the Forest boundary.

No conservation efforts have been undertaken due to the species and critical habitat not occurring on the Forest.

Critical habitat has been designated (March 8, 1994 - 59 FR 10906) and redesignated (April 25, 2000 - 65 FR 24328; March 21, 2007 - 72 FR 13356) in response to legal concerns and policy changes (see summary discussion at 75 FR 66482, p. 66485). The current critical habitat designation was published simultaneously with the reclassification of spikedace to endangered status on February 23, 2012 (77 FR 10810). There is no designated critical habitat located on the CNF. However, designated critical habitat is located in Redfield canyon less than 1 mile downstream of the forest boundary. In the action area, critical habitat has been designated in Aravaipa Creek from the confluence with the San Pedro River upstream to Stowe Gulch (approximately 28 miles), Turkey Creek extending from the confluence with Aravaipa Creek upstream to the confluence with Oak Grove Canyon (approximately 3 miles), Deer Creek extending from the confluence with Aravaipa Creek upstream to the boundary of the Aravaipa Wilderness (approximately 2 miles), in the Muleshoe Area (Hot Springs Canyon for approximately six miles, Redfield Canyon for approximately four miles, and Bass Canyon for approximately three miles).

B. Factors affecting the species and critical habitat within the action area

Spikedace and its designated critical habitat may be affected by groundwater pumping, watershed conditions, stormwater runoff, non-native fish species, livestock grazing, timber harvest, wildfire, recreational activities, and other habitat alterations.

Loach Minnow

A. Status of the species and critical habitat within the action area

The loach minnow is not currently found on the CNF; however, a population does occur downstream in Aravaipa Creek, Arizona. As described under the spikedace, Standards and Guidelineswould have similar effects on the loach minnow.

Loach minnow have recently been placed in additional streams as part of the recovery efforts for the species. In 2007, loach minnow were translocated into Hot Springs Canyon, in Cochise County, Arizona, and Redfield Canyon, in Cochise and Pima Counties, Arizona, and these streams were subsequently augmented (Robinson 2008a; Orabutt 2009, pers. comm.; Robinson *et al*. 2010a; Robinson *et al*. 2010b; Robinson 2011a, pers. comm.). Both Hot Springs and Redfield canyons are tributaries to the San Pedro River. Augmentation efforts have been suspended in Redfield Canyon due to drought and a lack of adequate flowing water. Augmentation efforts have been suspended at Hot Springs Canyon to allow managers to better evaluate if recruitment of loach minnow is occurring without further augmentation. Monitoring will continue at this site, and future augmentations may occur if needed.

Critical habitat within the action area for the loach minnow is as described under the spikdace.

B. Factors affecting the species and critical habitat within the action area

Loach minnow and its designated critical habitat may be affected on NFs by groundwater pumping, watershed conditions, stormwater runoff, non-native fish species, livestock grazing, timber harvest, wildfire, recreational activities, and other habitat alterations.

Sonora Chub

A. Status of the species and critical habitat within the action area

As mentioned above, the CNF contains the majority of the Sonora chub’s range in the U.S. The reader is referred to the Distribution and Abundance section above for an overview of the species’ status in the action area.

Critical Habitat
Critical habitat for the Sonora chub is discussed in the Status of the Species section above. All of the critical habitat for the Sonora chub occurs on land and waters of the CNF. The overall estimated current chub habitat is 10 stream miles in Sycamore/Penasco Creek and California Gulch including a 50-foot wide riparian area along each side of Sycamore and Penasco creeks. In Sycamore Canyon, the chub occurs within the Pajarita Wilderness and Goodding Research Natural Area (RNA) of the CNF. These special designations help protect a biological

community characterized by Mexican floral and faunal elements that do not otherwise occur, or are rare elsewhere, in the U.S. (Goodding 1961, Curran 1973, Smith 1984, USFS 1986).

According to the *Sonora chub/Charalito Sonorense (Gila ditaenia) 5-Year Review: Summary and Evaluation* (USFWS 2013), it is likely that there has been a reduction in the amount of wetted habitat due to ongoing drought conditions in the region (Arizona Department of Water Resources 2012). Physical habitat conditions likely improved incrementally as a result of the CNF's 1998 project to stabilize Hank and Yank's Tank, which impounds Yank Spring in Sycamore Canyon (within which Sonora chub occur) and implement other access changes and erosion control measures. In 1999, a bridge was constructed to replace the low water crossing of Ruby Road at Sycamore Canyon, thus reducing direct mortality of Sonora chub as well as the delivery of sediment to the stream.

B. Factors affecting the species and critical habitat within the action area

Threats to the Sonora chub include loss or degradation to habitat by mining, improper livestock grazing, and the introduction of non-native species into its habitats. A number of non-native species, including bullfrogs, mosquitofish, goldfish, black bullhead, channel catfish, bluegill, green sunfish, and largemouth bass have been recorded from occupied Sonora chub habitats in the United States and Mexico (Douglas 2009). Green sunfish and mosquitofish were identified as present in Sycamore Canyon in the final rule (USFWS 1986). Bullfrogs, mosquitofish, black bullheads, bluegill and green sunfish were identified in California Gulch in 1995 (USFWS 2001b) when Sonora chub were located there. Largemouth bass are also known from California Gulch. The origin of these non-native species is unclear; however, there are private ponds in the California Gulch and Sycamore Canyon watersheds that contain non-native species that are the likely sources.

As described in the 2012 BO/CO, management direction for the Wilderness and RNA units where the Sonora chub occurs is to maintain the area in climax vegetation. Removal of minerals, livestock grazing, use of motorized vehicles, and harvest of timber or fuelwood is not permitted, and recreation is limited to non-developed and dispersed use. Livestock grazing is permitted within Pajarita Wilderness outside of Goodding RNA. This management direction is applicable to Sycamore Canyon portions of habitat within the Gooding RNA and /or wilderness. The remainder of Sycamore drainage and California Gulch is open to multiple uses (USFS 1986).

Sonora chub have been able to survive in this watershed by expanding into riffles, runs, and pools during wet periods, and then shrinking back to deep pools as the stream dries. Mean annual precipitation ranges from about 12 to 22 inches, which comes from gentle rains in winter and high intensity localized thunderstorms in summer (USFS 1988). On an individual basis, a substantial number of Sonora chub die when they become trapped in habitats that do not sustain perennial water during arid periods (Carpenter and Maughan 1993). Recolonization is dependent on individuals that survive dry periods. This species has an amazing capacity for reproduction and recruitment as the habitat expands; it can seemingly explode from a small number of individuals occupying newly-wetted habitats in just a few weeks or months. The capability of the population to increase by several orders of magnitude within a few months is most likely an adaptation to the harsh climate and intermittent nature of its habitat, which has allowed the Sonora chub to survive to the present (Bell 1984).

Native fishes appear adept at maintaining populations during severe conditions so long as their habitats are unaltered (Minckley and Meffe 1987). Thus, a single catastrophic event, such as severe flood, fire or drought, is unlikely to eliminate Sonora chub from the U.S. However, floods in combination with other catastrophic events, such as wildfire, have caused the loss of isolated fish populations in other areas (Propst *et al*. 1992). Hale and Jarchow (1988) documented the recent and sudden extirpation of Tarahumara frog from the U.S (including Sycamore Canyon). The cause of that extirpation was thought to be an environmental toxicant, possibly associated with acid precipitation.

Bluegill and largemouth bass are competitors with, and predators on Sonora chub. We have no information indicating that this threat has increased since the time of listing. Efforts have been taken to remove bullfrogs (*Lithobates catesbeianus*) from areas surrounding Sycamore Canyon and California Gulch. If success is demonstrated, we anticipate a lessening of the risk of predation on Sonora chub. The risk of predation by ranid frogs would not, however, be eliminated, as we note that the intent of bullfrog removal is to encourage proliferation of Chiricahua leopard frogs (*L. chiricahuensis*), lowland leopard frogs (*L. yavapaiensis*), and/or Tarahumara frogs (*L. tarahumarae*).

The USFWS has discovered that unknown mining wastes and/or drilling compounds are entering California Gulch from a series of drilling pads immediately across the international boundary in Sonóra from at least November 2009 through October 2010. Visual inspection of these compounds indicates that they are sufficiently fine-grained as to be capable of occluding the gills of Sonora chub. Depending on the chemical compositions, they may be acutely and/or chronically toxic to the species. The discharges may also result in the filling of pools within which Sonora chub seek refuge from intermittently-dry stream reaches and/or embed sediments to the extent that the species' aquatic macroinvertebrate food base is appreciably reduced. In any event, this mine waste discharge represents an additional threat from mining, as had been identified in the Final Rule. The FWS also notes that the relatively recently discovered (AGFD 1995) metapopulation of Sonora chub in California Gulch also exists in a mining district, though levels of activity vary.

During the 2011 fire season, the Murphy fire burned through 68,079 acres that included portions of the CNF (Coronado National Forest, pers. comm., 2011). According to the district biologist, the effects of the fire were related to the fire itself and not the result of fire suppression. It is expected that Sycamore Canyon may be affected by ash and sediment, but only a portion of this watershed burned. Therefore, the FS stated, and we agree, that they do not believe the Murphy Fire's effects will significantly change the amount of suitable habitat for this Sonora chub. The Mule Ridge wildfire in June of 2016 burned small portions of the watersheds of both Sycamore Canyon and California Gulch, and reached the channel of the former. The fire was determined to have been unlikely to have resulted in long-term harm to Sonora chub or to the critical habitat (J. Douglas pers. comm. 2016) (discussed further in a subsequent section), but a more-intense and/or larger scale wildlfire could have serious adverse effects.

Critical Habitat

Water development, including water use by and impacts to water quality from mines, has already been described as a threat to the Sonora chub (USFWS 1986, 1992). There are currently-inactive mines located within the watershed of California Gulch and should these be reactivated, there could be impacts to Sonora chub habitat.

As stated above, the Murphy and Mule Ridge wildfires burned through a portion of Sycamore Canyon that included the critical habitat for the Sonora chub. We anticipate that some effects to Sonora chub critical habitat are likely and included some ash and sediment movement, and minor riparian vegetation loss, but we do not believe that these effects have significantly altered the critical habitat for Sonora chub.

The study of climate change and its effects on ecosystems has expanded greatly since Sonora chub was listed in 1986. Changes in temperature (Weiss and Overpeck 2005) and stream flow (Seager *et al.* 2007) are anticipated to reduce the amount of habitat available within the U.S. and worsen habitat conditions throughout the species' range. Climate change may therefore result in degraded habitat conditions in the designated critical habitat for the Sonora chub.

Desert Pupfish

A. Status of the species within the action area

Currently, the desert pupfish does not occur on the CNF, however it does occur within the action area. Desert pupfish were once widely distributed in desert springs, marshes, backwaters, and tributaries through much of the lower Colorado and Gila Rivers, from southern Arizona to southeastern California, and northern Sonora, Mexico (Minckley and Marsh 2009; USFWS 2010). Several efforts have been made to translocate populations of desert pupfish to locations on National Forest System lands, with at least one successful effort on Tonto National Forest. Desert pupfish have been considered for reestablishment on the CNF, and FWS.

Pupfish were reestablished in several locations within the action area, including Las Cienegas National Conservation Area, San Pedro Riparian National Conservation Area, Swamp Springs Canyon, Cherry Spring Canyon, and Aravaipa Canyon area. Stocking in future years are continuing in other suitable sites in the general area, along with supplemental stockings in the already stocked sites to establish and maintain genetic integrity of these small populations. Formal consultation was completed for the establishment of these species on BLM and the Nature Conservancy land in the Aravaipa Creek Watershed reestablishment BO (#02-21-04-F-0022). We anticipate that desert pupfish will occur in Aravaipa Creek, Turkey Creek, or other tributaries of Aravaipa Creek for the duration of this proposed action because high water flows during storms may move the fish downstream to Aravaipa and Turkey creeks, and provide access to other tributaries.

Critical Habitat
No desert pupfish designated critical habitat occurs within the action area.

B. Factors affecting the species within the action area

Because desert pupfish do not currently occur on the CNF, no consultations involving affects to the species on this NF have been conducted since the 2012 consultation for the continued implementation of the LRMP with the exception of the 2016 Biological Opinion and Conference Opinion for the Rosemont Copper Mine, Pima County, Arizona (Consultation number 22410-2009-F-0389 issued October 30, 2013 and the reinitiated consultation, number 22410-2009-F-0389R1 issued April 22, 2016 and amended April 28, 2016). The 2016 consultation addressed the effects of construction and operations of the copper mine, including the mine pit, waste rock piles, tailings, access roads, utility corridors, and onsite facilities (i.e., the mine "footprint"). We determined that the proposed action will not likely result in jeopardy to the desert pupfish and anticipated that take in the form of harm through the loss of habitat from groundwater drawdown is expected.

The currently occupied and future reestablishment sites within the action area have been, and continue to be, adversely affected by natural events, such as fire, flood, or drought, and from non-native species invasions, water withdrawal, improperly managed livestock grazing, recreational activities, and/or other land-use practices on public and private lands. The USFS, along with BLM, FWS, the Nature Conservancy, AGFD, Arizona State Parks, and private landowners, has committed to maintaining the current and future occupied sites, and possibly pursuing other sites for reestablishment. Past and current activities in the action area have resulted in some potential sites no longer being an option for reestablishment, but with the current commitments from the USFS and other organizations, potential pupfish sites will likely be maintained in the long-term, and pupfish will be reestablished in other sites.

Desert pupfish on federal lands are widely dispersed and in some cases vulnerable to events beyond the respective land management agencies' control. Such actions would include invasions or unauthorized introductions of non-native fishes and stochastic events such as floods. The risk associated with maintaining desert pupfish for the long-term across such a diversity of sites renders the species' status within the action area as tenuous, as it is rangewide.

Yaqui Catfish

A. Status of the species within the action area

As stated in the Status of Species section above, the 2012 BO (USFWS 2012), and the 2016 and 2017 BA Addendums (USFS 2016b and 2017), there are no known populations of Yaqui catfish within the CNF boundaries; however, the species does exist in ponds on the El Coronado Ranch, which borders the west boundary of the Chiricahua Mountains unit of the Douglas Ranger District. The ponds on the El Coronado Ranch are within the West Turkey Creek watershed (USFWS 2005). Yaqui catfish are also known at House Pond at the Slaughter Ranch adjacent to San Bernardino NWR, and at sites on the San Bernardino NWR. For ease of future consultations, in the event the Yaqui catfish becomes established on the CNF, the Standards and Guidelineswere analyzed as if this were already the case.

In the 2009-2010 annual monitoring of LRMP implementation, Yaqui catfish were captured in two of the three known sites/ impoundments, House Pond at the Slaughter Ranch and Big Tank at El Coronado Ranch. None were captured on San Bernardino NWR.

Critical Habitat
Critical habitat does not occur on the CNF, but critical habitat does exist on the San Bernardino NWR approximately 10 miles downstream. Critical habitat on the NWR provides habitat for several existing population of Yaqui catfish and provides expansion habitat for the Yaqui catfish. The critical habitat on the NWR is separated from the CNF by 10-15 miles of intermittent stream channels.

B. Factors affecting the species within the action area

Any effects to the Yaqui catfish as a result of FS activities would likely be due to habitat manipulation, which could alter habitat that could be occupied by the species, as well as cumulative effects from the introduction of non-native species.

Activities affecting the watershed could include those that lower the ground water level to the extent that the water flow from springs on San Bernardino NWR would be reduced could adversely impact occupied and unoccupied critical habitat. Such activities include, but are not limited to, pumping of ground water for agricultural and urbanization purposes and drilling activities associated with geothermal exploration. Any activity which would significantly alter the water chemistry of springs on San Bernardino NWR could adversely impact the critical habitat. Such activities include, but are not limited to, release of chemical or biological pollutants into surface or underground waters at a point source or by dispersal release.

The most likely activity with federal involvement that may potentially affect the Yaqui catfish or its designated critical habitat is geothermal exploration. This activity would occur beyond the boundary of the San Bernardino NWR, but could possibly affect underground aquifers supplying surface waters to the critical habitat. Geothermal exploration in the San Bernardino Valley is subject to federal regulation and licensing by the BLM. It should be emphasized that critical habitat designation may not affect geothermal exploration activities in the vicinity. Exploration activities may be allowed to proceed in the vicinity of critical habitat as long as artesian and surface water supplies at San Bernardino NWR are adequately protected (USFWS 1984).

Roundtail Chub

A. Status of the species within the action area

On the CNF, there are no streams occupied by roundtail chub. Occupied habitat is located in Araviapa Creek which is 3.6 miles from the Forest boundary.

B. Factors affecting the species within the action area

Roundtail chub populations have declined due to a combination of habitat loss and degradation related to dams, diversions, groundwater pumping, mining, development, recreation, improper livestock grazing, and competition and predation from non-native fishes. Global climate change is anticipated to worsen the effects of these threats.

Huachuca Water Umbel

A. Status of the species and critical habitat within the action area

Seven of the seventeen extant sites where Huachuca water umbel occurs are under management of the FS within the CNF (Sierra Vista Ranger District). These are the Scotia, Bear, Sunnyside, and Lone Mountain Canyons, and the Sycamore, Mud and Wakefield Mine Springs sites (USFWS 2016). Two additional sites on CNF have unknown population status – Parker Canyon Lake and O'Donnell Creek Spring sites. The Freeman Spring site is believed to be extirpated (USFWS 2016). The four canyon sites are at the highest known elevations for Huachuca water umbel; they are in the upper parts of the watershed and relatively secure from water withdrawals or water diversions, but more susceptible to scouring floods. The canyon sites are grazed, although part of Lone Mountain Canyon and Mud Spring occurrences are fenced. Monitoring shows tall and healthy plants within the exclosure, and damaged and diminutive plants outside the exclosure (J. Crawford, FWS, pers. comm. 2016).

Scotia Canyon has one of the largest populations with plants occupying most of the suitable habitat along the 4,800 foot perennial reach of the stream. Significant flows from the 2013 monsoon season scoured Scotia Canyon and larger patches of *L. schaffneriana* ssp. *recurva* were not as prevalent in the lower canyon portion as in previous years of survey; the flood also removed competing vegetation (J. Kraft pers. comm. February 26, 2014). In late August, 2014, severe monsoon flooding again caused scouring within Scotia Canyon. The impact to the patches of *L. schaffneriana* ssp. *recurva* in Scotia Canyon is unknown (USFWS 2014). Plants in this canyon have historically represented some of the densest occurrences of *L. schaffneriana* ssp. *recurva* known (Falk 1998, USFWS 2001).

The O'Donnell Creek and Freeman Springs sites are at lower elevation, surrounded by woodlands, with Freeman Springs protected from grazing by exclosures. The O'Donnell Creek site has previously been excluded from grazing, however recent monitoring noted that only remnants of fencing were observed and the site is open to livestock grazing (J. Crawford, USFWS, pers. comm., July 28, 2016). Freeman Spring is historically reported to contain springy soils and support *L. schaffneriana* ssp. *recurva* (USFWS 2013a). Ten years after the Ryan Fire and subsequent flooding and deposition, the taxon and the habitat no longer exist at Freeman Spring and are being replaced with a thick sediment layer and prominence of more drought resistant species such as *M. rigens* (USFWS 2013a).

Critical Habitat

As stated in the Status of the Species section above, the CNF contains 3 critical habitat units for the Huachuca water umbel. These include Units 3, 4, and 6. Unit 3 contains approximately 3.4 miles of Scotia Canyon upstream from near Forest Road 48; Unit 4 contains approximately 0.7 miles of Sunnyside Canyon near Forest Road 117 in the Huachuca Mountains; and Unit 6 consists of approximately 1.0 miles of Rattlesnake Canyon and 0.6 miles of an unnamed canyon, both of which are tributaries to Lone Mountain Canyon; approximately 1.0 miles of Lone Mountain Canyon; and approximately 1.0 miles of Bear Canyon; an approximate 0.6 miles reach of an unnamed tributary to Bear Canyon.

B. Factors affecting the species and critical habitat within the action area

As stated in both the 2012 BO/CO and the 2015 BA, water withdrawals, diversions, stream channelization, and levies in southern Arizona and Sonora have reduced the habitat available for Huachuca water umbel. Several historical locations no longer provide suitable habitat because perennial stream flows have ceased due to lowered water tables. Continued human population growth in southern Arizona is expected to put greater pressure on water resources. Off-road vehicle use is also noted as a threat to this species and populations in Bear Canyon have been impacted by off-road vehicle use.

Widespread watershed degradation occurred in southern Arizona in the late 1800s due to uncontrolled livestock grazing, mining, hay harvesting, timber harvesting, and other practices such as fire suppression. This led to widespread erosion and channel entrenchment that has contributed to long-term or permanent degradation and loss of cienega and riparian habitats throughout southern Arizona and northern Mexico. Poor livestock management can destabilize stream channels and disturb cienega soils creating conditions unfavorable to Huachuca water umbel, which requires stable stream channels and cienegas. Such management can also change riparian structure and diversity, altering watershed conditions. However, livestock grazing that is well managed can be compatible with Huachuca water umbel. Observations of *L. schaffneriana* ssp. *recurva*'s response to grazing indicate the taxon is capable of experiencing light to moderate grazing with negligible impact (Simms pers. comm. October 26, 2011, Anderson 2006, Edwards pers. comm. February 21, 2001, Rorabaugh 2013). However, *Lilaeopsis schaffneriana* ssp. *recurva* is affected by livestock grazing in the following ways: 1) trampling, 2) direct impacts from construction of range improvement projects, 3) changes in stream geomorphology that lead to erosion, sedimentation, and downcutting, and 4) watershed degradation and resulting adverse effects to stream hydrology, (USFWS 1999b Anderson 2006). Huachuca water umbel is capable of rapidly expanding from rhizomes and can recover quickly from light trampling. Light trampling may also keep other plant densities low, thus providing favorable Huachuca water umbel microsites (USFWS 1997).

If not controlled, grazing during dry periods when cattle spend a disproportionate amount of time in riparian areas may result in harmful effects to *L. schaffneriana* ssp. *recurva* and other riparian obligates (Edwards pers. comm. February 21, 2001; USFWS 2002a, Krueper 1996, Malcom and Radke 2008, USFWS 2014a). In such instances, severe and widespread trampling may occur; roots and soil structure can be damaged; vegetation species composition and structure can shift; soil can become compacted; stream banks can be degraded; runoff and soil erosion from storm events may increase with higher peak flows; and stream entrenchment may occur; all of which would have harmful effects on *L. schaffneriana* ssp. *recurva* habitat and existing occurrences (Krueper 1996, USFWS 2002a, Simms pers. comm. October 26, 2011).

The period of winter vegetation dormancy and water availability has decreased in recent years with the onset of earlier springtime temperatures (Cayan *et al*. 2005) and continuing drought conditions (Weiss and Overpeck 2005, Archer and Predick 2008). In Sunnyside Canyon, Lone Mountain Canyon and its tributaries, Bear Canyon, and Scotia Canyon, the current CNF Grazing Management Plan recommends grazing in winter months only when adequate water is available to disperse cattle and reduce impact on riparian areas (USFWS 2002b). This stipulation should be amended to include more areas that support *L. schaffneriana* ssp. *recurva* and implementation enforced.

Over-grazing of riparian areas has been shown to reduce the occurrence of *L. schaffneriana* ssp. *recurva* and damage its habitat (Falk 1998, Dupée 1999). Falk (1998) noted that along the *L. schaffneriana* ssp. *recurva* monitoring transects, seven areas in Bear Canyon and four areas in Scotia Canyon showed evidence of bank instability or trampling from livestock use. Six of seven areas containing *L. schaffneriana* ssp. *recurva* in Bear Canyon, and one of four in Scotia Canyon, no longer contained plants in 1995, providing some evidence that habitat degradation did occur and possibly contributed to patch extinction in localized areas. In Leslie Creek, researchers quantified the impacts of a single cow on individual *L. schaffneriana* ssp. *recurva* and concluded that even a small number of livestock left in one place could eradicate the taxon in that area (Malcom and Radke 2008). Researchers studying the effects of livestock removal at Cottonwood Spring concluded that two years following livestock removal, streamside and aquatic vegetation, and thus channel stability, were increased, all of which provided a benefit to

L. schaffneriana ssp. *recurva* (Gori and Backer 1999b). In the spring of 2014, *L. schaffneriana* ssp. *recurva* growing outside of cattle exclosures were diminished in size and quantity compared to those plants inside exclosures (USFWS 2014a).

The best available scientific and commercial information indicates that periodic disturbance removes competing vegetation and allows recolonization or expansion of *L. schaffneriana* ssp. *recurva* occurrences (USFWS 1999). Where natural disturbance is low or infrequent, occasional trampling and grazing by domestic livestock could improve habitat for *L. schaffneriana* ssp. *recurva*; however, excessive livestock use can be detrimental to the taxon and its habitat (Falk 1998, USFWS 1999, USFWS 2002a, Malcom and Radke 2008, USFWS 2014a).

Critical Habitat
Springs are the source for base flows for the critical habitat units. The watersheds for the springs are contained within Management Areas 4 and 9 on the Forest. Management Areas 9 is wilderness, which has minimal management, mostly directed towards maintaining wilderness values. Management Areas 4 is managed primarily for sustained harvest of forage and fuelwood while maintaining and improving game animal habitat. The vegetation surrounding Scotia, Sunnyside, and Bear Canyons is woodland and conifer forest. The vegetation surrounding Sycamore Canyon is mostly grassland, with that of O'Donnell Creek and Freeman Springs mostly woodland.

Seven exclosures have been built in occupied water umbel habitat to protect the species from the effects of livestock grazing and recreation use. Stricter forage utilization levels are in place on the Lone Mountain allotment, where Huachuca water umbel and critical habitat is located. The FS is pursuing water rights on springs in this area.

Planting of native plant or short-lived, non-persistent, non-native species for mine reclamation and post fire wildfire treatments, would reasonably ensure that non-native species would not out compete native species that are trying to reestablish (USFS 2016a). Using only locally sourced native plants and seeds will help ensure local genetics are maintained and preserved.

Pima Pineapple Cactus

A. Status of the species within the action area

The Pima pineapple cactus occurs within Management Area 4 of the CNF in the Nogales and Sierra Vista Ranger Districts. These populations are somewhat disjunct from the main distribution to the north. They represent only a minor part of the species' distribution and abundance, but are significant for their safety from potential development. The Pima pineapple cactus populations on the CNF are not susceptible to the land development threats responsible for destroying much of the species' habitat on private lands.

There are approximately 100 Pima pineapple cactus on lands managed by the CNF. The majority of the cacti occur on the Sierra Vista Ranger District, but a few individuals are on the Nogales Ranger District. Most of these plants have been monitored sporadically for the last 5 to 10 years. The predominant land use on the Forest is grazing. The non-native, invasive Lehmann's lovegrass dominates the herbaceous community.

B. Factors affecting the species within the action area

Dispersed, Pima pineapple cacti are becoming increasingly isolated as current land-management practices, increased recreational use when adjacent to urban expansion, and the continuing aggressive spread of non-native grasses threatens the habitat of the species. Also, the illegal collection of Pima pineapple cactus has been documented on numerous occasions throughout the range of the species. Hobbyists and commercial collectors are the two groups most likely to collect this species (USFWS 2012).

Improper livestock grazing during the mid-to-late 1800s and continuing livestock grazing practices may have significantly altered the ecosystem. Effects of improper livestock grazing include: erosion, changes in hydrology and microclimate, invasion of non-native plant species, shifts in density, relative abundance, and vigor of native species (USFWS 2012). Also, some modern range management practices, such as imprinting, chaining, and ripping can directly damage or destroy plants, as well as reduce the shrub component of the plant community.

Historically, the seeding of non-native grasses, predominately Lehman's lovegrass (*Eragrostis lehmanniana*), usually followed mechanical manipulation. This aggressive non-native species was introduced to provide cattle forage and soil stabilization. The non-native grass species Mediterranean grass (*Schismus barbatus*) is also common in Sonoran desert-scrub grassland transition habitats. Mediterranean grass habitats contribute dense, fine fuels that are readily flammable and carry fires in fire-intolerant habitat. The invasion of non-native plant species alters the fire regime, and may result in the destruction of Pima pineapple cactus by fire, as was described in your 2016 BA (USFS 2016a).

Off-road vehicle use can have negative effects on Pima pineapple cactus. The cacti are small and can be covered by grass, making them difficult to see. Cacti on the Sierra Vista Ranger District occur in relatively flat areas that are very popular for off-road vehicle use. This activity is not authorized by the FS, but the area was not adequately signed for non-entry. The CNF increased patrols during weekends and holidays to more effectively manage this activity in occupied habitat (USFS 2016a).

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Because this is a programmatic consultation and many site-specific actions have not yet been planned, we will only discuss adverse effects in terms of the general effects we anticipate will occur to each species and its critical habitat. We provide a more specific analysis of effects to the primary constituent elements of critical habitat for the Mexican spotted owl because of the known potential effects from vegetation management projects. We provide a table with objectives, standards, and guidelines that are specifically referred to in this consultation in

Appendix C of this BO/CO. Detailed effects discussions will occur as each site-specific project is developed, and these projects will be consulted on separately, as required.

Jaguar and Ocelot

Adverse and beneficial effects to the jaguar and its critical habitat, and the ocelot could occur as a result of implementing the forest programs discussed in the CNF LRMP. These effects are discussed below for the jaguar and ocelot. The jaguar and ocelot have similar but somewhat different life functions and habitat needs. Plan components are generally not definitive enough to differentiate among the finite requirements of these species. Therefore, they are analyzed together and effects by plan component below apply to both these species unless otherwise noted. Additionally, there are many plan components that address the needs of the broad range of prey, some of which may have effects to the prey species.

Wildland-Urban Interface and Landscape-scale Fire

The WUI and Landscape-scale Fire program combines elements of wildland fire prevention, response, and management; post-fire area stabilization and rehabilitation; and hazardous fuels planning, implementation, and monitoring. Specifically, management and activities provided for under the LRMP include fuels management through prescribed cutting, slash pile burning, slash removal, mechanical treatments (thinning and mastication), and grazing; treating the landscape with wildland fire (both prescribed and naturally-managed); and restoration of disturbed areas using native plant species or short-lived, non-persisting non-native species.

Fuels management, prescribed and naturally-managed fire, and restoration of disturbed areas have the potential to directly and indirectly affect jaguars, ocelots, their prey, and their habitats. According to the BA (USFS 2016a), fuels management on the CNF is ongoing and employs a variety of methods, including prescribed cutting, slash pile burning, slash removal, mechanical treatments (thinning and mastication), and grazing combined with prescribed burning and naturally-managed fire. Post-fire activities can include restoration of disturbed areas using native plant species or short-lived, non-persisting non-native species. These activities have the potential to directly affect jaguars and ocelots through disturbance caused by crews conducting them, resulting in jaguars and ocelots temporarily fleeing or avoiding these areas. Temporary avoidance of treatment areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses (i.e., unsuitable habitat, barriers), all of which could lead to injury or death. These potential effects to jaguars and ocelots should be temporary; however, they could be ongoing for the life of the project.

Jaguars and ocelots could also be directly affected by increased traffic within their habitats while the activities associated with these programs are being conducted, which could result in vehicular collisions with jaguars and ocelots. These collisions, particularly on high-speed paved roads, are known to be a source of mortality for both species in other parts of their ranges. However, we anticipate risk of vehicular collisions with jaguars and ocelots on the Forest associated with wildland fire and vegetation activities will be low because roads are typically travelled at low speeds. We are not aware of any jaguars or ocelots being struck by vehicles on slow-speed dirt roads.

Additionally, prescribed and/or naturally-managed fire could directly injure or kill a jaguar or ocelot through burn-over or smoke effects; however, we anticipate that the risk of this occurring is very low as both species are rare, with only a handful of documentations of either species on the forest. According to the U.S. FS, prescribed fire typically moves much slower than wildfire and it is very unlikely that a jaguar or ocelot would be unable to leave the area, simply because the fire behavior of a controlled burn is not that extreme (Shane Hall, U.S. Forest Service, via Debbie Brewer, January 6, 2014 electronic mail) (note: the communication was regarding ocelots, but because jaguars are larger and faster than ocelots, this statement should also apply to jaguars). In addition, prior to conducting a prescribed fire, an increase in human activity in the area to prepare for the burn would likely reduce the chance that either jaguars or ocelots would be in the area when burned. Therefore, the risk of injury or death of either species due to burn-over or smoke is unlikely.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. Fuels management, prescribed and naturally-managed fire, and restoration of disturbed areas may cause a temporary reduction in the prey base by directly affecting prey species in a similar manner as described above (disturbance due to human presence, increased vehicular traffic, burn-over, smoke, etc.), which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may also result in temporary impacts to prey habitat, causing prey species to alter their behavior and therefore the behavior of jaguars and ocelots. However, according to the BA, fresh vegetative growth stimulated by these activities and the reduction of litter and woody debris generally favor herbivores (e.g., prey for jaguars and ocelots). Therefore, fuels management, prescribed and naturally-managed fire, and restoration of disturbed areas should increase the prey base, which would be beneficial for both species.

In terms of indirect effects to jaguars and ocelots through habitat alteration, fuels management, prescribed and naturally-managed fire, and restoration of disturbed areas in habitats expected to be used by jaguars and ocelots are designed to reduce the density of vegetation in these communities in an attempt to return these communities to a more natural condition following decades of fire suppression. Based on this, we anticipate that fuels management, prescribed and naturally-managed fire, and restoration of disturbed areas in these areas may adversely affect jaguar and ocelot habitat. Fuels management activities, including prescribed cutting, slash pile burning, slash removal, mechanical treatments (thinning and mastication), and grazing, prescribed fire, and naturally-managed fire may temporarily degrade jaguar and ocelot habitat by reducing cover and water quality, thereby altering the behavior of jaguars and ocelots and potentially causing them harm by impairing their ability to breed, feed, or shelter.

Biophysical Features

Biophysical features occur in all vegetation types and at all elevations throughout the CNF. These features provide specialized seasonal and year-round habitats for a variety of wildlife species, and may provide denning and resting sites to jaguars and ocelots. The Forest proposes to install an average of two wildlife-friendly closures at mines, caves, or adits each year over a 10-year period, thereby protecting these natural features and the species that use these them from human disturbance and disease.

This program would ensure that no jaguar or ocelot is present in a cave, mine or adit when closing it; however, these closures would likely be designed for use by bats, and therefore may exclude larger species like jaguars or ocelots from specific caves, mines, or adits once completed. This could potentially directly affect jaguars and ocelots by altering their behavior and causing them to expend additional energy looking for denning and resting sites, which could cause harm by impairing their ability to shelter. However, considering that ocelots may use dense vegetative cover and jaguars may use dense vegetative cover, canyons, ridges, and rocky hills for denning and resting, other sites will likely be available for these purposes, and therefore the effects of this program should be minimal.

Water Resources – Natural

There are approximately 100 miles of perennial streams and 400 springs and seeps on the CNF, most of which likely benefit jaguars and ocelots by providing water to them and their prey, as well as areas for them to den and rest in vegetative cover. Every 10 years, the CNF will apply for at least 10 instream flow water rights on streams for recreation and wildlife purposes, prioritizing locations necessary for sustaining native fish populations and species of conservation concern; reconstruct at least 3 developed springs to provide aquatic habitat for the recovery of plant and/or animal species; and complete 3 stream restoration and/or development projects to benefit aquatic species of conservation concern. This program includes assessing proper functioning condition of natural waters; improving and maintaining water quality through the use of best management practices; improving and protecting riparian areas and other groundwater dependent ecosystems; protecting floodplains; and planning and implementing burned area emergency response activities. Future projects will be designed to protect and improve proper functioning condition and would employ best management practices, guidelines, and measures to protect these resources.

All of the activities described above have the potential to directly and indirectly affect jaguars, ocelots, their prey, and their habitats. They may directly affect jaguars and ocelots through disturbance caused by crews conducting them, resulting in jaguars and ocelots temporarily fleeing or avoiding these areas. Temporary avoidance of the treatment areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars), and other stresses, all of which could lead to injury or death. These potential effects to jaguars and ocelots should be temporary, lasting only as long as each project is implemented.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The activities in this program may cause a temporary reduction in the prey base by directly affecting prey species in a similar manner as described above (disturbance due to human presence), which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may result in temporary impacts to prey habitat, causing prey species to alter their behavior and therefore the behavior of jaguars and ocelots. Jaguar and ocelot habitat also may be temporarily degraded by reduced cover and water quality in and around water sources due to these activities. These potential effects to jaguars and ocelot habitat and their prey should be temporary, and several guidelines should help minimize impacts. NWS-G-1 and NWS-G-2 minimize input sediment to streams and protect and/or enhance the water quality, quantity, and aquatic habitat at natural springs and seeps, respectively. NWS-G-3 provides for the reduction of fuel buildup around natural water sources to protect them from uncharacteristic fire effects. NWS-G-4 provides that soil moisture recharge at outflows will not be impaired during management activities. This program, along with these guidelines should, in the long-term, protect the habitat around and water quality of natural water sources, thereby maintaining or improving natural waters for jaguars, ocelots, and their prey.

Water Resources – Constructed
There are approximately 400 developed springs, 300 wells, and 1,100 stock ponds on the CNF. These water features provide surface water resources, in many cases perennial sources, which augment natural water resources and provide valuable habitat for jaguars, ocelots, and their prey. This program proposes to install wildlife escape ramps in all aboveground constructed waters within 10 years of plan approval, and includes guidelines related to ramp construction, retrofitting artificial waters constructed for livestock to provide year-round drinking and habitat resources for native wildlife, and diversion of overflow to allow for soil moisture recharge and creation or maintenance of wetland habitat features.

All of the activities described above have the potential to directly and indirectly affect jaguars, ocelots, and their habitats. These effects are described above in the **Water Resources – Natural** section. This program should benefit jaguars and ocelots in the long-term by providing year-round water sources, habitat, and prey.

Soil Management
Soils are vulnerable to having decreased water available for plant growth, groundwater recharge, and stream recharge due to increases in evaporation and decreases in precipitation based on projections of future climate change for the region. Soils can directly affect the habitat of jaguars and ocelots by influencing vegetative cover and water resources, which can affect jaguars, ocelots, their habitat, and their prey. This program proposes to enhance or restore every 10 years, 2,500 to 15,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to attain necessary ground cover by litter and plant basal area to stabilize soil.

These treatments have the potential to directly and indirectly affect jaguars, ocelots, their prey, and their habitats. They may directly affect jaguars and ocelots through disturbance caused by crews conducting them, resulting in jaguars and ocelots temporarily fleeing or avoiding these areas. Temporary avoidance of the treatment areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars), and other stresses, all of which could lead to injury or death. These potential effects to jaguars and ocelots should be temporary, lasting only as long as each project is implemented.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The activities in this program may cause a temporary reduction in the prey base by directly affecting prey species in a similar manner as described above (disturbance due to human presence), which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may result in temporary impacts to prey habitat, causing prey species to alter their behavior and therefore the behavior of jaguars and ocelots. Jaguar and ocelot habitat also may be temporarily degraded by reduced cover and water quality in some areas due to these activities. These potential adverse effects should be temporary, and soils and watershed restoration projects should help improve jaguar and ocelot habitat, as well as habitat for and populations of their prey, thereby providing a long-term benefit to the two species.

Air Management
We anticipate this program will have no effect on jaguars or ocelots, or on the physical or biological feature or PCEs of jaguar critical habitat.

Animal and Rare Plants
This program includes inventory and monitoring, habitat assessments, habitat improvements through land treatments and structures, species reintroductions, development of conservation strategies, administrative studies, collaboration with research, and information and education. Activities in this program area that could directly or indirectly affect jaguars and ocelots include inventory and monitoring, habitat improvements through land treatments and structures, species reintroductions, and development of conservation strategies.

Inventory and monitoring, habitat improvements through land treatments and structures, species reintroductions, and development of conservation strategies have the potential to directly and indirectly affect jaguars, ocelots, their prey, and their habitats. These activities may directly affect jaguars and ocelots through disturbance caused by crews conducting work in jaguar or ocelot habitat, possibly resulting in jaguars and ocelots temporarily fleeing or avoiding these areas. Temporary avoidance of these areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses, all of which could lead to injury or death. Additionally, guideline ARP-G-1 would implement recovery plans associated with these federally-listed species, meaning that projects conducted under this program area would work toward species recovery, thereby benefitting the species.

Plan components include the consideration of reintroduction of extirpated species. Species reintroductions (including threatened and endangered species, such as fish and reptiles) may also directly and indirectly affect jaguars and ocelots, depending on the species and location of the reintroduction. The reintroduction of a prey species within jaguar and ocelot home ranges would increase the amount of food available for both species, resulting in beneficial effects. Although both species are close to the top of the food chain, reintroduction of species (i.e., Mexican wolves) which would compete for the same prey could result in adverse indirect effects to the jaguar and ocelot by reducing the prey available. In addition, the amount of prey species could be reduced to such an amount where the jaguar or ocelot would be pushed to travel longer distances to find suitable prey.

Additional indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The Animal and Rare Plants program may cause a reduction in the prey base by directly affecting prey species in a similar manner as described above, which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may result in impacts to prey habitat, causing prey species to alter their behavior and therefore the behavior of jaguars and ocelots. These potential effects to jaguars and ocelots should be minimal, however, for the same reasons as described above.

Habitat improvements through land treatments and structures and development of conservation strategies could impact jaguar and ocelot habitat; however, these impacts should be minimal because adverse effects should be intermittent and temporary. Furthermore, guideline ARP-G-1 implements recovery plans for federally-listed species and, therefore, projects conducted under this program would contribute to species recovery, ultimately benefitting jaguars and ocelots and their habitats.

Invasive Species Management
Reducing the threat of aquatic and terrestrial invasive species will allow the CNF to better manage for resilient landscapes and species populations that have a greater capacity to survive natural disturbances and uncertain future environmental conditions such as those driven by climate change and increasing human uses. Methods used to meet the overall desired conditions and objectives of the program include assessing and eradicating priority infestations or populations; monitoring, preventing and controlling infestations; coordinating with other Federal and State agencies; and planning and implementing burned area emergency response activities. These activities have the potential to directly and indirectly affect jaguars, ocelots, their prey, and their habitats. Future projects would be designed to restore and improve watershed conditions and maintain ecosystem function, and would employ best management practices, guidelines, and measures to protect watershed resources.

These activities may directly affect jaguars and ocelots through disturbance caused by crews conducting work in jaguar or ocelot habitat. This could result in jaguars and ocelots temporarily fleeing or avoiding these areas. Temporary avoidance of these areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses, all of which could lead to injury or death. Although these potential adverse effects to jaguars and ocelots may be ongoing for the life of the program, they should be minimal due to their intermittent, short-term nature. Importantly, this program should improve habitat and benefit jaguars and ocelots.

Jaguars and ocelots could also be directly affected by increased traffic within their habitats while the activities associated with the Invasive Species Management program are being conducted, which could result in vehicular collisions with jaguars and ocelots. These collisions, particularly on high-speed paved roads, are known to be a source of mortality for both species in other parts of their ranges. However, we anticipate risk of vehicular collisions with jaguars and ocelots on the Forest associated with Invasive Species Management activities will be low because roads are typically travelled at low speeds. We are not aware of any jaguars or ocelots being struck by vehicles on slow-speed dirt roads.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The Invasive Species Management program may cause a reduction in the prey base by directly affecting prey species in a similar manner as described above, which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may result in impacts to prey habitat, causing prey species to alter their behavior and therefore the behavior of jaguars and ocelots. As described above, however, these potential adverse effects to jaguars and ocelots should be minimal and the program should benefit jaguar and ocelot habitat.

Elements of the invasive species management program may impact jaguar and ocelot habitat; however, these impacts should be intermittent and temporary. Importantly, projects under this program will be designed to restore and improve watershed conditions and maintain ecosystem function, and will employ best management practices, guidelines, and measures to protect watershed resources, thereby leading to long-term habitat improvement for jaguars, ocelots, and their prey.

Forest Products
Common forest products available from the CNF include sawlogs, fuelwood, cactus, and beargrass. Sawlogs and fuelwood are generally available as byproducts of forest restoration or forest fuels reduction projects. Other less common forest products include manzanita, ferns, and mushrooms.

Forest product activities have the potential to directly and indirectly affect jaguars, ocelots, their prey, and their habitats. Impacts from these treatments on the jaguar and ocelot include noise disturbance, habitat modification, and increased human activity. These activities may directly affect jaguars and ocelots through disturbance caused by crews and people collecting the products in jaguar or ocelot habitat. This could result in jaguars and ocelots temporarily fleeing or avoiding these areas. Temporary avoidance of these areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses, all of which could lead to injury or death. These potential effects to jaguars and ocelots should be minimal, however, given that activities will likely be intermittent and short-term.

Jaguars and ocelots could also be directly affected by increased traffic within their habitats while the activities associated with the Forest Products program are being conducted, which could result in vehicular collisions with jaguars and ocelots. These collisions, particularly on high-speed paved roads, are known to be a source of mortality for both species in other parts of their ranges. However, we anticipate risk of vehicular collisions with jaguars and ocelots on the Forest associated with Forest Products activities will be low because roads are typically travelled at low speeds. We are not aware of any jaguars or ocelots being struck by vehicles on slow-speed dirt roads.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The Forest Products program may cause a reduction in the prey base by directly affecting prey species in a similar manner as described above, which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may result in impacts to prey habitat, causing prey species to alter their behavior and therefore the behavior of jaguars and ocelots. These potential effects to jaguars and ocelots should be minimal, however, for the same reasons as described above.

Collection of sawlogs and fuelwood associated with Forest Products could temporarily reduce cover and water quality for jaguars and ocelots. These effects should be minimal, however, as sawlogs and fuelwood will generally be byproducts of forest restoration or forest fuels reduction projects and collection activities will be localized and intermittent.

Minerals Management
The CNF is currently aware of approximately 37 mineral projects within jaguar and ocelot habitat (USFS 2016a). These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Actual mining infrastructure and disturbance is impossible to predict at the time of this document. Eighteen of the 37 projects are active and currently in place, while one project is inactive, four are completed, one project is unknown, one project is not applicable, and twelve are withdrawn from consideration at the point.

This program area has the potential to directly and indirectly effect jaguars, ocelots, their prey, and their habitats. The activities associated with this program area may directly affect jaguars and ocelots through increased human presence, construction and operation of mining infrastructure, and increased vehicular traffic. These activities can directly affect jaguars and ocelots through disturbance caused by increases in noise, human presence, and lighting, resulting in jaguars and ocelots fleeing or avoiding these areas. Avoidance of these areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses, all of which could lead to injury or death.

Additionally, access roads and the accompanying vehicle traffic and use of heavy equipment are often associated with mineral activities. Effects to jaguars and ocelots from these activities could result in direct mortality from vehicle collisions due to roads needed to access work locations. The increase in roads may also allow for avenues of illegal shooting, and the addition of human presence and occupation at a site increases the chances for harassment of and lethal encounters (i.e., poaching) with jaguars and ocelots.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The Minerals Management program may cause a reduction in the prey base by directly affecting prey species in a similar manner as described above, which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may result in impacts to prey habitat, causing prey species to alter their behavior and therefore the behavior of jaguars and ocelots. Indirect effects to jaguars and ocelots through habitat alteration may also occur. Activities under this program could degrade jaguar and ocelot habitat through loss and fragmentation of habitat from land or facility development, reduced cover, and reduced water quality, thereby altering the behavior of jaguars and ocelots and potentially causing them harm by impairing their ability to breed, feed, or shelter. Some of these effects to habitat may be minimized by some standards for this program, which require the use of native species when revegetating disturbed sites, as well as returning landforms and hydrologic function to a similar condition as adjacent natural terrain and systems. Implementing these standards could provide forage, cover, and water resources for prey species in some areas, as well as cover and water for jaguars and ocelots, once Minerals Management activities have ceased.

Public Access
The objective of the Public Access program is to increase the number of permanent legal access routes to and within the CNF by resolving the legal status deficiencies of 40 to 50 existing and proposed National Forest System roads and trails, using a variety of methods every 10 years.

The effects of this program are similar to those discussed in the Motorized Transportation System and Recreation Management programs, below.

Motorized Transportation System

The Motorized Transportation System program proposes to complete maintenance on at least 150 miles of high-clearance (maintenance level 2) roads annually; complete maintenance on at least 200 miles of passenger car (maintenance levels 3, 4, and 5) roads annually throughout the plan period, based on a safety prioritization; decommission, close, and restore 3 to 10 miles of unneeded non-system roads annually throughout the plan period, except for roads identified for potential public access routes; install at least one hardened road surface each year at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat in order to prevent downstream effects; and realign or remove 2 miles of roads in wetlands or meadows within 10 years of plan implementation.

Road maintenance, restoration of roads, hardened drainage crossings, and removal of roads can directly and indirectly affect jaguars and ocelots, their prey, and their habitats. All of these activities have the potential to directly affect jaguars and ocelots through disturbance caused by crews conducting the work, resulting in jaguars and ocelots temporarily fleeing or avoiding these areas. Temporary avoidance of these areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses, all of which could lead to injury or death. These potential effects to jaguars and ocelots are unlikely given that unimproved roads throughout the Forest are minimally maintained and road maintenance activities occur infrequently. Also, where most of the high quality jaguar and ocelot habitat occur, unimproved roads (including fire breaks, or one-lane dirt roads) are only minimally maintained, and generalized maintenance, such as filling potholes or repairing monsoon damage, is done only as needed.

Maintenance of roads may facilitate faster travel speeds and increased use of roads by the public. Use of roads may also allow for avenues of illegal shooting, as the addition of human presence within jaguar and ocelot habitat increases the chances for harassment of and lethal encounters (i.e., poaching) with jaguars and ocelots. Additionally, the use of roads associated with public (e.g., sight-seeing, hunting, and other recreational activities) or maintenance activities could also result in vehicular collisions with ocelots and jaguars. These collisions, particularly on high-speed paved roads, are known to be a source of mortality for both species in other parts of their ranges. However, we anticipate risk of vehicular collisions with jaguars and ocelots on the Forest associated with Motorized Transportation System activities will be low because roads are typically travelled at low speeds. We are not aware of any jaguars or ocelots being struck by vehicles on slow-speed dirt roads. Additionally, currently the CNF has 0.99 mile/mile^2 of FS roads, and the Revised LRMP focuses on a road density of less than 1 mile/mile^2 (USFS 2016a). This low road density standard is well within densities generally recommended for carnivore conservation (USFS 2016a), and therefore reduces the risk of vehicular collisions with jaguars and ocelots.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The Motorized Transportation System program may cause a reduction in the prey base by directly affecting prey species in a similar manner as described above, which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, road maintenance and increased public use of roads could lead to increased spread of non-native species and an increased fire risk. A direct reduction in habitat for jaguars, ocelots, and their prey is not anticipated, however, as all road maintenance is conducted within the existing roadways and roadbeds, and maintaining roads should make off-road travel (e.g., driving around rutted roads) less likely. Additionally, standard MTS-S-1 restricts motorized travel to designated roads and trails, which should reduce to impacts to jaguar and ocelot habitat in areas with limited or no road access. FS Road Maintenance Levels (ML) help identify travel speeds on the Forest. The majority of the roads on CNF are ML 2 and 3, which typically are designed for low traffic speed (USFS 2005).

Several other guidelines should benefit the habitat of jaguars, ocelots, and their prey in the long-term because they encourage the avoidance of road-building within riparian areas and hardening road surfaces at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat. Decommissioning, closing, and restoring unneeded non-system roads, as well as realigning or removing roads in wetlands or meadows, should also benefit the habitat of jaguars, ocelots, and their prey.

Recreation Management
The Recreation Management program provides a wide range of recreation settings, opportunities, and services, and nearly the entire Forest is open to the public for recreational use of one type or another. Program components include administration and management of resources and visitors at developed recreation sites, dispersed recreation settings, partnerships and tourism, interpretive services, recreation special use permits, congressionally designated areas, visual quality management, trail management, and scenic byways. The primary recreational activities include hunting, camping, birding, hiking, horseback riding and cycling on existing roads and trails, as well as off-highway vehicle use on existing roads and trails.

Recreational activities can directly and indirectly affect jaguars and ocelots, their prey, and their habitats. All of these activities have the potential to directly affect jaguars and ocelots through disturbance and harassment, avoidance of areas heavily-occupied by humans, and displacement from formerly-occupied areas, resulting in jaguars and ocelots temporarily or permanently fleeing or avoiding these areas. Avoidance of these areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses, all of which could lead to injury or death.

Managing for recreational activities may also allow for avenues of illegal shooting, as the addition of human presence within jaguar and ocelot habitat increases the chances for harassment of and lethal encounters (i.e., poaching) with jaguars and ocelots. Jaguars and ocelots could also be directly affected by increased traffic associated with the Recreational Management program, which could result in vehicular collisions with jaguars and ocelots. These collisions, particularly on high-speed paved roads, are known to be a source of mortality for both species in other parts of their ranges. However, we anticipate risk of vehicular collisions with jaguars and ocelots on the Forest associated with Recreational Management activities will be low because roads are typically travelled at low speeds. We are not aware of any jaguars or ocelots being struck by vehicles on slow-speed dirt roads.

Hunting activities, including walking through jaguar and ocelot habitat with dogs, inadvertently baying or treeing either species with dogs, and occasional discharge of firearms in their habitats may also directly affect both species. Of these, baying or treeing jaguars and ocelots with dogs would have the greatest potential impact on either species. Jaguars and ocelots have been treed by dogs several times recently in Arizona. Should jaguars or ocelots be treed or bayed, they would likely experience a stress response and would be prevented from feeding, breeding, and sheltering during the time they were treed. This, however, should last only a short time as the hunters are required to follow AGFD hunting regulations, which require hunters to: 1) stop pursuing either species once they aware that they are in pursuit of one, 2) call dogs off immediately, and 3) allow the animals to leave the area and take all steps to not intentionally harass the animal. After being treed or bayed, jaguars and ocelots may temporarily continue to experience increased stress levels and alter their behavior, including avoiding the area in which they were treed or bayed. Overall, however, possible disturbance to both species from hunters should be infrequent (as both species are rare) and temporary.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The Recreational Management program may cause a reduction in the prey base by directly affecting prey species in a similar manner as described above, which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, recreational activities could lead to increased vegetation trampling, spread of non-native species, and fire risk.

Scenery Management
The CNF Scenery Management program is responsible for activities such as desired landscape character. Scenic integrity objectives are defined by degrees or levels of alteration from the desired landscape character and the intent to achieve the highest possible scenic integrity. Some areas of the forest may require restoration in order to move toward the conditions described in the desired landscape character. The effects of this program are similar to those discussed in the WUI and Landscape-scale Fire and Soil Management programs, above.

Special Uses
The CNF administers over 620 special use authorizations. These uses include such activities as outfitting and guiding, research, various types of utility lines, communications sites, road permits and easements, and recreation residences. Also included are permits for campground, marina, and store facilities; filming; and numerous recreation events. The CNF also supports, through the permitting process, military, local law enforcement, and Department of Homeland Security activities. The effects of this program are similar to those discussed in the Forest Products, Public Access, and Recreation Management programs, above.

Cultural Resources
The Cultural Resources program proposes to complete 200 acres of inventory each year beyond the project-level (WUI, Forest Products, Transportation, etc.) inventory, so that the CNF's currently unidentified cultural resources can be recorded, evaluated, and protected; nominate at least five individual sites or at least two districts to the National Register of Historic Places within 10 years of plan approval; conduct stabilization or preservation activities at one or more priority heritage assets each year; within 5 years of plan approval, complete Native American Graves Protection and Repatriation Act (NAGPRA) repatriations of all items collected prior to 1990; host, sponsor, or participate in at least two interpretive events for the public every year;

provide opportunities for volunteers to participate in heritage resource conservation activities at two to five archaeological sites or historic properties every year; within 10 years of plan approval, enter at least two historic sites in the Arizona “Rooms with a View” cabin rental program; and inspect each priority heritage asset at least once every 5 years. The effects of these activities are similar to those discussed in the Forest Products, Public Access, and Recreation Management programs, above.

Tribal Relations
All tribes with traditional connections to lands that are now part of the CNF are recognized as having roles in the stewardship of the land. Many tribal members regularly visit these lands to gather traditional resources and to visit traditional cultural properties and sacred sites. Therefore, tribes share an interest in protecting important natural and cultural resources. The effects of this program are similar to those discussed in the Forest Products and Cultural Resources programs, above.

Range Management
The range program includes the production of forage for grazing and browsing livestock and wildlife, and natural beauty and quiet places. Livestock grazing is permitted on about 90 percent of the CNF, and most of the grazing occurs on a yearlong basis (USFS 2016a). Monitoring determines if acceptable progress is being made towards attainment of resource management objectives and, thus, desired conditions. Grazing use is administered through a grazing permit system on designated livestock grazing allotments.

Livestock grazing will continue throughout suitable rangelands on Forest lands. This program area has the potential to directly and indirectly affect the jaguar and ocelot, their prey, and their habitats. Activities involving human presence (e.g., monitoring, allotment rotations) and fences that impede movements have the potential to directly affect jaguars and ocelots by causing them to temporarily or permanently flee or avoid these areas. Avoidance of these areas could cause jaguars and ocelots to travel longer distances, possibly into or through less suitable habitat. Extra travel would require them to expend additional energy and increase the potential for encounters with humans, vehicles, potential predators (e.g., cougars, jaguars [for ocelots]), and other stresses, all of which could lead to injury or death. Effects from fencing may be minimized to some extent by guideline RAM-G-3, which states that construction or reconstruction of livestock fencing and replacement of non-permeable fencing where wildlife movement is restricted should be consistent with the appropriate state wildlife agency standards for safe passage of wildlife and/or species-specific fencing guidelines developed at the local or regional level. This may allow jaguars and ocelots to move more freely through fenced areas.

Indirect effects include impacts both to prey species and to jaguar and ocelot habitat. The Range Management program may cause a reduction in the prey base by directly affecting prey species in a similar manner as described above, which then could affect the ability of jaguars and ocelots to obtain food resources, leading to a decrease in fitness. Additionally, the project may result in impacts to prey habitat through trampling of vegetation, erosion, soil compaction, decreased vegetation cover, and changes in vegetation communities, all of which could degrade prey habitat and could cause prey species to alter their behavior and, therefore, the behavior of jaguars and ocelots. These same impacts could also affect jaguar and ocelot habitat by reducing cover and water quality, thereby altering the behavior of jaguars and ocelots and potentially causing them harm by impairing their ability to breed, feed, or shelter. Additionally, prey could be directly affected by a decrease in browse or forage because of grazing by cattle, which could then lead to a decrease in available prey for jaguars and ocelots. These impacts should be minimized, however, by several guidelines ensuring that forage utilization is managed such that 55-85% of forage is retained (RAM-G-1) and sufficient deferment from grazing in burned areas occurs to allow vegetation to recover (RAM-G-2). Maintaining sufficient browse allows for foraging habitat for species such as deer and rabbits, which provide prey for jaguars and ocelots, and deferment from grazing in burned areas allows for recovery of vegetation, providing cover for both prey and predators. Additionally, guidelines RAM-G-4 through RAM-G-7 are designed to maintain or promote ground cover providing for infiltration, permeability, soil moisture storage, soil stability, and forage and cover needs of native wildlife; maintaining riparian functions and processes; perpetuation of native plant species; and enhancing wildlife habitat. These guidelines should minimize the effects of grazing to jaguar and ocelot habitat, as well as the habitat of their prey.

Land Ownership Adjustments and Boundary Management

The sky islands nature of the CNF combined with the current complex land ownership pattern within and next to the CNF leads to the need for an intensive and extensive land ownership adjustment and boundary management program. This program includes: land ownership adjustments (donation, purchase, land exchange, and limited sales), withdrawals, right-of-way acquisition, landline location, and boundary modifications. Landline location surveys ensure that boundary lines are accurate. All of these programs ensure that public access, watershed protection, wildlife habitat, recreation, open space, and scenic resources continue to flourish on the CNF. Because land ownership adjustments and boundary management affect activities in all program areas, the effects of this program are similar to those previously described under all other programs, above.

Jaguar Designated Critical Habitat

In our analysis of the effects of the action on critical habitat, we consider whether or not a proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species. To determine this, we analyze whether the proposed action will adversely modify any of the PCEs that were the basis for determining the habitat to be critical. To determine if an action results in adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units and the PCEs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be considered because, collectively, they represent the best available scientific information as to the recovery needs of the species.

Below, we describe the PCEs and the effects from implementation of the CNF Revised Plan. We anticipate that the biophysical features, air management, and land ownership adjustments and boundary management programs will have no effect on the physical or biological features or PCEs of jaguar critical habitat.

Overarching requirement for jaguar critical habitat: Expansive open spaces in the southwestern United States of at least 38.6 square miles (24,710 acres).

Effect: The proposed actions could permanently affect open spaces because of the potential for development of mining projects, new roads, trails, special uses, utility right-of-ways, and range activities (fencing) resulting in long-term permanent loss of open spaces on CNF. Additionally, depending on location of projects, some program areas (i.e., WUI and landscape-scale fire, soil and water management, animal and rare plants, invasive species management, forest products) could result in a temporary loss of open space during and following project implementation.

The proposed action could diminish the amount of expansive open space in Units 2, 3, 4, and 5. These units will still contain sufficient open space to retain their function (i.e., the proposed action will not reduce any of the units to less than 38.6 mi^2).

PCE 1: Connectivity to Mexico
Effect: Connectivity to Mexico is an essential trait of the designated critical habitat and exists throughout each unit. Should a project be implemented or constructed such that it directly excludes any of the designated critical habitat from access by jaguars moving to or from Mexico, the areal extent of the PCE is reduced. Most projects (natural and constructed water features, animal and rare plant programs, and non-native invasive species management) would only occur on a very small portion of CNF at any time, thus these projects would not impact the connectivity to Mexico, and have no negative impact on this PCE. However, larger projects (1,000s of acres in size) within critical habitat (i.e., landscape-scale fire and minerals projects) would result in habitat disturbance excluding access by jaguars moving to or from Mexico, thus the areal extent of the PCE is reduced.

PCE 2: Adequate levels of prey species
Effect: The proposed actions (i.e., fuels management, invasive species management, recreation, motorized transportation, forest products, minerals management, soil management, water resource management, wildlife and plant management, and range management) could result in short-term sporadic loss of prey habitat, which, in turn will result in reduced levels of jaguar prey species. Activities occurring within jaguar critical habitat, such as wildland fire use, vegetation management, and grazing, will result in disturbance to the prey base, which would lead to deer, javelina and other species temporarily moving out of the area. Permanent loss of habitat resulting in transportation, trails, and mineral activities would have long-term negative impacts to this PCE. This could cause prey to avoid these areas, resulting in decreased densities of prey species.

PCE 3: Surface water sources within 12.4 miles of each other
Effect: Ephemeral and perennial streams, springs, seeps and constructed waters occur throughout CNF. Surface water could be dewatered due to mineral activities (there are 6 known active mineral projects within designated critical habitat) or altered (result of fuels, vegetation and watershed management activities), especially during periods of low flow and drought. However, there is no indication that PCE 3 will be reduced to a level that water will not be available in any 12.4-miles area. Because of the numerous water sources such as stock tanks and drinkers throughout CNF, PCE 3 will not be reduced below the threshold established for jaguar critical habitat. Further, CNF plans to reconstruct developed springs and restore streams on the forest, as well as provide year-round drinking at constructed water features for livestock.

PCE 4: Contain from greater than 1 to 50 percent canopy cover within Madrean evergreen woodland, generally recognized by a mixture of oak (*Quercus* spp.), juniper (*Juniperus* spp.),

and pine (*Pinus* spp.) trees on the landscape, or semidesert grassland vegetation communities, usually characterized by *Pleuraphis mutica* (tobosagrass) or *Bouteloua eriopoda* (black grama) along with other grasses.
Effect: There are approximately 489,000 acres of Madrean evergreen woodland and semi-desert grassland communities on CNF within designated jaguar critical habitat which meet this PCE. Currently there are 6 active mineral projects [including Rosemont Copper Mine (USFWS 2016)] on the CNF within jaguar critical habitat. These mineral projects will affect PCE 4 within each project footprint because they would directly affect and remove (for the construction and operational life of the mine) designated critical habitat; roads and trails will also directly and permanently affect critical habitat. However, the relative small acreage of the minerals operations compared to the extent of critical habitat across the CNF should not reduce this PCE below the overarching threshold requirement established for jaguar critical habitat.

WUI and landscape-scale fire projects, watershed and soil projects, wildlife and rare plant projects, NNIS projects, and range projects could result in reducing canopy cover within Madrean evergreen woodlands and semi-desert grasslands, however PCE 4 would not be reduced below the 1 percent canopy cover except in rare cases where total vegetation cover is removed to improve and restore the habitat. If this does occur, it would be temporary loss of canopy; however, this should not result in long-term reduction of canopy cover needed for PCE 4.

PCE 5: Are characterized by intermediately, moderately, or highly rugged terrain
Effect: Critical habitat within CNF contains moderate to highly rugged terrain. Proposed minerals operations would permanently affect the ruggedness of this PCE for the life of the operations until reclamation, including re-contouring and revegetation occurs. However, the relative small acreage of the minerals operations compared to the extent of critical habitat across the CNF should not reduce this PCE below the overarching threshold requirement established for jaguar critical habitat. There will be no effect to PCE 5 from the other program areas proposed actions within the CNF revised plan.

PCE 6: Are below 6,562 feet in elevation
Effect: Effects to this PCE are not anticipated from the proposed action, with the possible exception of minerals activities. Areas will not be created that exceed 6,562 feet in elevation under the proposed action. Minerals operations could result in creating additional small areas below the 6,562 feet in elevation from areas that are currently above this elevation. However, this would result in an insignificant increase to PCE 6 due to the relatively small acreage compared to the entire critical habitat within CNF.

PCE 7: Little human influence or disturbance
Effect: This PCE was developed using research that highlights the fact that jaguars generally avoid areas of human activity. Pursuant to the final rule, a higher human influence (HII) of less than 20 is an essential element of PCE 7. Specifically, this PCE includes minimal to no human population density, no major roads, and no stable nighttime lighting over any 0.4-square-mile area (USFWS 2014). The proposed project area with jaguar critical habitat has a low human density and contain no large communities; however, the action area does have a higher human density and several communities within and surrounding CNF outside critical habitat. The proposed project is currently in an area with HII values between 14 and 18.

With the continuous increase in recreational demand, along with the potential for landscape-scale fire, forest products and vegetation, minerals operations, range, watershed and soil, transportation invasive species control, water resource, and animal and rare plant activities, overall human influence and disturbance (from vehicles, roads, trails, noise, etc.) is likely to continue to increase, which will likely have a negative impact on PCE 7. Although the level of human influence will increase, at this time we cannot quantify the extent by which the HII will be affected due to the complicated way a number of variables interact to create HII. For example, road density is a component of HII, but we cannot determine if the existing roads in the area already drive observed human disturbance to the same extent that the proposed actions will under the program areas. The majority of the proposed actions will result in only short-term increases in human disturbance during the project and immediately following the activity, then be reduced to the current levels of human influence and disturbance. Similarly, we cannot determine the resulting value of the HII within jaguar critical habitat.

The presence of jaguars in the action area from 2012 through 2017 suggests that the amount of ambient light present is not great enough to repel the jaguar, indicating the area is currently "dark enough" for jaguars. It also suggests that the current HII is currently "low enough" for jaguars. However, once mineral operations are in place, jaguars may avoid these area because of the increased human disturbance (roads, lighting, etc.). Once mine operations cease, human activity and disturbance will decrease dramatically. Operating facilities will be removed and the waste and tailings landform will be revegetated. This will reduce many of the effects described above, including nighttime lighting, noise and traffic associated with mining operations on the CNF.

Long-term beneficial effects
Although fuels management, prescribed and naturally-managed fire, and restoration of disturbed areas may temporarily adversely affect both jaguars, and ocelots, their habitats, and jaguar critical habitat, they will also likely benefit both species and their habitats (including jaguar critical habitat) by preventing larger and more severe fires from occurring. More severe fires, like stand replacing fires, could potentially degrade much larger amounts of jaguar and ocelot habitat (including jaguar critical habitat) than the proposed WUI and Landscape-scale Fire program. Furthermore, areas affected by severe fires generally take much longer to recover than areas treated for fuels reduction. Therefore, while temporary adverse effects may occur to jaguars, ocelots, their habitats, and jaguar critical habitat, long-term benefits are also likely to occur.

Mount Graham Red Squirrel and Designated Critical Habitat

The Mount Graham red squirrel only occurs in the Pinaleño Mountains on the CNF. Under the direction of the CNF LRMP, adverse effects to the red squirrel and its critical habitat may occur as a result of implementation of the Wildland-Urban Interface and Landscape-scale Fire, Animal and Rare Plants, Invasive Species Management, Forest Products, Minerals Management, Motorized Transportation System, and Recreation Management. The Scenery Management, Special Uses, Cultural Resources, and Tribal Relations programs may have some effects similar to those described in some of the aforementioned programs.

Most of the red squirrel habitat is located within the Mt. Graham Astrophysical & Biological Research Area, and developed recreation and wild backcountry Land Use Zones as defined in the CNF LRMP. All known Mount Graham red squirrel middens are located within these areas. As shown in the Draft Recovery Plan for the Mount Graham red squirrel, smaller areas of habitat have been identified (by Hatten 2009) outside these areas, but these areas comprise approximately 10 to 15 percent of all Mount Graham red squirrel habitat on the CNF and no middens have been documented within any of these Management Areas.

Wildland-Urban Interface and Landscape-scale Fire

WUI and Landscape-scale Fire programs combines elements of wildland fire prevention, response, and management; post-fire area stabilization and rehabilitation; and hazardous fuels planning, implementation, and monitoring. Specifically, management and activities provided for under the LRMP include fuels management through prescribed cutting, slash pile burning, slash removal, mechanical treatments (thinning and mastication), and grazing; treating the landscape with wildland fire (both prescribed and naturally-managed); and restoration of disturbed areas using native plant species or short-lived, non-persisting non-native species. Treatments will be consistent with the objectives for forest-wide vegetation communities and resources, including dry mixed conifer, wet mixed conifer, and spruce-fir.

Forest-wide objectives VDM-O-1 and VWM-O-1 would treat at least 13,800 and 2,400 acres of dry mixed conifer and wet mixed conifer, respectively, using wildland fire and prescribed cutting every 10 years. Additionally, specific to the Pinaleño Mountains, objective PIN-O-1 treats at least 25% of the Pinaleño Ecosystem Management Area using fire, cutting, and mastication. WUI-O-1 would also treat potential Mount Graham red squirrel habitat, and guideline specific to VDM, VWM, and VSF include some provisions for treating within mixed conifer and spruce-fir vegetation types. Some of these activities could occur within Mount Graham red squirrel habitat and designated critical habitat, resulting in potential disturbance and loss of habitat, including reduced availability of midden locations, nesting trees, and forage resources.

Large-scale wildfire is an imminent threat to Mount Graham red squirrel, its habitat, and its critical habitat because of its restricted distribution (USFS 2004). CNF fire management activities directly address this threat. Fire activities can be both interrelated/interdependent or direct actions (e.g., prescribed fire, fire risk abatement). Standards and guidelines for this program are difficult to assess at the programmatic level, as the application of these standards can have positive long-term effects, but initial negative effects, and are dependent upon site specific prescriptions. However, after close analysis, all applicable Standards and Guidelineswithin this program are noted for their beneficial long-term effects, but are also noted for the possibility of initial short-term negative effects to Mount Graham red squirrel, its habitat, and its critical habitat.

Forest-wide trends on the Coronado NF show prescribed fires of over 128,000 acres from 2003 to 2015 (USDA 2016a), or an average 12,800 acres per year, which is one of the highest totals within the southwestern region (USDA 2016a). Prescribed fires in mixed conifer types can have a positive effect on Mount Graham red squirrel if the fire is not too severe by reducing ladder fuels and fuel loads, thus reducing the risk of large-scale wildfire (USFWS 2000). However, harm could occur to middens (active or inactive), nest trees, foraging resources, and the spruce-fir component of critical habitat from burning and other prescribed fire activities. Harassment through noise disturbance is also likely to occur during prescribed fire, cutting and mastication activities. Additionally, midden placement occurs in stands with high canopy cover, foliage volume, and large amounts of dead or downed wood, which keeps middens cool and moist and protects stored cones from opening and losing their seeds. Piling and burning debris within these areas could create new, relatively small openings in the canopy, potentially negatively affecting middens by causing them to dry out due to increased exposure, and possibly leading to greater predation of Mount Graham red squirrel by avian predators.

Several forest-wide guidelines and some specific to the Pinaleño Ecosystem Management Area seek to minimize the potential negative effects of this program. For example, guideline VWM-G-3 would require measures to help ensure forest composition provides primary food sources for Mount Graham red squirrel, while PIN-G-3c would avoid disturbance to middens during project implementation. PIN-G-3a allows for the needs of Mount Graham red squirrel to supersede all other species. Additionally, within the mixed conifer and spruce-fir vegetation types, guidelines VDM-G-1, VDM-G-2, VWM-G-1, VWM-G-2, VSF-G-1, and VSF-G-2 state that vegetation treatments should be designed such that structural stages are proportionally present to assure continuous old-growth characteristic across the landscape, thereby providing habitat necessary for Mount Graham red squirrel over the long-term. Also, forest-wide guideline VWM-G-3 provides for the creation and enhancement of cone production of white fir, corkbark fir, Engelmann spruce, and Douglas-fir to provide reliable food sources for Mount Graham red squirrel. Although wildlife habitat improvement is prohibited within Goudy Canyon Research Natural Area (PIN-S-1a), standard PIN-S-1b would allow vegetation manipulation within the Goudy Canyon RNA for approved research purposes, thus maintaining the white pine and Douglas fir conditions benefitting Mount Graham red squirrel habitat. In addition, guideline PIN-G-1 would benefit habitat for rare plant populations within the Pinaleño Ecosystem Management Area, several locations of which occur within Mount Graham red squirrel habitat, thereby preserving red squirrel habitat as well. PIN-G-3c restricts treatments that disturb Mount Graham red squirrel middens, thus also reducing the chance of harm to the squirrel.

Biophysical Features, Water Resources – Natural, Water Resources – Constructed, Soil Management, Air Management

We anticipate these programs will have no effect on Mount Graham red squirrel, its habitat, or its critical habitat.

Animals and Rare Plants

This program includes inventory and monitoring, habitat assessments, habitat improvements through land treatments and structures, species reintroductions, development of conservation strategies, administrative studies, collaboration with research, and information and education.

The CNF Forest Plan is very specific to the red squirrel and its habitat. All applicable forest-wide and Management Areas desired conditions, objectives, standards and guidelines are noted for their positive effects to the red squirrel, signifying that this program places an emphasis on endangered species and their requirements. There are several Standards and Guidelines (forest-wide, Management Areas, and Geographic Area specific) in this program that provide baseline habitat protection for Mount Graham red squirrel, including critical habitat protection.

The USFS Species Diversity and Viability Report assessed the Mount Graham red squirrel and found that programmatic direction under the LRMP would provide for viability. The viability report determined that Mount Graham red squirrel populations and habitat were both in a positive trend. Plan components that address impacts to Mount Graham red squirrel habitat and critical habitat are PIN-S-2, PIN-G-3a, PIN-G-3b, and PIN-G-3c. This standard and these guideline ensure that no new recreational development would occur within Mount Graham red squirrel habitat, the needs of the squirrel supersede the needs of all other species, hiking levels should not impact Mount Graham red squirrel or its habitat, and vegetation treatments should be designed and implemented to avoid disturbance of Mount Graham red squirrel middens. Together these work to minimize disturbance to Mount Graham red squirrel and preserve remaining Mount Graham red squirrel habitat and critical habitat. Additionally, guideline ARP-G-1 would apply habitat management objectives and species protection measures from Recovery Plans and signed Conservation Agreements as they pertain to Mount Graham red squirrel and would require that all activities comply with Recovery Plan habitat protection measures.

Invasive Species Management

Methods used to meet the overall desired conditions and objectives of the Invasive Species Management program include assessing and eradicating priority infestations or populations; monitoring, preventing, and controlling infestations; coordinating with other Federal, and State agencies; and planning and implementing burned area emergency response activities. Future projects would be designed to restore and improve watershed conditions and maintain ecosystem function and would employ best management practices, guidelines, and mitigation measures to protect watershed resources.

This program area has the potential to help with removing Abert's squirrel and other non-native species within Mount Graham red squirrel habitat and critical habitat. Abert's squirrels are considered an invasive species and are now found on Mt. Graham from the pine forest to the spruce-fir zones, so it is likely that resource competition has increased between these species (USFWS 2008). Removal of Abert's squirrels through this program would likely benefit Mount Graham red squirrel by reducing resource competition.

Another high-level threat to Mount Graham red squirrel, its habitat, and its critical habitat is habitat destruction through widespread defoliation and subsequent mortality of trees due to insect epidemics and tree diseases, from both native and non-native sources. Guideline ISM-G-1 states that insect outbreaks will not be controlled, except to protect threatened and endangered species; therefore, this guideline allows some insect and disease life cycles to be treated to protect Mount Graham red squirrel, its habitat, and its critical habitat, which should benefit the subspecies. Additionally, treating stands to reduce catastrophic wildfires as described in the WUI and Landscape-scale Vegetation Management section will also reduce the possibility of insect outbreaks and tree diseases, thereby having positive impact on Mount Graham red squirrel, its habitat, and its critical habitat in the long-term. Guideline PIN-G-3a ensures that red squirrel habitat needs supersede the needs of all other species, which also integrates with this program to benefit the subspecies.

Herbicide and pesticide treatments, which are included in this program, are expected to continue under this plan as they have under the previous forest plan, typically through ground-based spot treatments. These treatments usually occur in or near recreation sites, along roadsides, and other areas where non-native species are most likely to occur. The use of herbicide and pesticides can have adverse direct effects on Mount Graham red squirrel through ingestion of or contact with chemicals. Any potential future projects implemented under this plan would be assessed on a case-by-case basis to determine potential effects on and minimization for these effects on Mount Graham red squirrel, its habitat, and its critical habitat.

Forest Products
Common forest products available from the CNF include sawlogs, fuelwood, cactus, and beargrass. Sawlogs and fuelwood are generally available as byproducts of forest restoration or forest fuels reduction projects, which are activities described under WUI and Landscape-scale Fire program. Other less common forest products include manzanita, ferns, and mushrooms.

This program area has the potential to impact Mount Graham red squirrel and its habitat by potentially reducing foraging, nesting, and midden resources, as well as disturbing Mount Graham red squirrel due to human presence. Certain types of mushrooms are eaten by Mount Graham red squirrel, some of which are also eaten by people (e.g., truffles, boletes). Removal of these types of mushrooms may impact Mount Graham red squirrel foraging resources by directly removing them from red squirrel habitat. Additionally, Mount Graham red squirrel may use a variety of grasses and lichens when building dreys, possibly including beargrass; therefore, removing beargrass from Mount Graham red squirrel habitat may impact the subspecies' nesting resources. Finally, Mount Graham red squirrel have been noted using wood piles to cache cones and mushrooms for the winter. If wood is piled after vegetation treatments and is not collected quickly by fuelwood users, there is the potential that Mount Graham red squirrel may begin using a wood pile to cache food resources. All of these activities may also disturb Mount Graham red squirrel due to human presence within red squirrel habitat.

Disturbance caused by people walking through Mount Graham red squirrel habitat to pursue these activities may affect individual Mount Graham red squirrel to some extent; however, this disturbance likely will be minimal and temporary, as these activities are limited in scope and season. In addition, to offset the effects of fuelwood gathering, CNF has stopped all harvesting of timber, fuelwood, and Christmas trees, and has restricted campfire wood gathering in some areas to protect Mount Graham red squirrel habitat and protect middens. Therefore, the effects of activities under this program are likely minimal and temporary. No effects to the spruce-fir component of Mount Graham red squirrel critical habitat are expected due to this program.

Minerals Management
Although no mineral explorations are expected to occur over the life of this plan within Mount Graham red squirrel habitat, the Minerals Management program area does have the potential to impact Mount Graham red squirrel habitat and critical habitat by creating a reduction of available resources to Mount Graham red squirrel if mineral activity should occur. Although facility development and mineral exploitation is restricted, new facilities and mineral extraction are not prohibited within the range of the Mount Graham red squirrel, including within critical habitat. If mineral activity were to occur, site-specific management plans and guidelines would be developed for any new facilities, and these would be required to comply with the recovery plan guideline (ARP-G-1) to give adequate consideration for the welfare of the squirrel.

Public Access
There are no public access issues within the range of the Mount Graham red squirrel; therefore, we anticipate this program will have no effect on Mount Graham red squirrel, its habitat, or its critical habitat.

Motorized Transportation System
The Motorized Transportation System program proposes to complete maintenance on at least 150 miles of high-clearance (maintenance level 2) roads annually; complete maintenance on at

least 200 miles of passenger car (maintenance levels 3, 4, and 5) roads annually throughout the plan period, based on a safety prioritization; decommission, close, and restore 3 to 10 miles of unneeded non-system roads annually throughout the plan period, except for roads identified for potential public access routes; install at least one hardened road surface each year at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat in order to prevent downstream effects; and realign or remove 2 miles of roads in wetlands or meadows within 10 years of plan implementation.

Road maintenance, restoration of roads, hardened drainage crossings, and removal of roads can directly and indirectly affect Mount Graham red squirrel and its habitat (including critical habitat) through habitat fragmentation and direct mortality by vehicles. Maintenance and restoration of roads may facilitate faster travel speeds and increased use of roads by the public, which potentially could lead to increased mortality of Mount Graham red squirrel by vehicles, which have been documented as a source of mortality. Additionally, the use of roads associated with public (e.g., sight-seeing, hunting, and other recreational activities) or maintenance activities could also result in vehicular mortality of Mount Graham red squirrel.

If roads are closed as directed in objective MTS-O-3, impacts may be beneficial, as there would be reduced fragmentation to habitat (including critical habitat) and no interaction between vehicles and red squirrels. Standard MTS-S-1 may also be beneficial to Mount Graham red squirrel, as motorized travel would be restricted to designated routes and trails, resulting in no off-road or trail travel. This would reduce the direct mortality of run over by vehicles. Additionally, standard PIN-S-2 ensures no new residences or developed recreation areas would be established in Mount Graham red squirrel habitat; therefore, no new roads would be constructed within Mount Graham red squirrel habitat or critical habitat for these purposes.

Recreation Management
The primary recreational activities that occur under the Recreation Management program include hunting, camping, birding, hiking, horseback riding and cycling on existing roads and trails, and off-highway vehicle use on existing roads and trails.

This program area has the potential to impact Mount Graham red squirrel by human disturbance during recreational activities. Recreational use occurs within the range of the red squirrel, but is regulated. Plan components that address recreational impacts to Mount Graham red squirrel habitat include PIN-S-2; this standard ensures that no new recreational development would occur within Mount Graham red squirrel habitat or critical habitat, thereby preserving the remaining habitat and critical habitat. Additionally, guideline PIN-G-3b states that hiking use levels should not negatively impact Mount Graham red squirrel or its habitat, which minimizes disturbance to Mount Graham red squirrel and its habitat due to hiking activities. It is not known if recreational use within the range of the red squirrel exceeds capacity at certain times; however, with these standards and guidelines in place, effects are likely to be minimal. There is no effect to Mount Graham red squirrel critical habitat due to the Recreation Management program, as all critical habitat is within the Mount Graham red squirrel Refugium, which is currently closed to the public.

Scenery Management
The Coronado NF Scenery Management program is responsible for activities such as desired landscape character. Scenic integrity objectives are defined by degrees or levels of alteration

from the desired landscape character and the intent to achieve the highest possible scenic integrity. Some areas of the forest may require restoration in order to move toward the conditions described in the desired landscape character. The effects of this program are similar to those discussed in the WUI and Landscape-scale Fire program, above.

Special Uses
The Coronado NF administers over 620 special use authorizations. These uses include such activities as outfitting and guiding, research, various types of utility lines, communications sites, road permits and easements, and recreation residences. Also included are permits for campgrounds, marina, and store facilities; filming; and numerous recreation events. The Coronado NF also supports, through the permitting process, military, local law enforcement, and Department of Homeland Security activities. The effects of this program are similar to those discussed in the Forest Products and Recreation Management programs, above.

Cultural Resources
The Cultural Resources program proposes to complete 200 acres of other resource project inventory each year, so that the Coronado's currently unidentified cultural resources can be recorded, evaluated, and protected; nominate at least five individual sites or at least two districts to the National Register of Historic Places within 10 years of plan approval; conduct stabilization or preservation activities at one or more priority heritage assets each year; within 5 years of plan approval, complete Native American Graves Protection and Repatriation Act (NAGPRA) repatriations of all items collected prior to 1990; host, sponsor, or participate in at least two interpretive events for the public every year; provide opportunities for volunteers to participate in heritage resource conservation activities at two to five archaeological sites or historic properties every year; within 10 years of plan approval, enter at least two historic sites in the Arizona "Rooms with a View" cabin rental program; and inspect each priority heritage asset at least once every 5 years. The effects of these activities are similar to those discussed in the Forest Products and Recreation Management programs, above.

Tribal Relations
All tribes with traditional connections to lands that are now part of the Coronado NF are recognized as having roles in the stewardship of the land. Many tribal members regularly visit these lands to gather traditional resources and to visit traditional cultural properties and sacred sites. Therefore, tribes share an interest in protecting important natural and cultural resources. The effects of this program are similar to those discussed in the Forest Products and Cultural Resources programs, above.

Range Management
Rangeland Management and associated livestock activities are currently not allowed within the range of Mount Graham red squirrel. Therefore, we anticipate this program will have no effect on Mount Graham red squirrel, its habitat, or its critical habitat.

Lesser Long-Nosed Bat

Effects of the proposed action that may affect the lesser long-nosed bat include the implementation of the wildland fire and vegetation management, biophysical features, soil management, animal and rare plants, invasive species management, forest products, minerals management, motorized transportation system, recreation management, and range management programs. The lesser long-nosed bat is most sensitive to activities that might adversely affect roost sites, particularly actions such as recreational caving, use for illegal border activities and associated enforcement actions, and research and monitoring.

Wildland-Urban Interface and Landscape-scale Fire
WUI and Landscape-scale Fire activities encompass all vegetation communities on the CNF, including those habitats occupied and used by the bat. Treatment of these areas includes thinning, removal of fuels from the landscape, or altering the fuel profile to reduce the potential for loss of property. The treatment of WUI allows the CNF the flexibility to manage landscape-scale wildland fire for resource benefit. This program would reduce the risk of uncharacteristic fire impacts, which result in potential impact to lesser long-nosed bat through loss of habitat and disturbance. The LRMP directs that activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from recovery plans (ARP-G-1). Over the long-term, implementing Recovery Plan guidance should result in positive impacts to the bat and its habitat. Fire suppression activities could impact the lesser long-nosed bat due to adverse human-wildlife interactions. For example, a large and sudden human presence to suppress a fire or extended human presence to rehabilitate burned areas could disturb temporary night roosts or deter foraging activities. Other impacts could involve loss or degradation of habitat with the creation of fire lines, back burning operations, construction of roads, or fire retardant drops, which could lead to the loss of some potential forage plants. While some forage plants could be lost to fire, the number of affected plants likely would account for a small amount of the total available plants found within likely foraging areas in the CNF.

Objectives for fuels management within lesser long-nosed bat habitats include treatments using wildland fire, thinning, mastication and non-native invasive species treatments (WUI-O-1, VDC-O-1, VGC-O-1, VME-O-1, and VPO-O-1). At the landscape-scale, projects will be designed to provide for wildlife movement between treated and untreated areas (VLS-G-1), to ensure habitat availability. Guidelines provide for maintaining paniculate agave populations during vegetation treatments within lesser long-nosed bat habitats within desert, grassland chaparral, Madrean encinal woodland and pine-oak woodland communities (VDC-G-3, VDC-Grasslands-G-2, VIC-G-1, VME-G-2, and VPO-G-1), thus ensuring sustainable foraging habitat.

While prescribed fire is beneficial in many respects, fire could negatively affect the bats' food plants, resulting in short-term adverse effects to the bat. Effects to the bat will depend on the overall success of the prescribed burn, intensity, and timing (see below). Slauson *et al*. (1999) studied how prescribed burning might impact nectar and pollen production and the reproductive success of Palmer's agave, but more importantly, how fire may impact the use of agaves by bats in the Peloncillo Mountains. No significant differences were found in visitation of bats between burned and unburned plots. The mosaic burn pattern that resulted from the fire did not produce large contiguous areas without flowering agaves that were beyond the foraging distances of bats. The authors concluded that based on their results, burning did not impact overall bat food plants. However, they also state that additional study is also needed to understand bat foraging behavior more clearly and the long- and short-term effects of various burning frequencies and intensities on agaves.

Fire suppression activities could impact the lesser long-nosed bat due to adverse human-wildlife interactions. For example, a large and sudden human presence to suppress a fire or extended human presence to rehabilitate burned areas could disturb temporary night roosts or deter foraging activities. Other impacts could involve loss or degradation of habitat with the creation of fire lines, back burning operations, construction of roads, or fire retardant drops, which could lead to the loss of some potential forage plants. While some forage plants could be lost to fire, the number of affected plants likely would account for a small amount of the total available plants found within likely foraging areas in the CNF.

The only significant threat to stands of agaves in the forested areas is fire. Fuel loads are high in some portions of the CNF, and a stand-replacing, catastrophic wildfire could occur due to lightning strikes or project-related causes such as recreational use or ordnance. Because Parry's agave occurs primarily in openings and often on rocky slopes where fuel loads are relatively light, agave populations may not be severely directly affected by wildfire. Openings created by fire could conceivably increase habitat for agaves, temporarily. However, post-fire erosion of slopes could bury or scour hillsides and rocky places where agaves occur.

Biophysical Features
The CNF plans to install an average of two wildlife friendly closures at mines, cave or adits each year (BIP-O-1). The lesser long-nosed bat is expected to be affected both directly and indirectly by the proposed action. While closure activities will occur at features when lesser long-nosed bats are not present, the structures used to close the mine features may result in abandonment of the roost when lesser long-nosed bats return to the roost. Direct mortality may occur if bats collide with the structures. The number of bats that can occupy a roost or productivity of the roost may decline if the closure structures affect conditions within the roost such as flight space, temperature, humidity, or air flow. If mine closures shift disturbance and activity to other roosts that are not protected, this project would then indirectly affect those roost sites if abandonment or mortality of lesser long-nosed bats resulted. Closure structures may also make the site more visible and attract additional disturbance to the site. If the project is effective in reducing disturbance and other impacts at lesser long-nosed bat roost sites, the overall effects of the action will be beneficial.

The need for protection of important roost sites for lesser long-nosed bats is clear. Potential roost disturbance threats, principally in the form of visitation by either illegal border crossers or their pursuers, have increased drastically in the past ten years. Additional potential disturbance is expected because projected population growth in the vicinity of lesser long-nosed bat distribution means that recreational disturbance may become a greater problem (USFWS 2007b).

Prior to closing any mine or cave features, inspecting would occur to determine if any species are present (BIP-S-1). This will ensure that if lesser long-nosed bats are present, the appropriate precautions will be implemented to protect the species and its habitat, and avoid any direct impacts to the bats (BIP-G-3). If needed, bat roosts will be managed to enhance and protect bat populations (BIP-G-5).

Water Resources – Natural and Constructed
Lesser long-nosed bat are not known to readily drink from surface water sources. We anticipate these programs will have no effect on the lesser long-nosed bat or its habitat.

Soil Management
Restoration of upland habitats (SOI-O-1) could result in the loss of lesser long-nosed bat foraging plants due to vegetation treatments. However, guideline ARP-G-1 would minimize any potential adverse effects by implementing recovery plan protection measures.

Air Management
We anticipate this program will have no effect on the lesser long-nosed bat or its habitat.

Animals and Rare Plants
This program area is responsible for survey, inventory, and monitoring of species and works with other agencies to sustain viable populations of all species on the CNF. The Species Diversity and Viability Report assessed the lesser long-nosed bat and determined that lesser long-nosed bat population trends were unknown and habitats were in a positive trend. Harvesting of cacti plants and other plant species is allowed on CNF with a permit, however guidelines provide for maintaining a sustainable paniculate agave population throughout the lesser long-nosed bat habitat on the CNF. It is unlikely that the removal of even a few plants would have a significant effect on the availability or distribution of plant foods for the lesser long-nosed bat.

Guideline ARP-G-1 requires that activities occurring within lesser long-nosed bat habitat should follow the recovery plan and support recovery actions for the lesser long-nosed bat. Guideline ARP-G-5 protects bats roost from disturbance during occupancy periods, and restricts activities from modifying roost habitat quality and factors that can result in the spread of disease during non-occupancy periods. These guidelines will minimize adverse effects to lesser long-nosed bat habitat.

Invasive Species Management
The presence and spread of non-native invasive species has an effect on the fire regime and can increase the fuel and intensity of fire and decrease the availability of native lesser long-nosed bat forage habitat (AGFD 2016). This program would help with the removal of non-native invasive species. The objective VDC-O-1 and guideline ISM-G-1 would help remove non-native invasive animals. Herbicide and pesticide treatments are expected to continue under this plan as they have under the previous forest plan. The use of herbicide and pesticides can have adverse effects on lesser long-nosed bat. Insecticides and rodenticides could harm bats if they were to come into direct contact with these chemicals. However, we consider there to be a small likelihood that the use of chemicals by the FS would have an appreciable effect on bat populations.

Any potential future projects implemented under this plan would be assessed on a case by case basis to determine potential effects on individual species and to minimize them. Management approaches including detecting and treating new populations of invasive species before they become established would help reduce fire intensity, which could benefit lesser long-nosed bat foraging habitat.

Forest Products
As mentioned previously, harvesting of cacti and other plant species is allowed on CNF with a permit, however guidelines provide for maintaining a sustainable paniculate agave population throughout the lesser long-nosed bat habitat on the CNF. It is unlikely that the removal of even a few plants would have a significant effect on the availability or distribution of plant foods for the lesser long-nosed bat.

Minerals Management

Future minerals activities could result in disturbance and loss of habitat, including removal of forage plants, as well as increased noise, vibrations, traffic and light. The proposed action could directly affect and result in the permanent loss of lesser long-nosed bat post-maternity roost sites. The proposed action would affect lesser long-nosed bats through the removal of potential lesser long-nosed bat forage plants (i.e., paniculate agaves) in the late-summer range of the species. Reduced food sources could result in reduced reproduction success or could result in the abandonment of the action area and nearby roosts by lesser long-nosed bats. Any individual lesser long-nosed bats present within the footprint of mine infrastructure (including the pit, buildings, roads, tailings or waste piles, etc.) could either be crushed or forced to relocate. Increased light levels could disrupt this nocturnal species, resulting in changes in dispersal, reproductive behavior, communication patterns, and decreased foraging success (Longcore and Rich 2004). Similarly, noise and vibrations from construction of the mine or blasting will disturb lesser long-nosed bats, likely causing changes in dispersal, reproductive behavior, communication patterns, decreased foraging success, increased predation and stress response, and possibly damaged hearing if the noise is loud enough (NoiseQuest 2011; Pater *et al.* 2009). Increased traffic (including night traffic) from minerals operations could result in disturbance to bats if foraging in the area.

Standards and guidelines would help minimize impacts to the lesser long-nosed bat. Standard MIN-S-2 and guideline VLS-G-2 would require only native plant species or short lived non-persistent, non-native species to be used for reclamation of disturbed sites. Standard MIN-S-1 would only allow the minimum amount of structures and occupancy needed to conduct mining operations. These standards and guideline will reduce disturbance and habitat loss to lesser long-nosed bats from minerals activities.

Public Access

The effects of this program are similar to those discussed in the Motorized Transportation System and Recreation Management programs, below.

Motorized Transportation System

Currently the CNF has 0.99 mile/mile^2 of FS roads, and the Revised LRMP focuses on a road density of less than 1 mile/mile^2 (USFS 2016a). The Motorized Transportation System program proposes to accomplish maintenance; decommission, close, and restore unneeded roads; install hardened road surface at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat in order to prevent downstream effects; and realign or remove roads in wetlands or meadows within 10 years of plan implementation (Objectives MTS-O-1, MTS-O-2, MTS-O-3, MTS-O-4 and MTS-O-5).

Road construction and maintenance, restoration of roads, hardened drainage crossings, and removal of roads can directly and indirectly affect lesser long-nosed bats and its habitat. All of these activities have the potential to directly affect habitat through loss of agave plants that may be within a new road corridor or immediately adjacent to road bed from heavy equipment doing road work. Maintenance of existing roads would improve road surface, resulting in increased traffic and increase the potential for encounters with vehicles, which could lead to injury or death. These potential effects to bats are minimal given that unimproved roads throughout the Forest are minimally maintained and road maintenance activities occur infrequently.

The low road density, along with no off-road vehicle travel on the CNF, will reduce the potential for recreation in or near bat roosts, and subsequently reducing chances of disturbance and abandonment. As stated above, lesser long-nosed bats appear to be sensitive to human disturbance and even brief visits by humans is sufficient to cause them to temporarily abandon roosts. Mortality or injury of lesser long-nosed bats could also occur due to collisions with vehicles. The frequency of such collisions is unknown, but the potential exists for bats to collide with fast moving vehicles.

If roads are closed as directed in objective MTS-O-3, impacts may be beneficial, as there would be reduced fragmentation to habitat and reduced interaction between vehicles and bats. Standard MTS-S-1 would be beneficial to lesser long-nosed bat, as motorized travel would be restricted to designated routes and trails.

Recreation Management
Roosting lesser long-nosed bats are very sensitive to human intrusion. Recreational cavers, illegal border users, law enforcement, or researchers entering mines, caves, or other sites where lesser long-nosed bats might day roost could result in temporary or permanent desertion of the roost. Disturbance of known roost sites appears to be minimal. Hunting is allowed near the known lesser long-nosed bat roosts. Potentially, a hunter could discharge a weapon near a roost site and disturb bats or cause them to temporarily abandon the roost. However, this type of disturbance is likely to be infrequent, and most hunting occurs after the bats have left in the fall. Future unauthorized human entry has some potential to transmit white nose syndrome, which could have population-level effects, if the disease reaches CNF. The disease agent has been spreading rapidly since its discovery in the eastern U.S. in 2006 but it is not currently known to have reached the western U.S, with the exception of several locations in Washington State.

Scenery Management, Special Uses, Cultural Resources, Tribal Relations
We anticipate these programs will have no effect on the lesser long-nosed bat or its habitat.

Range Management
The range program includes the production of forage for grazing and browsing livestock and wildlife, and natural beauty and quiet places. Livestock grazing is permitted on about 90 percent of the CNF, and most of the grazing occurs on a yearlong basis (USFS 2016a). Monitoring determines if acceptable progress is being made towards attainment of resource management objectives and, thus, desired conditions. Grazing use is administered through a grazing permit system on designated livestock grazing allotments.

Cattle grazing can adversely affect agave survivorship and bolting. Cattle probably trample young agaves, as well. Direct effects due to grazing may be more intense in areas grazed during the flowering season of agave and where cattle congregate near water sources. Excessive browsing on newly emergent flower stalks of agaves has been suggested as possibly decreasing foraging opportunities and thus contributing to population declines. Impacts from livestock grazing activities may occur from trampling or grazing on young saguaros (Abouhalder 1992).

Impacts to forage plants through implementation of the rangeland management program may occur through direct herbivory and possible trampling by livestock, and alteration of the vegetation community. Widmer (2002) found that livestock herbivory on agaves diminished significantly at distances greater than 0.75 miles from water. Thus, many remote (from water) agave populations are likely to be unaffected by livestock grazing. No long-term investigation has quantitatively documented the effect of grazing on agave mortality following stalk herbivory. Individual paniculate agave plants only bloom once in their life (20 years). However, agave stalks are rich in carbohydrates, and as they begin to bolt (i.e., rapid expansion and increased height of stem and formation of flowers) are particularly palatable to domestic livestock and other wild herbivores as well (Howell 1996). Cattle have been known to "walk down" agave flowering stalks (T. Cordery, USFWS, 1998, unpubl. data). Effects on bat forage plants due to livestock grazing are expected to be more intense where livestock congregate near water sources and less intense on steep slopes or among rocks where grazing is generally lighter because of topography and agaves are at higher densities. To summarize, effects from livestock activities occur in areas where lesser long-nosed bats forage that could cause adverse responses to bats. However, to what degree livestock grazing alters the distribution and abundance of agaves and other food plants used by lesser long-nosed bat populations needs further study.

Guidelines RAM-G-1 and RAM-G-2 would minimize impacts to bat foraging habitat by restricting forage utilization by cattle to 15 to 45 percent of current year's growth and allowing plant recovery and vigor after areas are burned. In addition, guidelines RAM-G-4, RAM-G-6, and RAM-G-7 would provide for the growth and perpetuation of native plant species (including agaves) sufficient for the forage needs of the lesser long-nosed bat.

Mexican Spotted Owl

Wildland-Urban Interface and Landscape-scale Fire

These program areas include management through prescribed cutting, slash pile burning, slash removal, mechanical treatments (thinning and mastication), and grazing; treating the landscape with wildland fire (both prescribed and naturally-managed); and restoration of disturbed areas using native plant species or short-lived, non-persisting non-native species. Treatment includes thinning and/or removal of fuels from the landscape to reduce fuels and the potential for loss of private property. Reducing fuels allows the CNF the flexibility to manage wildland fires for resource benefit. Landscape-scale wildland fire is one method used for ecosystem restoration and enhance resiliency of vegetation communities by maintaining more sustainable fuel loads, improved habitat diversity, and watershed integrity. This program would reduce the risk of uncharacteristic fire impacts, including stand-replacing fires, which result in potential impact to Mexican spotted owl through habitat modification and disturbance. The LRMP directs that activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from recovery plans (ARP-G-1). In general, the CNF expects that for most WUI and fire projects implemented under the revised LRMP in protected activity centers and recovery habitat, they will follow the Recovery Plan (USFS 2016a). Over the long-term, implementing Recovery Plan guidance should result in positive impacts to the owl and its habitat for most project-specific actions associated with this program.

Burning and thinning treatments were designed to move the vegetation communities toward desired conditions as identified in the Mexican spotted owlrecovery plan (USFWS 2012a). Two objectives of this program area, VDM-O-1 and VWM-O-1 include the treatment (through fire and/or mechanical means) of 13,800 acres of dry mixed conifer and 2,400 acres of wet mixed conifer respectively every ten years. If treatments occurred evenly across the landscape, this would result in a 30 year treatment interval for the mixed conifer vegetation community. Thinning and/or wildland fire treatments in the protected activity center (PAC) and recovery habitat may indirectly impact Mexican spotted owls by affecting the habitat structure including snags, downed logs, woody debris, multi-storied canopies, and dense canopy cover. Treatment of these vegetation types will also have short-term effects to foraging and nest/roost habitat of Mexican spotted owl. Short term impacts would include: change in stand structure which may impact nesting and foraging habitat; noise from thinning operations which would cause disturbance to any individuals in the area at the time of operations; and reduced severe wildfire risk. There would be adverse long-term effect due to the treatment return interval, as stated above.

In addition, WUI-O-1 includes treatment of 5,000-10,000 acres every year. Additionally, each Ecosystem Management Area which encompasses Mexican spotted owlhabitat would treat from 15-40% every ten years. Effects from prescribed fire within protected activity centers and recovery habitats are difficult to quantify due to the uncertainty inherent in prescribed fire. Past experience and research have shown that large logs, snags, large trees, and oaks – all key habitat components for Mexican spotted owl habitat – may be destroyed or damaged during these activities (Horton and Mannan 1988). After a landscape scale fire, it also provides for reestablishment of native plants needed by wildlife and their prey.

For most projects, site-specific treatments of Mexican spotted owl habitat will be designed to meet the guideline ARP-G-1, which requires that all activities within federally listed species habitat should apply objectives and measures from species recovery plans. The use of wildland fire provides for desired potential natural vegetation types conditions including maintaining habitat needed by wildlife. After treatment, it also provides for reestablishment of native plants needed by wildlife and their prey. The guidelines VPP-G-1, VPP-G-2, VPP-G-3, VPP-G-5, VDM-G-1, VDM-G-2, VDM-G-3, VDM-G-5, VWM-G-1, VWM-G-2, VWM-G-3, VWM-G-4, VWM-G-6, VSF-G-1, VSF-G-2, and VSF-G-4 would retain and enhance habitat for prey species to benefit the foraging needs of Mexican spotted owl. There is the potential for these treatments to adversely affect Mexican spotted owls and/or important habitat components (and PCEs) in the forested potential natural vegetation types (ponderosa pine-oak, dry mixed conifer, wet mixed conifer and spruce fir). Mechanical treatments designed to meet fuels reduction objectives in protected activity centers could result in reduced canopy cover, loss of multi-layered canopy structure, and reductions in snags and coarse woody debris.

Water Resources – Natural

This program area has the potential to benefit Mexican spotted owl and critical habitat by improving habitat conditions. Restoration and development of natural water resources will make surface water more available for Mexican spotted owl and the prey they depend upon. The objectives that apply that would benefit Mexican spotted owl and their habitat in this program area are NWS-O-1 which encourages the CNF to apply for water rights and NWSO-2 which would encourage reconstruction of springs to provide for the recovery of wildlife species.

Specific guidelines that would improve habitat for the prey Mexican spotted owl depend on include:

- NWS-G-1 could minimize impacts to soil resources which would reduce sediment flow into stream habitat;
- NWS-G-2 require projects to protect or enhance water quality and quantity, and aquatic habitat, and;

- NWS-G-3 reduces fuel buildup protect water sources from uncharacteristic fire effects.

Activities under this program have the potential for short-term effects to Mexican spotted owl habitat (*e.g.*, disturbance where these restoration efforts occur within spotted owl habitat), but also have the potential for long-term improvement to overall watershed and riparian conditions for the Mexican spotted owl. Activities under these plan components will also be guided by ARP-G-1 to be consistent with the Mexican spotted owl Recovery Plan and have the potential to provide long-term benefit by improving riparian habitat and habitat for prey species. Guidelines RIA-G-3 and RIA-G-4 provide maintenance of PCEs 2, 3, and 4 on the CNF, which include shade component, snags and large downed woody debris.

Activities within this program restore and maintain watershed and riparian conditions on the CNF. These activities could be conducted in protected activity centers and recovery habitat. However, these projects with predicted long-term benefits may reduce habitat quality for Mexican spotted owls in the short-term. In the short-term, direct and indirect effects to the Mexican spotted owl and its habitat may include disturbance (from noise and human presence during project implementation) and the short-term loss of key Mexican spotted owl and prey habitat components (e.g., reduced canopy and herbaceous vegetation cover, and loss of riparian vegetation). Therefore, over the life of this consultation, we expect that implementation of this program would result in short-term adverse effects to Mexican spotted owls and their habitat.

Water Resources – Constructed
This program area has the potential to both positively and negatively impact Mexican spotted owl prey species. Prey species would benefit from the improved habitat conditions at constructed water sites (i.e., stock tanks), but the development of the stock tanks would result in increased ungulate grazing resulting in adverse effects to prey species habitat or the ability of the understory to carry low-intensity fire. The objective COW-O-1 is intended to reduce drowning mortality of small mammals and other wildlife associated with constructed waters such as livestock and wildlife troughs. The guideline COW-G-1 will help design future water sources and retrofit existing constructed water sources to meet this objective.

Animal and Rare Plants Program
The USFS Species Diversity and Viability Report assessed the Mexican spotted owl. The viability report determined that Mexican spotted owl population trend was unknown and that the habitat was in a positive trend. The guideline ARP-G-1 would apply habitat management objective and protection measures from the Mexican spotted owl Recovery Plan, thus improving habitat for the species. This guideline will provide overarching guidance for activities as it directs the forest to apply management objectives in the Mexican spotted owl recovery plan, which describes many standards for management of Mexican spotted owl and their habitat.

Forest Products
Forestry activities planned under the revised LRMP emphasize the restoration of forests, resulting in improved species habitat. In general, the CNF expects that for most projects implemented under the revised LRMP in protected activity centers and recovery habitat, they will follow the Recovery Plan (USFWS 2012a). Over the long-term, implementing Recovery Plan guidance should result in positive impacts to the owl and its habitat for most project-specific actions associated with this program. The FS typically implements measures to

minimize effects to key habitat components (such as retaining large trees, large snags, etc.) and the owl (such as conducting forestry operations outside the owl breeding season when in or near protected activity centers). However, in the short-term, direct and indirect effects to the Mexican spotted owl and its habitat may include disturbance (from noise or activities near protected activity centers, and smoke), the loss of key habitat components, and reduced severe wildfire risk. This section describes the potential effects of future projects to Mexican spotted owls and how actions implemented under the LRMP may result in short-term adverse effects to the species and its habitat; however, we also expect that implementation of the revised LRMP would reduce the potential for high severity fire effects and provide increased protection to existing and future Mexican spotted owl habitat.

This program area may have localized short term adverse effects but provide long term benefits through reduced likelihood of habitat loss from large wildland fires. Short term impacts would include change in stand structure which may impact nesting and foraging habitat, and noise from thinning operations which would cause disturbance to any individuals in the area at the time of operations. This program area has the potential to impact PCEs of Mexican spotted owl critical habitat by altering forest structure or reducing quality of prey habitat. All activities would be designed to comply with the Mexican spotted owl Recovery plan identified in ARP-G-1. This would benefit Mexican spotted owl foraging habitat and prey habitat by providing an open stand with various structural stages. The guidelines VDM-G-1 and VSF-G-1 would also ensure that these vegetation treatments would continue to provide a continuous representation of old growth characteristics. MOM-G-1 and 2 are intended to protect and enhance meadow habitat important to Mexican spotted owl prey species. FOP-G-1 will ensure that making progress toward desired conditions is the goal of timber harvest.

When treatments occur within potential Mexican spotted owl habitat there is potential for habitat components to be removed, modified, or re-distributed. There is the potential for loss of snags, logs, and large trees and reduced canopy closure within owl habitat due to conflict with restoration needs and/or habitat enhancement goals. Mechanical treatments adequate to meet fuels and restoration management objectives in recovery habitats may result in the short-term loss of some habitat components (USFWS 2012a).

There is the potential for mechanical treatments to adversely affect Mexican spotted owls and/or important habitat components. Mechanical treatments designed to meet fuels reduction objectives in protected activity centers could result in reduced canopy cover, removal of large trees, loss of multi-layered canopy structure, and potentially significant reductions in snags and coarse woody debris.

The Forest Plan includes an objective to treat (using both thinning and burning) 2,500-10,000 acres every ten years to maintain watershed stability thereby maintaining the function and structure of streams, floodplains, and riparian vegetation (RIA-O-1). This objective is to be met by applying guidelines RIA-G-2, 3, and 4 which will limit livestock effects to riparian areas, retain large woody debris in stream channels, and favor the growth of large diameter riparian trees. The guidelines VDM-G-1, VWM-G-1 and VSF-G-1 would also ensure that these vegetation treatments continue to provide a continuous representation of old growth characteristics. Treatments needed to accomplish these guidelines would, of course, be designed as directed in ARP-G-1 to be consistent with management of Mexican spotted owl critical habitat.

Minerals Management
The CNF is currently aware of approximately 27 mineral projects within Ecosystem Management Areas where Mexican spotted owl and Mexican spotted owl critical habitat occur. These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Actual mining infrastructure and disturbance would be impossible to predict at the time of this document. Seventeen of these projects are active and currently in place, while three projects are expected to occur in the foreseeable future, two are completed and five are withdrawn from consideration at the point. Four projects are located on the Santa Catalina Ranger District within the Santa Catalina Ecosystem Management Area, eleven on the Nogales Ranger District within the Santa Rita and Tumacacori Ecosystem Management Areas, and twelve on the Sierra Vista Ranger District within the Huachuca Ecosystem Management Area.

Mineral extraction may result in the removal of owl habitat and/or disturbance to the spotted owl during the breeding season. The proposed desired conditions and guidelines for these activities would assist in reducing or eliminating these impacts by restricting or prohibiting some surface use in Mexican spotted owl habitat. In addition, efforts to concentrate uses to the extent possible would limit the amount of habitat that would be affected by development of these facilities. The desired conditions and guidelines for mineral and mining activities would only apply to new, not existing, leases.

We cannot predict what might occur in the Minerals Program that may impact Mexican spotted owls or their habitat. However, we know from past consultations (e.g., Rosemont) that there are likely to be some impacts to owls and/or their habitat from this program on the CNF. This program is likely to have short and long-term adverse effects to the Mexican spotted owl due to habitat fragmentation, noise disturbance, and loss of prey habitat. The standards and guidelines required under this program are expected to minimize, but may not eliminate all of these adverse effects. Therefore, over the life of this consultation, we expect that implementation of the Minerals Program would result in adverse effects to Mexican spotted owls, their prey species, and their habitats.

Motorized Transportation System
This program area could impact Mexican spotted owl critical habitat and Mexican spotted owl nesting and roosting sites through motorized entry, road construction and maintenance activities. There are currently nearly 100 miles of system roads within protected activity centers on the CNF (USFS 2016a). Roads (including road maintenance) and related recreation activities (often associated with motor vehicles such as all terrain vehicles) have contributed noise and disturbance to Mexican spotted owl, along with loss and habitat fragmentation. High road densities can increase human presence into areas and increased human presence and/or activities can result in spotted owls flushing or leaving their roost. On a local scale, roads and trails through protected activity centers may fragment habitat continuity, alter natural movement patterns, and increase disturbance to resident owls. Effects are variable depending on time of day/night, intensity, frequency, and distance to Mexican spotted owl. Persistent noises are likely more disruptive than infrequent disturbances, and intensity of disturbance is proportional to noise level. Roads in nest/roost replacement areas and other recovery habitats may also result in a loss of habitat components (e.g., large logs, snags, and hardwoods) as people access these areas for fuelwood cutting.

The FS typically implements measures to minimize effects to the owl and habitat components from the construction of roads and trails (such as avoiding road maintenance activities near protected activity centers during the breeding season, avoiding construction of new roads in PAC habitat, etc.). Under this program, the FS may also seasonally or permanently close existing roads in certain circumstances. Seasonally or permanently closing roads within areas where spotted owls are known to occur would reduce the amount of disturbance, particularly during the breeding season (March 1 to August 31). The actual effects to the Mexican spotted owl and/or owl protected and recovery habitat would be dependent on methods, location, and timing of such activities.

Ongoing activities within the transportation program include the operation and maintenance of the transportation system on the CNF, which consists of roads and trails that provide access to areas on the forest including: private land, structures and improvements under special use permit, recreational opportunities, and facilities that support land and resource management activities. We would expect that over the life of the project, there could be additional new and temporary road construction to help support forest restoration activities which may result in short-term adverse effects to Mexican spotted owls and their habitat.

The BA did not identify any specific desired conditions related to this program that are relevant to the Mexican spotted owl or its critical habitat, but there are objectives, standards, and guidelines which are relevant. Objectives MTS-O-1 and MTS-O-2 will work to maintain 150 miles of high clearance roads and 200 miles of passenger car roads annually. MTS-O-3 would decommission and restore up to 10 miles of unneeded non-system roads annually. Decommissioning and restoring unneeded roads within Mexican spotted owl critical habitat would help eliminate the noise and disturbance from their use within spotted owl habitat. However, road work activities also have the potential to disturb spotted owl, if present.

Standard MTS-S-1 could also potentially reduce noise and disturbance to spotted owl and reduce vehicle soil and vegetation impacts across their habitat by limiting motorized vehicle travel to designated roads and motorized trails. Guidelines RIA-G-1, MTS-G-2 and MTS-G-3 restrict new road construction in riparian areas, meadows and wetlands unless alternate routes have greater resource impacts, in which case effects to natural waterflow, vegetation and ecosystem function should be minimized. These guidelines would provide for needed habitat for Mexican spotted owl prey species. Moreover, ARP-G-1 guides the forest to apply measures defined in recovery plans for all activities that occur within federally listed species habitat.

The revised LRMP would strive to implement the Recovery Plan (USFWS 2012a) and guidelines that would minimize impacts to the Mexican spotted owl and its habitat. However, due to the FS's multiple use mission, restoration of forested habitats, and active management of spotted owl habitat, we anticipate that over the life of this consultation (15 years) there will be activities implemented under this plan that could result in adverse effects to the owl and its habitat. Project activities associated with forest management (e.g., fuels reduction projects, forest restoration, salvage logging, fire management) would likely be the predominant activities occurring within and adjacent to Mexican spotted owls and their habitat. These activities can result in disturbance during the breeding season (such as mechanized logging, hauling routes, smoke), habitat modification (short-term reductions in large logs, snags, and other key habitat components), and habitat degradation (such as long-term loss of old-growth, pre-settlement trees to create openings for regeneration). Other actions, such as those conducted under the Lands or

Special Uses Program (based upon recent site-specific consultations), Recreation, or other programs identified above, could also result in adverse effects to Mexican spotted owls from modification of prey species habitat due to disturbance related to construction of infrastructure near occupied areas.

Recreation Management
Recreation activities may affect Mexican spotted owls directly through disturbances caused by human activity (e.g., hiking, shooting, off-road vehicle use, rock climbing, geo-caching, or camping at nesting, roosting, or foraging sites) or indirectly through alteration of habitats such as damage to vegetation, soil compaction, illegal trail creation, and increased risk of wildland fire. Development of new recreational facilities (e.g., trailheads, mountain bike trails, etc.) and expansion of existing facilities (e.g., campgrounds and hiking trails) may alter owl habitat. The nature of the recreation program can come into conflict with Mexican spotted owl management across the forest and may result in disturbance to owls. Typically, this is a result of recreationists wanting to conduct activities (such as off-road vehicle group rides) in or adjacent to protected activity centers during the breeding season. Other recreation activities in the region that have resulted in potential adverse effects to the Mexican spotted owl include building trails and developing recreational facilities within protected activity centers .

Effects are variable depending on time of day/night, intensity, frequency, and distance to Mexican spotted owl. Some developed recreation sites are within Mexican spotted owl habitat and some are adjacent to protected activity centers; however, these sites have been in place for decades. Persistent noises are likely more disruptive than infrequent disturbances, and intensity of disturbance is proportional to noise level. Rock climbing is an increasingly popular activity on the CNF and at times may occur within or adjacent to protected activity centers. Forest Plan guideline REC-G-6 directs the forest to manage the activity to balance the needs of the climbing public with the needs of plant and animal species. However, the overarching guideline in the Forest Plan ARP-G-1 requires that activities are implemented consistent with recovery plans. The Mexican spotted owl recovery plan guides land management agencies to minimize disturbance from recreational activities such as all terrain vehicle use and rock climbing in protected activity centers during the breeding season.

All activities would be compliant with ARP-G-1 which ensures that all projects in federally listed species habitat will apply guidelines of the appropriate recovery plan. Guideline REC-G-2 ensures that recreation sites are managed so there is no unacceptable resource damage or impact to the landscape; this helps ensure that Mexican spotted owl habitat is minimally impacted from disturbance.

The LRMP includes standards and guidelines to reduce the impacts to Mexican spotted owls from recreation activities; however, there is also direction in the LRMP to improve recreational opportunities. Over the life of the LRMP, this could result in impacts (i.e., disturbance during nesting/roosting and foraging periods and increased noise from human activities) to Mexican spotted owls and their habitat.

Range Management
Grazing allotment plans, as developed under the revised LRMP, provide guidance for managing and monitoring public lands range use by livestock on the CNF. Grazing can adversely affect the Mexican spotted owl primarily through four indirect effects: 1) diminished prey availability

and abundance; 2) increased susceptibility of habitat to destructive fires; 3) degradation of riparian and meadow plant communities; and, 4) impaired ability of plant communities to recover or develop into more suitable Mexican spotted owl habitat (USFWS 2012a). Although the CNF strives to manage livestock allotments to maintain habitat for the owl and its prey, multiple factors (such as yearly precipitation) may determine the specific influences of livestock on Mexican spotted owl habitat. Livestock grazing utilization levels incompatible with sustainable prey habitat has the potential to indirectly effect the Mexican spotted owl. However, the desired conditions for livestock grazing in the revised LRMP should promote understory vegetation production in forested and grassland habitat. The objectives identified in the revised LRMP should aid in improving habitat conditions for prey species across the CNF. The desired conditions and guidelines for livestock grazing in montane meadows/openings would help maintain habitat for prey species in these areas. Ponderosa pine-oak forest would be managed such that there are grasses and needle cast to provide the fine flashy fuels needed to maintain the natural fire regime.

Livestock grazing may result in minimal effects to protected activity centers on the CNF because of the steep, forested areas where they occur that provide less forage. We also expect that the revised LRMP desired conditions and guidelines would result in insignificant effects to prey availability in recovery habitat in ponderosa pine-oak.

The following guidelines help minimize adverse impacts to the Mexican spotted owl, its prey and their habitat:

- RAM-G-1 helps minimize impacts to habitat needs for wildlife by retaining needed amounts and structure of herbaceous vegetation.
- RAM-G-2 ensures that plant recovery and vigor are sufficient following burning activities by deferring grazing;
- RAM-G-4 ensures ground cover is retained to be sufficient for the needs of native wildlife species;
- RAM-G-6 ensures native plant species are used and perpetuated; and
- RAM-G-7 helps minimize adverse impacts by maintaining or enhancing habitat for wildlife through intensity, frequency, occurrence and period of grazing.

Range program activities provide guidance for managing livestock on the CNF. Livestock grazing may have minimal effects to protected activity centers due to the steep, forested areas where they occur. Livestock grazing may still adversely affect important habitats needed by Mexican spotted owl and their prey species. The standards and guidelines required under this program are expected to minimize, but not eliminate these adverse effects. Therefore, over the life of this consultation, we expect that implementation of the Rangeland Program would result in short-term adverse effects to Mexican spotted owls, their prey species and their habitats.

Mexican Spotted Owl Designated Critical Habitat

In our analysis of the effects of the action on critical habitat, we consider whether or not a proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species. To determine this, we analyze whether the proposed action will adversely modify any of the PCEs that were the basis for determining the habitat to be critical. To determine if an action results in adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PCEs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be considered because, collectively, they represent the best available scientific information as to the recovery needs of the species.

Below, we describe the PCEs related to forest structure and maintenance of adequate prey species and the effects from implementation of the LRMP. The PCEs for steep-walled rocky canyonlands are not analyzed in this BO because this habitat does not occur within the action area.

Primary Constituent Elements related to forest structure:

PCE: A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30 percent to 45 percent of which are large trees with mean diameter at breast height of 12 inches or more.
Effect: Actions implemented under the revised LRMP are expected to retain the range of tree species (i.e., conifers and hardwoods associated with Mexican spotted owl habitat) and would not reduce the range of tree sizes needed to create the diverse forest and multi-layered forest canopy preferred by owls. Some loss of trees of all types and mean diameter at breast height size classes would occur from actions such as hazard tree removal, prescribed fire, and forest thinning (as implemented under WUI and Landscape-scale Fire and Forest Products Programs). However, actions implemented under the revised LRMP are expected to maintain a range of tree species and sizes needed to maintain this PCE in protected activity centers and recovery habitat across the CNF because the FS is implementing the Recovery Plan guidelines that strive to retain large trees, canopy cover appropriate for owl habitat, and a diverse range of tree species. Removal of trees and various tree species may also occur as part of the Recreation (development of recreation sites) and Motorized Transportation Programs (creation, maintenance of roads); but these effects should be small in extent and intensity. Therefore, the function and conservation role of this PCE would not be compromised by the proposed action.

PCE: A shade canopy created by the tree branches covering 40 percent or more of the ground.
Effect: We expect that tree shade canopy would be reduced following thinning and burning treatments implemented under the revised LRMP in WUI and Landscape-scale Fire and Forest Products Programs. However, we do not expect reduction of canopy cover in Mexican spotted owl forested habitat to be reduced below 40 percent because the FS has adopted the Recovery Plan recommendations that include managing for higher basal area and increased canopy cover in Mexican spotted owl habitat versus pure ponderosa pine or other forest and woodland habitats. Previous treatments under the previous LRMP were not expected to reduce the shaded canopy below 40 percent. We would expect that some small reduction in existing canopy cover (5 to 10 percent) may actually aid in increasing understory herbaceous vegetation and forb production, which could benefit Mexican spotted owl prey species. The function and conservation role of this PCE would not be compromised by the proposed action.

PCE: Large, dead trees (snags) with a mean diameter at breast height of at least 12 inches.
Effect: Large snags would most likely be reduced following proposed prescribed burning and hazard tree removal actions conducted under WUI and Landscape-scale Fire and Forest Products

Programs (and possibly other programs as well). Currently, large snags are rare across the action area, and any loss of this habitat component may be significant in terms of maintaining Mexican spotted owl and prey habitat. Some snags would be created through prescribed burning, which could benefit the Mexican spotted owl. However, snags currently used by Mexican spotted owls for nesting are typically very old, large mean diameter at breast height, highly decayed snags with cavities. In individual burning projects, the FS would attempt to minimize loss of these large snags through conservation measures (such as lining or using lighting techniques to avoid snags). Research has indicated that following burning treatments, upwards of 30 percent of these existing snags may be lost within treated (i.e., burned) forests, resulting in short-term adverse effects to this PCE (Randall-Parker and Miller 2000). However, the study design did not include active protective measures for large snags. This is why conservation measures that the FS implements to protect the largest and oldest snags (particularly those with nest cavities) are critically important. Therefore, though we anticipate there would be a measurable loss of snags due to implementation of the revised LRMP, efforts to protect this rare resource would be made as part of any forest or fuels management project. As such, the function and conservation role of this PCE would not be compromised by the proposed action. Guideline MOM-G-3 would retain standing dead snags greater than 12 inches diameter breast height that would benefit Mexican spotted owl habitat.

Primary Constituent Elements related to maintenance of adequate prey species:

PCE: High volumes of fallen trees and other woody debris.
Effect: Fallen trees and woody debris would likely be reduced by the proposed burning treatments (broadcast, piling, and maintenance burning) as part of WUI and Landscape-scale Fire Program, as well as through the Recreation Management program which would reduce the availability of fallen trees and downed woody debris in the vicinity of picnic areas and campgrounds. Logs are expected to be reduced by approximately 30 percent within protected and recovery Mexican spotted owl habitat (Randall-Parker and Miller 2002). This loss of large logs would result in short-term adverse effects to this primary constituent element and could result in localized impacts to prey species habitat. Furthermore, across the CNF, it is likely that hazard tree removal and prescribed burning would also create fallen trees and woody debris as trees are felled (i.e., cut) and left on the ground or are killed post-burn and fall. However, based upon current data for many of these areas, there is an excess supply of coarse woody debris due to the exclusion of frequent, low-severity fire, which can increase the likelihood of high-severity fire within recovery habitat. Therefore, some removal of woody debris would result in an overall benefit to the function and conservation role of this PCE, though short-term adverse effects would likely occur within some project areas.

PCE: A wide range of tree and plant species, including hardwoods.
Effect: We expect this PCE would be positively affected by the actions taken under WUI and Landscape-scale Fire and Forest Products Programs. Plant species richness would increase following thinning and/or burning treatments that result in small, localized canopy gaps. Individual projects conducted under the revised LRMP typically would include conservation measures that focus on retaining oaks and other hardwoods, but some level of short-term loss could occur at the individual project level. However, the function and conservation role of this PCE would not be compromised by the proposed action.

PCE: Adequate levels of residual plant cover to maintain fruits and seeds, and allow plant regeneration.
Effect: Short-term decreases in plant cover would result from prescribed burning conducted under WUI and Landscape-scale Fire Program, and possibly some limited reductions from livestock managed under the Range Management Program (see discussion in Recovery Plan, pgs. 42-3). We expect long-term increases in residual plant cover because fire treatments would provide conditions suitable for increased herbaceous plant growth by removing a thick layer of dead plant debris within treated areas. The mosaic effect created by burned and unburned areas and by opening up small patches of forest within protected habitat is also expected to increase herbaceous plant species diversity (Jameson 1967, Moore *et al*. 1999, Springer *et al*. 2001) and, in turn, assist in the production and maintenance of the Mexican spotted owl prey base. The combination of low-intensity prescribed burns and thinning during restoration projects would most likely result in only short-term effects to the Mexican spotted owls with regard to modifying prey habitat within treatment areas. In frequent-fire landscapes, herbaceous understory response and plant regeneration tends to be positive following tree removal and prescribed fire (Springer e*t al*. 2001). There is the potential for the Range Management Program to have adverse effects on the production of plant cover post-burning if livestock were allowed to graze burned areas too soon following fire. However, the revised LRMP includes desired conditions and guidelines to maintain healthy levels of forage and managing livestock following prescribed fire. Therefore, the function and conservation role of this PCE across the CNF would not be compromised by the proposed action.

Effects of the action on the role of critical habitat in recovery

Adverse effects from the revised LRMP are not expected to negatively affect Mexican spotted owl recovery and/or further diminish the conservation contribution of critical habitat to the recovery of the Mexican spotted owl.

The revised LRMP includes a guideline (ARP-G-1) to integrate habitat management objectives and species protection measures in accordance with the Recovery Plan (USFWS 2012a). These actions were identified by the Recovery Team as being necessary to recover the Mexican spotted owl and the CNF is implementing these actions in designated critical habitat. Designated critical habitat includes all protected (PACs) and recovery habitat (unoccupied Mexican spotted owl habitat) within critical habitat units. These actions include the following:

- The CNF has and continues to designate 600 acres surrounding known Mexican spotted owl nesting and roosting sites. Protected activity centers are established around owl sites and are intended to protect and maintain occupied nest/roost habitat. Nesting and roosting habitat is rare across the range of the Mexican spotted owl, and by identifying these areas for increased protection, the FS is aiding in recovery.
- The CNF has identified and is managing pine-oak, mixed conifer, and riparian forests that have potential for becoming Mexican spotted owl replacement nest-roost habitat, or are currently providing habitat for foraging, dispersal, or wintering habitats. As stated above, nesting and roosting habitat is a limiting factor for the owl throughout its range. By managing critical habitat for future replacement nest/roost habitat, the CNF is aiding in recovery.

- The population monitoring protocol in the 1995 Recovery Plan has proven to be impractical due to logistics and expense. A new population monitoring protocol was developed within the current Recovery Plan based on Mexican spotted owl occupancy (i.e., presence/absence). The FS Regional Office is currently working with the FWS to implement the pilot study (ongoing now).
- The CNF's intent is to integrate the best available recovery habitat management objectives where possible into forest restoration and/or fuels reduction projects with the overall goal to protect owl protected activity centers from high-severity wildland fire, and to conduct actions to improve forest sustainability (e.g., thinning and prescribed burning) to ensure Mexican spotted owl habitat continues to exist on the forest.
- The CNF is implementing on-going projects previously consulted on under site specific BOs. BOs issued for these projects have noted adverse effects to PCEs and spotted owls. However, these projects are designed to result in long-term benefits to spotted owls habitat by reducing fuels and the risk of high severity wildland fire (Pinaleno Ecosystem Restoration Project). For example, the Arizona Forest Utility Hazard Tree Removal Phase II Project (USFWS 2008), though it is designed to protect infrastructure through the removal of hazard trees near utility lines, will ultimately reduce the risk of fire ignition from a power line into adjacent spotted owl habitat, particularly protected activity centers.

These actions should increase the sustainability and resiliency of Mexican spotted owl habitat (particularly through fuels management and forest restoration actions). Therefore, implementation of the CNF's LRMP is not expected to further diminish the conservation contribution of critical habitat to the recovery of the Mexican spotted owl.

The revised LRMP would strive to implement the Recovery Plan (USFWS 2012a) and guidelines that would minimize impacts to the Mexican spotted owl and its habitat. However, due to the FS's multiple use mission, restoration of forested habitats, and active management of spotted owl habitat, we anticipate that over the life of this consultation (15 years) there will be activities implemented under this plan that could result in adverse effects to the owl and its habitat. Project activities associated with forest management (e.g., fuels reduction projects, forest restoration, salvage logging, fire management) would likely be the predominant activities occurring within and adjacent to Mexican spotted owls and their habitat. These activities can result in disturbance during the breeding season (such as mechanical treatments, hauling routes, smoke), habitat modification (short-term reductions in large logs, snags, and other key habitat components), and habitat degradation (such as long-term loss of old-growth, pre-settlement trees to create openings for regeneration). Other actions, such as those conducted under the Minerals, Recreation, or other programs identified above, could also result in adverse effects to Mexican spotted owls from modification of prey species habitat due to disturbance related to construction of infrastructure near occupied areas.

Western Yellow-Billed Cuckoo

Many of the effects to jaguars and ocelots apply to cuckoos, since cuckoos also use riparian and Madrean evergreen woodland drainages habitats and are therefore incorporated by reference for the western yellow-billed cuckoo.

Wildland-Urban Interface and Landscape-scale Fire
This program area covers all vegetation communities on the CNF, including those areas of human populations and developments at imminent risk from wildfire. Treatment of these areas includes thinning, removal of fuels from the landscape, or altering the fuel profile to reduce the potential for loss of property. The treatment of WUI will allow the Forest the flexibility to manage landscape-scale wildland fire for resource benefit. This program's purpose is to maintain current vegetation condition at, or move them towards, specific desired conditions set for the different forest and non-forested potential natural vegetation types by planned and unplanned fire ignitions and other vegetation treatments (USFS 2016a). Short-term effects of this program may cause increased flood runoff, scouring, and debris deposition in yellow-billed cuckoo habitat.

Watershed improvement through vegetation treatments including wildland fire use (planned and unplanned) may reduce the likelihood of wildfire entering riparian and ephemeral drainage habitats, and future post-fire runoff. Objectives WUI-O-1, VGC-O-1, VIC-O-1, VME-O-1, VPO-O-1, and RIA-O-1, as well as RIT-O-1, HUA-O-1, TUM-O-1, WHE-O-1, CHI-O-1 and CAT-O-1 would treat areas that could potentially be suitable yellow-billed cuckoo habitat, including ephemeral Madrean evergreen woodland drainages and adjacent hillsides, and riparian habitats. These objectives would restore uplands which would benefit riparian resources in the long-term, but could result in effects to riparian habitat and woodland drainages through short-term watershed affects such as sedimentation.

In addition, guidelines VME-G-1 and VPO-G-2, would leave clusters of live trees and shrubs to provide for breeding, feeding, shelter and other habitat needs. Although noise and disturbance could have negative effects on yellow-billed cuckoos, these guidelines would ensure habitat needs are retained for the species. Guidelines NWS-G-1 and NWS-G-2 would minimize sedimentation to streams from projects occurring in upland habitats and protect aquatic and ephemeral drainage habitats, thus reducing impacts to the cuckoo. NWS-G-3 would reduce fuel buildup around streams, thus reducing negative impacts to riparian areas due to fire effects. This program area could reduce impacts to yellow-billed cuckoo, although vegetation treatments using wildland fire may result in short-term impacts from post fire flooding or habitat loss from projects occurring in, or adjacent to, yellow-billed cuckoo habitat.

There are 125 acres of proposed critical habitat occurring within the CNF in Florida Wash (an additional 63 acres occurs immediately adjacent to CNF within the same proposed critical habitat unit, for a total of 188 acres within unit). All of these 125 acres are contained within a urban interface. However, cuckoos are found in many drainages throughout CNF that are not currently proposed as critical habitat. Management of WUI and landscape-scale wildland fire has the potential to result in short-term impacts to yellow-billed cuckoo, its occupied habitat, and its proposed critical habitat. The primary potential impacts from this treatment may include changes to habitat through structural changes or loss of nesting structure.

These treatments would reduce the risk of overall long-term loss of yellow-billed cuckoo habitat, including riparian areas and Madrean evergreen woodland ephemeral drainages and hillsides. Wildland Fire can result in short-term impacts to the yellow-billed cuckoo (e.g. loss of floodplain or immediate upland hillside area vegetation), especially if the fire is followed by heavy post-fire flooding. Wildland fire suppression activities may also affect the yellow-billed cuckoo if staging areas for equipment, camps, and other associated activities within wildfire activities are placed in its habitat.

The implementation of the standards and guidelines associated with this program area would reduce impacts to yellow-billed cuckoo. However, vegetation treatments implemented to meet desired conditions of the particular potential natural vegetation types used by the yellow-billed cuckoo or within watersheds including yellow-billed cuckoo habitat could result in short-term impacts to their habitat.

Water Resources – Natural
The BA does not specify which natural water resource areas would be treated under this program. However, it notes that projects to improve conditions of natural water sources could include, but are not limited to, assessing proper functioning condition ; improving and maintaining water quality through the use of best management practices; improving and protecting riparian areas and other groundwater dependent ecosystems; protecting floodplains; and planning and implementing burned area emergency response activities. Future projects would be designed to protect and improve proper functioning condition and would employ best management practices, guidelines, and measures to protect these resources. Projects in riparian areas and ephemeral Madrean evergreen woodland drainages and hillsides would promote recruitment and maintenance of native riparian vegetation needed by the yellow-billed cuckoo. Projects in the riparian and stream habitats would have localized, short-term effects including streambank disturbance, vegetation reduction, sediment deposition into the stream, and disturbance to wildlife, including yellow-billed cuckoo.

All activities completed under this program would be implemented according to standards and guidelines and best management practices as described below and in the BA. Projects would have short-term adverse effects to the species and habitat but would have long-term beneficial effects as watersheds, drainages, and aquatic and riparian habitats improve towards the desired conditions listed in the LRMP.

Several relevant objectives that guide management and activities for this program are to improve watershed condition and function, and riparian conditions across the CNF. Wetland objective WET-O-1 would restore native vegetation and waterflow, thus improving habitat for the species. RIA-O-1 would treat uplands to maintain watershed stability and structure and function of streams, floodplains and riparian vegetation. Over the next 10 years there will be benefits to this species habitat by implementing objectives NWS-O-1, NWS-O-2, and NWS-O-3. Objective NWS-O-1 would work toward securing water rights, NWS-O-2 and NWS-O-3 would restore sites to provide aquatic habitat for the recovery of plant and animal species. These objectives would help provide continuous habitat to support self-sustaining yellow-billed cuckoo populations and habitat. This includes floodplains and adjacent upland areas and ephemeral Madrean evergreen woodland drainages and adjacent hillsides used by foraging, nesting, and migrating yellow-billed cuckoos. Collectively these objectives could potentially result in long-term improvements for the yellow-billed cuckoo if done in occupied or suitable habitats. In addition, MTS-O-3, MTS-O-4 and MTS-O-5 would improve riparian habitat, thus improve yellow-billed cuckoo habitat.

Standard WET-S-1 would maintain acres of existing wetlands during management activities, thereby ensuring the continued riparian community habitats. MTS-S-1 would require motorized vehicles remain on designated roads and trails, thus ensuring riparian habitat is not impacted. Guidelines RIA-G-1, MTS-G-2 and MTS-G-3 would minimize effects to natural waterflow and native vegetation communities when road construction is necessary within riparian areas.

There are approximately 10,700 acres of montane meadows, wetlands and riparian areas (potential natural vegetation type) (USFS 2016a). Approximately 5,265 of these acres are ephemeral Madrean evergreen woodland drainages and riparian areas (potential yellow-billed cuckoo habitat) on the CNF. The maximum treatment level discussed (mostly in upland habitats) would eventually lead to improvements in yellow-billed cuckoo habitat during the life time of the LRMP.

Animals and Rare Plants
This program includes inventory and monitoring, habitat assessments, habitat improvements through land treatments and structures, species reintroductions, conservation strategy development, administrative studies, research collaboration, and information and education. Guideline ARP-G-1 would implement recovery plans associated with federally-listed species. RIA-O-1, RIA-G-1, and RIA-G-2 aid in protecting the sustainability of riparian areas and minimizing damage to these areas by cattle and vehicular traffic, which will benefit the species. Within Madrean evergreen woodland habitats, oak and mesquite mixed species drainages should be protected for cuckoos, as well as the xeroriparian mixed oak habitat.

This program area could reduce impacts to yellow-billed cuckoo, although species surveys and habitat assessments could result in short-term impacts from vegetation trampling and disturbance to individual yellow-billed cuckoos in the area. Habitat enhancement projects such as riparian fencing to protect habitat could also have short-term vegetation and soil impacts in occupied habitat and adjacent hillsides and uplands (e.g., vehicles delivering/laying out materials).

Invasive Species
This program area has the potential to help improve yellow-billed cuckoo habitat by removing invasive non-native species. Methods used include: assess and eradicate priority infestations or populations; monitor, prevent and control infestations; coordinate with other Federal and State agencies; and plan and implement burned area emergency response activities. Management approaches include developing treatment plans to control or eradicate invasive species to protect and recover federally listed species. Noxious weed prevention practices include cleaning equipment, using weed-free hay, seed mixes and fill materials. These practices would be required in contracts and special use permits. Projects would be designed to restore and improve watershed conditions and maintain ecosystem function and would employ best management practices, guidelines, and measures to protect watershed resources.

As habitat becomes dominated by non-native species, foraging, nesting and cover habitat is reduced and degraded for the western yellow-billed cuckoo. Objective WET-O-1 would restore native vegetation at wetland sites, thus improving habitat for the bird. Pesticide treatments are expected to continue under this plan as they have under the previous forest plan. The use of pesticides can have adverse effects on aquatic and riparian species as well as upland species. The use of pesticides may impact forage base for specific individual species. Any potential future projects implemented under this plan would be assessed on a case by case basis to determine potential effects on individual species and to minimize them.

Forest Products
The sale of forest products are often associated with thinning and fuels reduction projects or silvicultural treatments, and can result in impacts to both upland and riparian habitats. Fuelwood gathering and other projects have occurred in habitat used by western yellow-billed cuckoo on the CNF and are expected to continue. These kinds of projects can have adverse effects on yellow-billed cuckoo habitat. Activities that occur during the migration or breeding season could directly affect the species by displacing individuals or disrupting their breeding or feeding activities. Indirect effects could occur through habitat manipulation. This program area could reduce impacts to yellow-billed cuckoo, although vegetation treatments may result in short-term impacts due to flooding or habitat loss from projects occurring in or adjacent to yellow-billed cuckoo occupied habitat. Thinning projects can result in removal of suitable breeding habitat in Madrean evergreen woodland drainages and riparian areas through the removal of oaks and other suitable species.

These activities may reduce the likelihood of wildfire entering riparian habitats and future post-fire runoff. Objectives FOP-S-1, FOP-S-2, and FOP-G-1 would ensure that timber harvesting activities would be consistent with making progress towards the desired conditions of the Forest Plan. WUI-O-1, VDC-O-1, VIC-O-1, VME-O-1, VPO-O-1, VPP-O-1, and RIA-O-1, as well as RIT-O-1, HUA-O-1, TUM-O-1, WHE-O-1 and CAT-O-1 would treat areas that could potentially be suitable yellow-billed cuckoo habitat. These objectives would restore uplands which would benefit riparian resources in the long-term, but could result in effects to riparian and woodland drainage habitats through short-term watershed affects such as sedimentation.

The guidelines RIA-G-3, RIA-G-4, NWS-G-1, NWS-G-2, and NWS-G-3 would favor retention of large riparian woody debris and trees and minimize input of sediment into streams thereby improving water quality, providing habitat with cover, reducing fuel buildup and regulating stream temperatures. In addition, guidelines VME-G-1 and VPO-G-2, would leave clusters of live trees and shrubs to provide for breeding, feeding, shelter and other habitat needs. Although noise and disturbance could have negative effects on yellow-billed cuckoos, these guidelines would ensure habitat needs are retained for the species. These plan components would help to minimize effects of the forest products program. These guidelines would help to minimize effects of the forest products program and benefit proposed critical habitat by providing perching, foraging and nesting habitat as well as prey habitat.

Minerals Management
This program area has the potential to impact the western yellow-billed cuckoo, its habitat, and its prey, often through disturbance and potential loss/fragmentation of habitat, from land or facility development or activities. Access roads and the accompanying vehicle traffic are a necessary component of mineral activities. In most cases mineral removal also requires the use of heavy equipment on the site. In addition, surface occupancy causes direct habitat loss and the addition of human occupation increases the chances for harassment and possible mortality. Additional disturbances from mining related activities include noise (blasting, hauling and dumping materials, drilling, etc.). These activities can cause the cuckoos to leave an area. Additionally, minerals activities could potentially have a major effect on groundwater and surface flow loss.

The CNF is currently aware of approximately 37 mineral projects within Ecosystem Management Areas where western yellow-billed cuckoo habitat occurs (including Rosemont, Sunnyside and others). Many of these project locations are within or adjacent to occupied yellow-billed cuckoo habitat. These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Actual mining infrastructure and disturbance would be impossible to predict at the time of this document. Eighteen of these projects are active and currently in place, while one project is inactive, four are completed, one project is unknown, one project is not applicable, and twelve are withdrawn from consideration at the point.

Direct impacts from construction and operation of mining facilities will harm cuckoos by removing suitable habitat and displacing breeding or foraging birds and/or by disturbing cuckoos where suitable habitat is not displaced. If there are resident birds present at the time of tree removal and site preparation, individuals could abandon their roosting and nesting sites. If present, nests and eggs would be lost if ground disturbance occurred during the nesting season. Any individuals present in or adjacent to mining operations could also experience impacts from decreased surface water flow in occupied canyons, riparian areas and drainages, loss of prey availability, groundwater drawdown, noise, vibrations, and artificial night lighting (SWCA 2015). These effects could range from habitat use changes, activity pattern changes, increased stress responses, decreased foraging efficiency and success, reduced reproductive success, increased predation risk, intraspecific diminished communication, and hearing damage (NoiseQuest n.d. [2012]; Pater *et al*. 2009). The magnitude of effects from noise, vibration, and light are uncertain, but these effects are expected to decrease as the distance from the operations increases.

Mining operations contribute incremental effects that will diminish surface flows, the dimensions of pool habitat, and reduce water quality, resulting in significant degradation of the aquatic and riparian ecosystems on which yellow-billed cuckoo depend. They will also affect riparian systems to varying degrees via the withdrawal of groundwater from the aquifer that sustains springs and streams as well as by alterations in surface runoff patterns within the watershed of the streams. One key finding is that increasing depths to groundwater will eventually result in changes in the species composition of a given sites' riparian community (i.e., hydroriparian communities would suffer decreased vigor and extent, eventually transitioning to a xeroriparian community). It is also possible that the groundwater declines resulting from mining operations, while seemingly minor, will increase current or future levels of hydrologic variation to the point that present-day riparian communities cannot perpetuate themselves. Both lowered groundwater and reduction in streamflow affect hydroriparian and xeroriparian vegetation along drainages, although xeroriparian habitat can withstand greater water loss. The reduction in groundwater lowers the water table, while the reduction in streamflow reduces the length, width, and depth of wetted streambed. The net result is reduced plant regeneration, herbaceous and shrub growth, tree survival, foliar cover, woodland width, and prey abundance that coincides with the reduced length, width, and depth of wetted streambed and depth to groundwater.

Maintenance of existing stands of cottonwood and/or willow forests requires the presence of relatively shallow groundwater. Lite and Stromberg (2005) found that cottonwood and Goodding's willow plants were able to compete successfully with non-native saltcedar plants when the maximum depth to groundwater was less than or equal to 8 feet. Cottonwood and willow growth and survival suffer from water stress when groundwater declines below key depth thresholds, particularly if the declines are rapid; the proposed action's effects do not exhibit such immediacy. Seasonal declines of 3 feet have caused mortality of saplings of cottonwood and willow (Shafroth *et al*. 2000). Mature cottonwood trees have been killed by abrupt, permanent drops in the water table of 3 feet, with lesser declines (1 ½ feet) reducing stem growth (Scott *et al.* 1999, 2000).

There are no current or proposed mines or accompanying operations within the proposed yellow-billed cuckoo critical habitat area of 125 acres on the CNF. However, proposed mine locations overlap with occupied cuckoo habitat throughout the forest. Several mines are located upstream of suitable and occupied habitat so there is a potential for mining pits to be excavated to a depth greater than that of the regional aquifer and water would drain from storage in the aquifer into the pit. The need to dewater the pit during mining operations would result in ongoing water removal via pumping of aquifer water storage. Upon cessation of mining, a pit lake would form, and evaporation from this water body would continue to remove water from storage in the regional aquifer. If mining activities were to occur within or upstream of yellow-billed cuckoo habitat, it would likely result in the loss of cuckoo habitat as well as disturbance to birds that might be using those areas. Mining plans of operation will likely require restoration of habitat upon completion of mining activities; however, those areas will be devoid of habitat throughout the life of the mining activities and beyond.

The standard MIN-S-1 and guideline VLS-G-2 would require only native species be utilized for reclamation, thereby providing future habitat reproduction and rearing habitat as well as reducing the likelihood that non-native species would become established.

The standards and guidelines associated with this program area could reduce impacts to yellow-billed cuckoo. However, actions implemented by this program area would result in both short-term and long-term impacts to the yellow-billed cuckoo from habitat disturbance and destruction, as well as surface and ground water modification from the minerals activities in riparian areas that support western yellow-billed cuckoos and their habitat.

Motorized Transportation System

This program includes transportation and maintenance, as well as decommissioning (obliteration) of roads and trails. Designated roads, trails, and motorized recreation areas could impact yellow-billed cuckoo and their habitat by removing riparian vegetation, the degradation of watershed function and integrity, and by disturbing individuals during maintenance activities. Roads crossing or adjacent to streams can remove and alter riparian vegetation. Transportation projects could have localized and short-term adverse effects to yellow-billed cuckoo and their habitat from actions within riparian areas. Several objectives will result in improvement of habitat for the yellow-billed cuckoo, although there could be some negative short-term impacts including disturbance and displacement of individuals or disruption of their breeding or feeding activities if the activities occurred when the birds were present. Objectives MTS-O-3, MTS-O-4, and MTS-O-5 would improve riparian habitat by decommissioning and restoring roads, realigning roads out of wetlands, and hardening drainage crossings to improve downstream habitat.

Under the Standard MTS-S-1, motor vehicle use is restricted to existing roads and trails. This standard also ensures that sedimentation from vehicles is reduced and limits sediment carrying flows from entering yellow-billed cuckoo habitat. Guidelines MTS-G-2, MTS-G-3, and RIA-G-1 directs that new road construction should be avoided in riparian areas except to cross drainages, unless alternate routes have greater overall resource impacts. If needed, location and design will minimize effects to the resources. If a road in cuckoo habitat is required, adverse effects could occur. A road constructed in cuckoo habitat would result in the permanent loss of habitat that could be used for perching or nesting. This loss of habitat would not be considered short-term since the area would remain devoid of vegetation in perpetuity. Additionally, if a road is constructed or subsequently maintained during the migration period or breeding season, yellow-billed cuckoos could be displaced by construction activities. Unneeded non-system roads in riparian habitat that will be decommissioned would benefit yellow-billed cuckoos by allowing the recovery of vegetation and by reducing the potential of disturbance. ARP-G-1 would ensure that any construction and maintenance activities would apply any protection measures specified in the species' recovery plan. These standards and guidelines will, in the long-term, result in minimizing the threats of transportation management to the species and its riparian habitat.

Approximately 921 feet of system roads occur within the proposed western yellow-billed cuckoo critical habitat on the CNF (USFS 2016a). If no new roads are planned for construction within the proposed critical habitat, there should be little to no effect on any PCEs from the motorized transportation system program. Objective MTS-O-3, MTS-O-4, and MTS-O-5 and guidelines MTS-G-2, and MTS-G-3 would help minimize potential negative effects and maintain or improve PCEs by promoting the hydrologic integrity and retaining of important riparian vegetation.

Recreation Management

This program area could impact yellow-billed cuckoos and their prey through disturbance by recreationists, and potential degradation of habitat from activities such as camping and hiking. Noise and visual disturbance by recreation users is a significant effect that should be included in this section. Presence of dogs can also disturb cuckoos. All these potential effects may lead to cuckoos avoiding the area or abandoning nests or fledglings. Streams and adjacent areas on the CNF provide numerous recreational activities. The user demands and concentrated uses in these areas can prevent development of or alter vegetation and habitat needed by the yellow-billed cuckoo by trampling vegetation or compacting soils in riparian areas.

There are two developed campgrounds either adjacent to occupied yellow-billed cuckoo habitat or within proposed critical habitat. The Peppersauce Campground, located on Peppersauce Wash of the San Pedro River, is 250 feet upstream and 900 feet downstream of yellow-billed cuckoo sites. There are many more developed campgrounds adjacent to or in occupied cuckoo habitat. Arizona Boys Ranch is located 0.25 mile from a yellow-billed cuckoo site. There is also a trailhead located within proposed critical habitat of Florida Wash in which cuckoos have been located both upstream and downstream of trailhead location. Numerous trails and trailheads are also located within 0.25 mile of other known yellow-billed cuckoo sites.

Dispersed recreation may occur in yellow-billed cuckoo habitat including, but not limited to hiking, fishing, camping outside of developed campgrounds, and hunting. There is a potential for trampling of yellow-billed cuckoo habitat and damaging riparian vegetation from activities associated with dispersed camping when recreationists access riparian areas from their campsites. Whether existing trails in riparian areas are a barrier or trail density limits habitat development or persistence of yellow-billed cuckoo is unknown as there is no habitat assessment data to date to determine habitat availability or suitability in these areas. In some cases, there may not be existing trails to access the stream at all desired locations, resulting in the need to walk along the streambank in yellow-billed cuckoo habitat.

Guideline ARP-G-1 would ensure that the appropriate protection measures would be followed for any activities that might occur within the species habitat. Recreation guideline REC-G-2 ensures that recreation sites are managed so there is no unacceptable resource damage or impact to the landscape, this helps ensure that yellow-billed cuckoo habitat does not receive unacceptable resource damage, which includes riparian systems.

Actions implemented by this program area could result in short-term impacts from recreational use within riparian areas occupied by yellow-billed cuckoo. Forest visitors may create new trails by trampling riparian vegetation when accessing streams. This may reduce riparian cover and available food, needed by the yellow-billed cuckoo, if significant amounts of vegetation are impacted in occupied habitats. The LRMP includes standards and guidelines to reduce the impacts to yellow-billed cuckoo from recreation activities; however, there is also direction in the LRMP to improve recreational opportunities. Although an increase in recreation is likely to take place over the next 10 to 15 years, there is no direction within the LRMP to increase offered recreation opportunities, only to improve existing recreational experience/opportunities. Over the life of the LRMP, an increase in recreation opportunities may result in adverse impacts to yellow-billed cuckoo and their habitat from clearing of habitat to create recreation sites, as well as increased disturbance from recreationists.

Range Management
Livestock grazing has the potential to negatively affect habitats used by cuckoos, including Madrean evergreen woodlands and ephemeral drainages, through overgrazing. Livestock can affect the recruitment of riparian vegetation, destabilize stream banks, exacerbate erosion, and ultimately alter the hydrologic function of watersheds. The objectives and guidelines applicable to this program area could reduce impacts to yellow-billed cuckoo from livestock grazing. Habitat enhancement projects such as riparian fencing to protect habitat could also have short-term vegetation and soil impacts in adjacent uplands (e.g., vehicles delivering/laying out materials) that may affect the yellow-billed cuckoo and its habitat. The objectives, standards and guidelines required under this program are expected to minimize, but not eliminate, these adverse effects. Therefore, over the life of this consultation, we expect that implementation of the Range Program could result in adverse effects to the yellow-billed cuckoo and their habitat.

These potential effects will be reduced or eliminated by objectives WET-O-1, NWS-O-1, NWS-O-2, and NWS-O-3, and guidelines WET-G-1, RIA-G-2, RIA-G-3, RIA-G-4, RAM-G-1, RAM-G-2, RAM-G-4, RAM-G-5, RAM-G-6, and RAM-G-7 and help the CNF achieve the desired condition of diverse and resilient ecosystems, including areas crucial to yellow-billed cuckoos. Wetland objective WET-O-1 would restore native vegetation and natural waterflow patterns at wetlands sites, thus improving habitat for these species. Over the next 10 years there will be benefits to these species habitats by implementing objectives NWS-O-1, NWS-O-2, and NWS-O-3. These objectives would have the CNF apply for 10 instream flow rights per decade to ensure water for aquatic and riparian species, reconstruct three developed springs to provide for recovery of species, and complete stream restoration to benefit aquatic and riparian species of conservation concern.

Guideline WET-G-1 only allows livestock grazing in wetland areas if there would be no significant deleterious effects to the function of the wetland. Guidelines RIA-G-2, RIA-G-3, and RIA-G-4 which will limit livestock effects to riparian areas, retain large woody debris in stream channels, and favor the growth of large diameter riparian trees. Guideline RAM-G-1 provides for habitat needs for wildlife, by retaining needed amounts and structure of herbaceous vegetation. Guideline RAM-G-2 provides for sufficient deferment of grazing following burning (wildfire or prescribed) to recover plant growth and vigor, thus reducing sediment into stream channels, as well as providing habitat for the prey species. The guideline RAM-G-4 would maintain or promote ground cover providing for soil moisture and stability. RAM-G-5 uses structures (fencing, etc.) in a way that it doesn't conflict with riparian functions and processes. Guideline RAM-G-6 will help in restoring native plant species, while RAM-G-7 limits grazing intensity to provide for desired plant species growth, which helps maintain proper watershed functions. These objectives and guidelines protect or restore riparian or wetland habitats and the uplands that may influence the listed bird habitat.

Livestock grazing in occupied habitat and proposed cuckoo critical habitat could result in indirect adverse effects through habitat manipulation. Livestock consume young age-class riparian woody vegetation that cuckoos could eventually use for breeding. Continued forage use on young riparian vegetation can result in long-term adverse effects if suitable breeding habitat is not permitted to develop. Insects that the yellow-billed cuckoo feeds upon may also be affected by those actions that affect riparian vegetation. Livestock overgrazing in Madrean evergreen woodlands and drainages will result in a decline in prey abundance.

Approximately 18 acres of the proposed western yellow-billed cuckoo critical habitat on the CNF is included in an active allotment. In addition, there are numerous yellow-billed cuckoo occupied habitat locations (see Environmental Baseline) within active grazing allotments. Direct and indirect effects from this grazing allotment could increase erosion and sedimentation, and introduce invasive vegetation, however since the acreage is so small the effects would be insignificant and discountable. Any potential affects will be reduced and minimized by RAM-G-1, 2, 4, 5, 6, and 7 and help the CNF achieve the desired condition of diverse and resilient ecosystems, including habitat areas crucial to western yellow-billed cuckoo.

Western Yellow-Billed Cuckoo Proposed Critical Habitat

In our analysis of the effects of the action on critical habitat, we consider whether or not a proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species. To determine this, we analyze whether the proposed action will adversely modify any of the PCEs that were the basis for determining the habitat to be critical. To determine if an action results in adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PCEs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be considered because, collectively, they represent the best available scientific information as to the recovery needs of the species.

The FWS has proposed to designate approximately 546,335 acres of critical habitat in Arizona, California, Colorado, Idaho, Nevada, New Mexico, Texas, Utah, and Wyoming (USFWS 2014a).

Primary Constituent Elements for the Yellow-billed Cuckoo

PCE 1 and 2: Riparian vegetation and adequate prey base.
Effect: Livestock grazing in yellow-billed cuckoo proposed critical habitat could result in indirect adverse effects through habitat manipulation. Livestock consume young age-class riparian woody vegetation that cuckoos could eventually use for breeding. Continued forage use on young riparian vegetation can result in long-term adverse effects to these PCEs if suitable breeding and prey habitat is not permitted to develop. Insects that the yellow-billed cuckoo feeds upon may also be affected by those actions that affect riparian vegetation.

Watershed and soil projects may include instream improvement projects which may have short-term adverse effects to riparian vegetation. There may be localized, short-term adverse effects from projects in riparian zones such as temporary disturbance of habitat through vegetation removal; however, these effects would be minimized by standards and guidelines as previously described. Furthermore, while watershed improvement projects related to instream habitat improvements would likely have short-term adverse effects, we anticipate that long-term benefits to primary constituent elements of proposed critical habitat will occur by maintaining and possibly improving their ability to contribute to the conservation and recovery of the species.

The transportation program area may have adverse effects if a road is constructed in cuckoo proposed critical habitat. A road constructed in proposed critical habitat would result in the permanent loss of the primary constituent elements of critical habitat associated with riparian areas. This loss of riparian habitat-related primary constituent elements would be considered long-term since the area would remain devoid of vegetation in perpetuity. Additionally, if road maintenance activities are required at any time, primary constituent elements related to riparian habitat that have regrown could be diminished. Because we expect new roads to be limited in critical habitat, we do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

Minerals activities could result in the loss of both the riparian habitat and insect prey base primary constituent elements of critical habitat in those areas. Mining plans of operation will likely require restoration of habitat upon completion of mining activities; however, if mining occurs in proposed cuckoo critical habitat, those areas remain devoid of the primary constituent elements of critical habitat, especially the riparian habitat components, throughout the life of the mining activities.

The recreation program activities such as dispersed camping, hiking, and other recreation activities could result in diminished riparian habitat through vegetation manipulation and disturbance from activities associated with dispersed camping when recreationists access riparian areas from their campsites. There are numerous plan decisions that address potential impacts of recreation to riparian areas, which would include those designated as critical habitat.

PCE 3: Dynamic riverine processes.
Effect: Actions implemented under the LRMP are expected to retain and protect this PCE. There are standards and guidelines to ensure that areas supporting listed species are not dewatered or impaired to the point that they cannot support riparian and aquatic species and the habitats they require. There are objectives, standards and guidelines that would enhance or restore stream and riparian habitat. Actions implemented under the LRMP have required standards and guidelines to protect instream flow, consistent with existing water rights and laws, that are expected to retain and protect this PCE.

Erosion resulting from wildland fire, watershed improvements, recreation use, road improvements, mineral activities, and grazing could cause erosion impacts to streams and rivers. In riparian areas, soil erosion may eliminate existing vegetation and limit recovery of vegetation that has been disturbed. In addition to their direct contribution to erosion, these activities may result in additional disturbance from future activities and recreation. A number of standards and guidelines would reduce erosion effects within proposed critical habitat and other occupied territories, thus protect this PCE.

In summary, although there would be long-term effects to the PCEs of proposed critical habitat from vegetation removal, loss of prey base, and possibly increased erosion affecting recovery of riparian habitat, these effects would be small in extent and magnitude and we expect that the function of these critical habitat units for conservation of the cuckoo would not be impeded.

Sonoran Tiger Salamander, Chiricahua Leopard Forg, Northern Mexican Gartersnake

Specific habitats used by these species may not be identical; however, the effects of implementing projects under Forest Programs are similar in all three species habitats. Adverse effects to the Sonoran tiger salamander, Chiricahua leopard frog and northern Mexican gartersnake and their designated and proposed critical habitat could occur as a result of WUI and landscape-scale fire, both natural and constructed water resource, soil management, animal and rare plant activities, invasive species, forest products, minerals, motorized transportation system, recreation and range management projects. Projects are expected to occur in all watersheds within these species analysis area. Projects would have short-term adverse effects to the species and habitat but would have long-term beneficial effects as watersheds, aquatic, and riparian habitats move towards desired conditions.

Desired conditions, objectives, standards and guidelines are expected to have long-term beneficial impacts, if implemented in streams or watersheds occupied by these species and their prey, through restoration of hydrologic conditions and functions. Short-term impacts associated with project implementation could result including increases in sedimentation, soil compaction, alterations in hydrologic conditions and functions, and changes in water quality. Measures are implemented at the project level, and site specific conditions, project activities, and timing will determine their efficacy.

Wildland-Urban Interface and Landscape-scale Fire

These program areas represent all vegetation communities on the CNF within those areas of human populations and developments at imminent risk from wildfire. Treatment of these areas includes thinning, removal and slash piling (for subsequent burning) of fuels from the landscape, or altering the fuel profile to reduce the potential for loss of property. Wildland fire can result in short-term impacts to the Sonoran tiger salamander, Chiricahua leopard frog and northern Mexican gartersnake and their critical habitat by burning their habitat or from post-fire flooding. Wildland fire use may reduce the likelihood of future wildfires from entering riparian and aquatic habitats and limiting post-fire runoff into listed species habitat/critical habitat. Wildland fire suppression activities may also affect these species if staging areas are placed in its habitat. The treatment of WUI allows the Forest the flexibility to manage landscape-scale wildland fire for resource benefit.

Landscape-scale wildland fire is one of the methods used for ecosystem restoration. The goal of this program is to enhance resiliency of all vegetation communities on the CNF by maintaining more sustainable fuel loads, improved habitat diversity, and watershed integrity.

There are several objectives that guide management and activities under this program which may offset impacts to these species. Objectives WUI-O-1, PEL-O-1, RIT-O-1, VIC-O-1, VME-O-1, VPO-O-1 and VPP-O-1 would direct management activities to help restore fire to its historic role where large-scale, high-severity fires were rare and restore uplands which would benefit aquatic resources in the long-term, but could result in effects to these species habitats through short-term watershed affects such as sedimentation. The primary potential impacts from this treatment may include changes to habitat through sedimentation or water quality.

Objective RIA-O-1 would treat 2,500 to 10,000 acres of uplands every 10 years to maintain watershed stability and function of streams, flood plains, and riparian communities. This objective could help reduce or minimize short term impacts that may result from wildland fire use and other fuel reduction activities by not treating entire listed species watersheds at one time. This would help limit runoff and sediment from any one future wildfire event in the uplands above occupied or potentially occupied listed species habitat. However, with only 1,000 acres treated annually, the likelihood of previously treated areas to be within a wildfire is small. Wildland fire use projects would generally not burn in wetland habitat; however it has the potential to burn adjacent upland habitats causing indirect effects on riparian habitat. Effects include increased runoff from watersheds, adding to flood flows and deposition of debris and sediment originating in the burned area. Intact upland vegetation will reduce indirect effects from runoff and erosion by maintaining watershed stability.

Watershed improvement through vegetation treatments including wildland fire use (planned and unplanned), prescribed cutting and mastication may reduce the likelihood of wildfire entering riparian habitats and future post-fire runoff. Slash piles, commonly generated through mechanical fuels treatments, are an attractive nuisance for gartersnakes and can lead to elevated risk of adverse effects to gartersnakes depending on the size and location of slash piles, how long they are left in place to cure, and when they are burned. When properly applied, prescribed fires and fuels management projects should have long-term benefits to Chiricahua leopard frog, Sonoran tiger salamander and northern Mexican gartersnake populations by reducing the likelihood of catastrophic wildfire. However, any fire, regardless of severity, will likely have short-term adverse effects to these species populations in the action area (Southwest Endangered Species Act Team (SESAT) 2008).

In uplands, juvenile or adult Chiricahua leopard frogs that are dispersing or moving across terrestrial uplands during a fire may be scorched or burned (Pilliod *et al*. 2003), although the likelihood is low as overland dispersal typically occurrs during wet conditions. Eggs, larvae, or adults that are exposed to sudden increases in water temperature or changes in water chemistry from ash and smoke, may be killed or experience some type of sublethal physiological stress (SESAT 2008). Mechanical thinning and the construction of firebreaks and roads for fire management could also occur in conjunction with these activities. Mechanical removal of fuels, such as thinning of understory vegetation, may also result in ground disturbance. This could potentially influence the quality of the area for dispersing frogs and generate sediments and impact hydrological characteristics of watersheds influencing aquatic sites used by Chiricahua leopard frogs (Madrid *et al*. 2006). Firebreaks may similarly inhibit dispersal (Chan-McLeod 2003). The associated traffic from firebreak construction may also increase the likelihood of contamination of aquatic sites with petroleum products and the adverse effects these chemicals may have on frogs (Mahaney 1994). These firebreaks and roads may also act as a barrier to frog movement and dispersal. Traffic on roads near occupied frogsites may also result in direct mortality to dispersing frogs, although on lightly used roads this may be uncommon (Forman *et al*. 2003). Unpaved roads and firebreaks can contribute to increased amounts of sedimentation to aquatic sites (Pilliod *et al*. 2003). Roads constructed to waters (perhaps to obtain water for suppression activities) may facilitate the spread of non-native predators/competitors or disease *(Bd, bsal, TSV)*. Roads and firebreaks may create small pools of water that may provide temporary habitat for dispersing frogs (Pilliod *et al*. 2006, USFWS 2007).

Within the Geographic Areas in which Sonoran tiger salamander, Chiricahua leopard frog and northern Mexican gartersnake occupy anywhere from 15-40% of the Ecosystem Management Areas could be treated within the next 10 years (CHI-O-1, DRA-O-1, PEL-O-1, RIT-O-1, TUM-O-1, HUA-O-1, WHE-O-1, GAL-O-1, and PIN-O-1). Objective RIA-0-1 would treat 2,500 to 10,000 acres every ten years specifically to maintain streams and riparian vegetation. Guidelines NWS-G-1, NWS-G-2 and NWS-G-3 would be beneficial to the three species and their habitat by reducing adjacent fuel buildup around water sources, minimizing sediment into streams and protecting water quality, quantity and habitat. Guideline TUM-G-1 would leave islands of mesic microenvironments around riparian areas, as well as leaving woody debris on side slopes and stream channels. These treatments would reduce the risk of overall long-term loss of Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake habitat.

This program area has standards and guidelines to reduce impacts to all three species and their prey. However, vegetation treatments using wildland fire may result in short-term adverse effects or impacts from post fire flooding or habitat modification from projects occurring in or adjacent to their habitats. These adverse effects may include excessive sediment deposited into important fish prey habitats and direct removal of important habitat structure along occupied streams from burning or post-fire flood events, however guidelines are in place to reduce sedimentation into streams. Long-term effects from mechanical thinning, firebreaks, and other activities to reduce fuels would potentially be positive as these activities reduce the changes wrought by catastrophic wildfires.

Wildland Fire projects that occur in watersheds that contain critical habitat are expected to have short-term adverse effects related to water quality. These may include increased sediment input into occupied streams, ponds, and stock tanks. These effects may be minimized by standards and guidelines as previously discussed.

Water Resources – Natural

Overall, the Water Resources program plan components are positive for these listed species and their habitats in the long-term and would maintain or improve watershed condition related to water quality, non-native species, soils, riparian vegetation, and rangeland vegetation. However, these projects (i.e., protecting or enhancing water quality, quantity and aquatic habitat; maintaining soil moisture; minimizing sediment, etc.) may have localized, short-term adverse effects such as streamflow and streambank alteration, and excess sediment erosion or deposition. These adverse effects could alter water quality and affect habitat qualitity; however; we would expect them to be short in duration and intensity.

Methods used in this program area include assessing proper functioning condition; improving and maintaining water quality through the use of best management practices improving and protecting riparian areas and other groundwater dependent ecosystems; protecting floodplains; and planning and implementing burned area emergency response activities. Future projects would be designed to protect and improve proper functioning condition and would employ best management practices, guidelines, and measures to protect these resources. These activities promote recruitment and maintenance of native riparian vegetation, which provide cover and habitat for Sonoran tiger salamander, Chiricahua leopard frog and northern Mexican gartersnake and maintain stable water temperature for native fish in the streams.

There is the potential to impact Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake or their habitat through associated recreation or grazing activities by trampling or harassment of or changing/reducing riparian and floodplain/streambank vegetation used as protective cover, or destroying cover types important for protection and thermoregulation, such as logs. The BA does not specify the watersheds or riparian or stream areas that would be treated under the LRMP. However, over the next 10 years there will be benefits to these species habitats by implementing objectives NWS-O-1, NWS-O-2, and NWS-O-3. These objectives would have the CNF apply for 10 instream flow rights per decade to ensure long-term water for aquatic species, reconstruct three developed springs to provide for recovery of species and complete stream restoration to benefit aquatic species of conservation concern. Wetland objective WET-O-1 would restore native vegetation and natural waterflow patterns at wetlands sites, thus improving habitat for these species.

Riparian guidelines (RIA-G-1, RIA-G-2, and RIA-G-3) restrict new road construction to minimize effects, restrict livestock grazing if there is significant deleterious effects in riparian area, and favor snags, large trees and large diameter woody debris in and near stream channels during vegetation treatments, thus, improving the habitat and limiting runoff and sedimentation. Guidelines NWS-G-4 and NWS-G-5 would be beneficial to the three species and their habitat by maintaining soil moisture at water source outflows and by allowing for natural instream movement of native fish and preclude non-native species movement. Guidelines MOM-G-1 and 2 would direct that no new water diversions would occur and restrict staging areas within meadows which would maintain habitat for the species. Standard WET-S-1 restricts the loss of wetland habitat during activities, while guideline WET-G-1 only allows livestock grazing in wetland areas if there would be no significant deleterious effects to the function of the wetland. Guidelines LOA-G-3b and 3d guide non-Federal land acquisition where there is vital T&E or other wildlife habitat and/or wetlands, riparian area and other water-oriented lands, thus acquiring possible additional suitable lands for these species.

Water Resources – Constructed
This program area has the potential through grazing activities to impact the Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake or their habitat, through livestock trampling of individuals or riparian and floodplain/streambank vegetation, or destroying basking features such as logs, while moving through an area, since most constructed water resources are for grazing. Objective COW-O-1 requires the installation of wildlife escape ramps at all aboveground constructed waters, while guideline COW-G-1 states that the ramps should extend to the bottom and near the edge of the constructed water source, and at such an angle that it doesn't entrap wildlife. The standards RAM-S-2 and RAM-S-3 ensure that grazing permits shall be in compliance with the CNF's Stockpond and Aquatic Habitat Management and Maintenance Guidelines for the Chiricahua Leopard Frog and the CNF's Stockpond Management and Maintenance Plan for the Sonoran tiger salamander. These two standards ensure that grazing management complies with the CNF Habitat Management guidelines outlined for the Chiricahua leopard frog and Sonoran tiger salamander. The guidelines COW-G-2 and COW-G-3 allow for construction of water developments that support aquatic species recovery and direct overflow to maintain or create aquatic habitat for the benefit of species recovery. The guidelines HUA-G-1 and HUA-G-2 specifically protects Arizona treefrog habitat, which also benefits the other species by protecting water levels for different life stages and from detrimental management actions.

Soil Management
This program areas primary objectives are to stabilize soil which would improve habitat and prey habitat for these species. The objective, SOI-O-1 would help maintain habitat needs for aquatic species by requiring that vegetation treatments enhance or restore soil condition by requiring vegetative ground cover. This objective would result in maintenance or enhancement of these species habitat.

Soil improvement projects that involve instream improvement are expected to have short-term adverse effects to leopard frog and gartersnake habitat components, water quality, and prey base. There may be localized, short-term adverse effects from projects in riparian zones such as localized sediment input into habitat, temporary disruption of prey base, and temporary disturbance of habitat. However, these effects would be minimized by standards and guidelines as previously described. Furthermore, while projects related to instream habitat improvements would likely have short-term adverse effects, we anticipate that long-term benefits to primary constituent elements of critical habitat will occur by maintaining and possibly improving their ability to contribute to the conservation and recovery of the species.

Animal and Rare Plants Program
The FS Species Diversity and Viability Report assessed Sonoran tiger salamander, Chiricahua leopard frog, and northern Mexican gartersnake. The viability report determined that Sonoran tiger salamander and Chiricahua leopard frog population trends were unknown and habitats were in a negative trend; the report also showed that the northern Mexican gartersnake population and habitat trend were both negative. The guidelines ARP-G-1, HUA-G-1 and HUA-G-2 provide for the continued existence of these species which use aquatic habitats.

FWS and AGFD permits, as well as USFS permits, are required for the collection of threatened and endangered species, which reduces the risk of over-collection of any T&E species. Within wilderness areas, standard WLF-S-2 requires that reintroduction only occur when a species is extirpated by human-induced events and is indigenous to the area. Although this may adversely affect the species in the short-term, over the long-term the species (if reintroduction is successful) benefit from this activity. Native fish restoration projects are expected to benefit the northern Mexican gartersnake in the long-term; however, they could also result in short-term adverse effects. Management actions needed to support native fish restoration could include approval of construction and maintenance of a fish barrier and other projects to improve aquatic habitat for the species. These projects would have localized, short-term adverse effects to the species from barrier construction and maintenance such as streamflow alteration, sedimentation, and disturbance to individual gartersnakes. Project implementation would follow appropriate standards and guidelines to minimize impacts to the species and aquatic habitat. These native fish restoration projects are expected to have long-term benefits by improving existing habitat for the snake, providing new habitat, and providing increased prey availability and lowered predation risk.

The effects from native fish restoration projects, are expected to be through habitat modification and invasive fish species removal. CNF's management actions to support native fish restoration could include practices that would improve aquatic habitat and manage for non-native species which would benefit the leopard frog and a suite of other prey species. These projects would have localized, short-term adverse effects of streamflow alteration and sedimentation. Project implementation would follow appropriate standards and guidelines, as described above, to minimize impacts to critical habitat. Actions implemented under the LRMP should not result in a net loss of stock tanks within critical habitat. Therefore, dispersal and non-breeding habitat should remain intact for Chiricahua leopard frog. Actions implemented under the LRMP should not significantly reduce or modify habitats needed for dispersal from one water body to another, nor would they be expected to result in the creation of barriers to movement.

Invasive Species Management

This program area has the potential to assist with removing invasive non-native species. The guideline ISM-G-1 directly benefits these species by recommending the removal of non-native invasive animals in or near occupied habitat while guideline RAM-G-6 will focus on restoring native plant species. Herbicide and pesticide (including piscicides) treatments are expected to continue under this plan as they have under the previous forest plan. The use of herbicide and pesticides can have adverse effects on aquatic species as well as upland species. Any potential future projects implemented under this plan would be assessed on a case by case basis to determine potential effects on individual species and to minimize them. Amphibians in general, and ranid frogs in particular, are quite sensitive to pesticides and other chemicals. These chemicals have a variety of direct and indirect effects on amphibians (Sparling 2003). The use of pesticides may impact forage base for specific individual species. Use of these chemicals in occupied habitat is likely to result in mortality or injury to salamanders, frogs, and gartersnakes as well as reduced feeding success and reduced vegetation cover if applied on or near water.

Guideline VLS-G-2 ensures only native plant or short lived, non-persistent non-native species will be used for wildfire treatments. Management Areas-ISM-G-1 allows for the use of human controls to protect threatened and endangered species. Invasive species impact the survival and reestablishment of these native amphibians and reptiles. American bullfrogs, northern crayfish, non-native tiger salamanders, along with warm water non-native fishes are increased stressors on these species.

Forest Products

The sale of forest products are often associated with thinning and fuels reduction projects or silvicultural treatments. Projects such as these can result in impacts to upland and aquatic habitat. The guidelines RIA-G-3, RIA-G-4, NWS-G-1, and NWS-G-3 would favor retention of large riparian woody debris and trees and minimize input of sediment into streams thereby improving water quality, providing habitat with cover, reducing fuel buildup and regulating stream temperatures. These plan components would help to minimize effects of the forest products program.

This program area has the potential to impact Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake and their prey, through disturbance and potential loss/fragmentation of habitat. Short term impacts would include change in stand structure which may impact foraging areas of these species.

Vegetation treatments implemented under this program may cause short-term increases in flood runoff, scouring and sediment deposition into Sonoran tiger salamander, Chiricahua leopard frog, and northern Mexican gartersnake and their prey habitats. Removal of native prey numbers this would be expected to affect Sonoran tiger salamander, Chiricahua leopard frog, and northern Mexican gartersnake. The standards and guidelines described above and in the listed fish portion of the BO are intended to reduce this impact on these species and their prey.

Minerals Management

This program area has the potential through land or facility development or other activities to impact the Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake or their prey, through disturbance, potential loss/fragmentation of habitat, and dewatering. Access roads and the accompanying vehicle traffic are a necessary component of mineral activities, which could result in direct mortality to these species from being run over by vehicles. In most cases mineral removal also requires the use of water resources. Previous mineral extraction activities have been shown to dewater springs and streams that provide habitat for these species, which would have an adverse effect on northern Mexican gartersnake as well as the other species. In addition, surface occupancy causes direct habitat loss and the addition of human occupation increases the chances for harassment and mortality. There is a potential for mining operations to be excavated to a depth greater than that of the regional aquifer and water would drain from deep storage in the aquifer into the pit. The need to dewater the pit during mining operations would result in ongoing water removal via pumping of aquifer water storage. Upon cessation of mining, a pit lake would form, and evaporation from this water body would continue to remove water from storage in the regional aquifer.

Guideline VLS-G-2 ensures only native plant or short lived, non-persistent, non-native species will be used for mine reclamation, ensuring adequate cover for the species following the cessation of activities. The CNF is currently aware of approximately 25 mineral projects within Ecosystem Management Areas where Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake occur. These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Actual mining infrastructure and disturbance would be impossible to predict at the time of this document. Fifteen of these projects are active and in place, while three projects are expected to occur in the foreseeable future, two are completed and five are withdrawn from further consideration. One project is located on the Douglas Ranger District within the Dragoon Ecosystem Management Area, one on the Safford Ranger District within the Galiuro Ecosystem Management Area, eleven on the Nogales Ranger District within the Santa Rita and Tumacacori Ecosystem Management Areas, and twelve on the Sierra Vista Ranger District within the Huachuca Ecosystem Management Area.

Motorized Transportation System

Transportation projects could have localized and short-term adverse effects to listed amphibians and reptiles in the project area and their habitat from actions taken near or in-stream of aquatic habitats. Vehicle traffic on roads may injure or kill northern Mexican gartersnake and Chiricahua leopard frog up to 1 mile or more away from aquatic habitat. Disturbance, loss/fragmentation of habitat and erosion from roads that deposit sediment or concentrate runoff into riparian areas may impact the listed species. Roads crossing or being adjacent to streams can remove and alter riparian vegetation, impact stream channel function and structure, and alter and degrade aquatic habitat through changes in water quality and increases in sediment depositionwhich would also have an impact on the prey species.

Impacts from vehicle traffic on roads to these species include direct mortality from being run over by vehicles, increased opportunity for collection, and direct habitat loss and/or fragmentation and harassment. MTS-O-4 would result in addition of one hardened road crossing per year to reduce effects to water quality and wildlife habitat. Similarly, MTS-O-5 would realign or remove 2 miles of roads from aquatic or meadow habitat in a decade to improve habitat conditions for aquatic species.

Projects improving watershed condition in the uplands would improve or minimize this program's sedimentation impacts to aquatic and riparian conditions where listed species occur and within their critical habitats. Objectives MTS-O-1 and 2 improve road conditions and reduce sedimentation by maintaining high-clearance and passenger car roads. By decommissioning, closing and restoring unneeded non-system roads, MTS-O-3 also improves conditions and reduces sedimentation, although there could be short-term negative impacts during the restoration period when vegetation may be minimal. In addition, if some of these decommissioned and restored roads are within riparian areas or cross stream channels within northern Mexican gartersnake habitat, it will have long-term beneficial impacts. Decommissioning, closing, and restoring existing roads would have the potential to beneficially affect the Sonoran tiger salamander, Chiricahua leopard frog, and northern Mexican gartersnake if the roads are in areas where the species are located. Road closures could benefit the species if roads are near or lead to ponds used by these species, thereby reducing the likelihood of road kills, protecting water quality, and, most importantly, reducing disturbance, potential disease transmission, collection, and introduction of non-native predators associated with recreation or other activities.

Under the standard MTS-S-1, motor vehicle use is restricted to existing roads and trails. This standard also ensures that sedimentation from vehicles is reduced and ensures salamanders and the other species will not risk being run over away from roads. Guideline MTS-G-3 helps to sustain natural water flow and maintain native vegetation communities. RIA-G-1 directs that new road construction should be avoided in riparian areas except to cross drainages, unless alternate routes have greater overall resource impacts. If needed, location and design will minimize effects to the resources.

Ongoing activities within the transportation program include the operation and maintenance of the transportation system on the CNF, which consists of roads and trails that provide access to areas on the forest including: private land, structures and improvements under special use permit, recreational opportunities, and facilities that support land and resource management activities. We would expect that over the life of the project, there could be additional new and temporary road construction to help support forest restoration activities which may result in short and long-term adverse effects to these listed species and their habitat.

Recreation Management

This program area has the potential through recreation activities to impact Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake or their prey, through disturbance and potential loss/fragmentation of habitat as stated under the Natural Water Resources section above. The use of motorized vehicles represents a popular and growing form of recreation on the CNF. Under the standard MTS-S-1, motor vehicle use is restricted to existing roads and motorized trails. The guideline HUA-G-2 recommends that recreation actions that could affect species habitat minimize those effects.

Range Management

This program area has the potential through grazing activities to impact the Sonoran tiger salamander, Chiricahua leopard frog, or northern Mexican gartersnake and/or their habitat, often through livestock trampling of individuals or riparian and floodplain/streambank vegetation removal, or destroying basking features such as logs. Plan components applying to this program area are listed below, followed by discussion of potential effects to the species. The two standards RAM-S-2 and RAM-S-3 ensure that grazing management complies with the CNF Habitat Management guidelines outlined for the Chiricahua leopard frog and Sonoran tiger salamander. The guideline HUA-G-2 recommends that grazing actions that could affect species habitat minimize those effects. RAM-G-5 recommends that grazing structures within riparian areas be located so as to avoid conflict with riparian functions and processes and RAM-G-3 contains guidelines on fencing structures to provide safe wildlife passage. Additional guidelines RAM-G-2, RAM-G-6 and RAM-G-7 provide for plant growth and vigor. These guidelines ensure that cover is available for Sonoran tiger salamander, Chiricahua leopard frog, and northern Mexican gartersnake to protect them from potential predators.

Maintenance of stock ponds adversely affects the Sonoran tiger salamander and Chiricahua leopard frog, and therefore northern Mexican gartersnake in the short term by temporarily eliminating habitat and prey for the species. Long-term drought conditions may dry these ponds which could result in lack of breeding by these species and lead to local extirpation.

Similar to native fish restoration projects, direct effects to the species and their habitats resulting from livestock grazing are expected to be similar to the indirect effects to species through habitat modification as described previously. Livestock grazing can affect the habitat as a result of movement along the streams, temporarily reducing hiding cover, trampling streambanks, contributing to sedimentation, and adding waste deposits that can impair water quality. Impacts to water quality would be greatest during seasonal low flow periods and during droughts.

Additionally, livestock grazing can alter prey availability for the species through reduced cover for prey, reduced water quality for prey, and direct trampling of prey (in particular egg masses). Implementation of rangeland management standards and guidelines, as described above and in the BA, provide guidance to reduce livestock grazing impacts to riparian areas. We do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

Chiricahua Leopard Frog Designated Critical Habitat

In our analysis of the effects of the action on critical habitat, we consider whether or not a proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species. This is based on analysis of whether the proposed action will adversely modify any of the PCEs that were the basis for determining the habitat to be critical. To determine if an action results in adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units and the PCEs of those units, to assess the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be considered because, collectively, they represent the best available scientific information as to the recovery needs of the species.

PCE 1: Aquatic Habitats:
EFFECTS: WUI and landscape-scale fire projects that occur in watersheds that contain leopard frog critical habitat are expected to have short-term adverse effects to water quality. These may include increased sediment input into leopard frog-occupied streams, ponds, and stock tanks. These effects may be minimized by standards and guidelines as previously discussed by program in the effects of the action section.

Watershed and soil improvement projects that involve instream improvement and transportation projects that involve roads in, or adjacent to streams are expected to have short-term adverse effects to this PCE related to leopard frog habitat and water quality needs of its larval stages. There may be localized, short-term adverse effects from projects in riparian zones such as localized sediment input into habitat, and temporary disturbance of habitat. However, these effects would be minimized by standards and guidelines as previously described. Furthermore, while watershed improvement projects related to instream habitat improvements would likely have short-term adverse effects, we anticipate that long-term benefits to primary constituent elements of critical habitat will occur by maintaining and possibly improving their ability to contribute to the conservation and recovery of the species.

Range activities effects to this PCE are expected to be similar to the indirect effects to northern Mexican gartersnake through habitat modification as described above. Livestock grazing can affect the PCEs of critical habitat as a result of movement along the streams, temporarily reducing cover, trampling streambanks, contributing to sedimentation, and adding nitrogenous waste that can impair water quality which may affect the leopard frog's larval stages. Range program standards and guidelines, as described above and in the BA, provide guidance to reduce livestock grazing impacts to riparian areas. In addition, the standards and guidelines, discussed above that prevent the spread of non-native aquatic species and disease during project implementation is expected to benefit the PCEs.

The effects to this PCE from native fish restoration projects, implemented under the Animal and Rare Plants Program, are expected to be through habitat modification and invasive fish species removal. CNF management actions to support native fish restoration could include practices that would improve aquatic habitat and manage for non-native species which would benefit the leopard frog. These projects would have localized, short-term adverse effects of streamflow alteration and sedimentation. Project implementation would follow appropriate standards and guidelines, as described above, to minimize impacts to this PCE.

PCE 2: Dispersal and non-breeding habitat.
EFFECTS: Actions implemented under the LMP should not result in the loss of stock tanks within critical habitat. Therefore, dispersal and non-breeding habitat should remain intact. Actions implemented under the LRMP should not significantly reduce or modify habitats needed for dispersal from one water body to another, nor would they be expected to result in the creation of barriers to movement.

Northern Mexican Gartersnake Proposed Crical Habitat

Watershed improvement projects that involve instream improvements are expected to have short-term adverse effects to the primary constituent elements of critical habitat related to habitat components, water quality, and prey base. There may be localized, short-term adverse effects from projects in riparian zones such as localized sediment input to the streams, temporary disturbance of habitat, and temporary disruption of prey base; however, these effects would be minimized by standards and guidelines as previously described. Furthermore, while watershed improvement projects related to instream habitat improvements would likely have short-term adverse effects, we anticipate that long-term benefits to primary constituent elements of critical habitat will occur by maintaining and possibly improving their ability to contribute to the conservation and recovery of the species.

Direct effects to the primary constituent elements of northern Mexican gartersnake critical habitat resulting from native fish restoration projects are expected to be similar to the indirect effects to the species through habitat modification as described above. CNF program area management actions needed to support native fish restoration could include construction and maintenance of fish barriers to restrict non-native fish from inhabiting areas currently occupied by only native species, and other projects that would result in improvement of aquatic habitat for the species. These projects would have localized, short-term adverse effects to the primary constituent elements of critical habitat from barrier construction and maintenance such as streamflow alteration, sedimentation, and disturbance to the gartersnake's prey base. Project implementation would follow appropriate standards and guidelines, as described above, to minimize impacts to the primary constituent elements of critical habitat. These native fish restoration projects are expected to have long-term benefits to gartersnake critical habitat by improving existing or increasing available habitat, improving water quality, and potentially providing increased prey availability. We do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

Similar to native fish restoration projects, direct effects to the primary constituent elements of critical habitat resulting from livestock grazing are expected to be similar to the indirect effects to northern Mexican gartersnake through habitat modification as described above. Livestock grazing can affect the primary constituent elements of critical habitat as a result of movement along the streams, temporarily reducing shelter cover, trampling streambanks, contributing to sedimentation, and adding nitrogenous waste that can impair water quality. Impacts to water quality would be greatest during warmer months seasonal low flow periods and during droughts. Additionally, livestock grazing can alter prey availability for the snakes through reduced cover for prey, reduced water quality for prey, and direct trampling of prey. Implementation of Rangeland Management standards and guidelines, as described above and in the BA, provide guidance to reduce livestock grazing impacts to riparian areas. We do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

PCE l. Aquatic or riparian habitat that includes:

a. Perennial or spatially intermittent streams of low to moderate gradient that possess appropriate amounts of in-channel pools, off-channel pools, or backwater habitat, and that possess a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of processing sediment loads; or
b. Lentic wetlands such as livestock tanks, springs, and Cienegas; and
c. Shoreline habitat with adequate organic and inorganic structural complexity to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities (e.g., boulders, rocks, organic debris such as downed trees or logs, debris jams, small mammal burrows, or leaf litter); and
d. Aquatic habitat with characteristics that support a native amphibian prey base, such as salinities less than 5 parts per thousand, pH greater than or equal to 5.6, and pollutants absent or minimally present at levels that do not affect survival of any age class of the gartersnake or the maintenance of aquatic prey populations.

Effect: There may be localized, short-term adverse effects to this PCE from watershed improvement projects, roads and trails, livestock grazing, and minerals projects in aquatic habitats such as streambank disturbance and sediment input which may deposit in important fish prey habitats. These projects may temporarily reduce the function of critical habitat through diminished prey base; however, we anticipate that this PCE would be maintained or improved in the long-term. In the long-term, projects are expected to improve soil and vegetation condition in the uplands and will likely improve or at least minimize impacts to aquatic and riparian conditions along streams. Implementation of standards and guidelines previously described are anticipated to reduce the effects of forest programs in the sub-watersheds occupied by northern Mexican gartersnakes and their prey.

Maintenance activities conducted within and near proposed northern Mexican gartersnake critical habitat could temporarily increase turbidity of surface water within and downstream of the maintenance area. However, impacts on water quality should be localized and temporary, and best management practices will be implemented to reduce sedimentation and runoff from roads and other infrastructure. With the exception of these potential effects to water quality, activities implemented under the proposed action are expected to retain this PCE for the northern Mexican gartersnake as explained under 1.a. and l.b.

PCE 2. Adequate terrestrial space (600 feet lateral extent to either side of bankfull stage) adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation.

Effect: The Transportation Program may have adverse effects if a road is constructed in gartersnake proposed critical habitat. A road constructed in gartersnake habitat would result in the permanent loss of the primary constituent elements of critical habitat associated with terrestrial space adjacent to stream systems. Additionally, if road maintenance activities are required at any time, primary constituent elements related to riparian habitat that have regrown could be diminished.

The Recreation Program authorized activities such as dispersed camping, hiking, and other recreation activities may adversely impact adjacent terrestrial habitat through vegetation manipulation and disturbance. There are numerous plan decisions that address potential impacts of recreation to riparian and adjacent areas, which would include those proposed as critical habitat. The LRMP includes standards and guidelines to reduce the impacts to riparian habitats, including those inhabited by northern Mexican gartersnake; however, there is also direction in the LRMP to increase and/or improve recreational opportunities. Over the life of the LRMP, this could result in impacts to gartersnake proposed critical habitat.

There are objectives that would enhance or restore stream and riparian habitat which would connect existing habitats and allow movement of riparian obligate species, such as the northern Mexican gartersnake, between them. Roads and motorized trails would be designed and located so as to not impede terrestrial and aquatic species movement and connectivity.

PCE 3. A prey base consisting of viable populations of native amphibian and native fish species.
Effect: Program actions that involve ground disturbing projects in the uplands and within riparian and aquatic habitats are expected to have short-term adverse effects to the PCEs of proposed critical habitat related to prey base. There may be localized, short-term adverse effects from projects in watersheds and riparian zones such as sediment input to the streams, temporary disturbance of habitat, and temporary disruption of prey base. Long-term adverse effects may occur when roads, trails, or other heavy use areas are located within proposed critical habitat. However, these effects would be minimized by standards and guidelines as previously described under the northern Mexican gartersnake discussion above and listed fish species discussion below.

PCE 4. An absence of non-native fish species of the families Centrarchidae and Ictaluridae, bullfrogs, and/or crayfish *(0. virilis*, *P. clarki*, etc.), or occurrence of these non-native species at low enough levels such that recruitment of northern Mexican gartersnakes and maintenance of viable native fish or soft-rayed, non-native fish populations (prey) is still occurring.
Effect: The CNF is implementing conservation measures to ensure that actions implemented under the LRMP, particularly movement of water under the Fire and Range programs does not result in the incidental movement of non-native species into critical habitat.

New Mexico Ridge-Nosed Rattlesnake

Designated critical habitat for the New Mexico ridge-nosed rattlesnake does not occur within or near the action area; thus, no critical habitat for this species will be affected as a result of the proposed action. Most of the desired conditions, objective, standards and guidelines within the CNF LRMP will have a positive response on the New Mexico ridge-nosed rattlesnake. However, some Standards and Guidelinesand programs may negatively impact New Mexico ridge-nosed rattlesnake and their habitat.

Wildland-Urban Interface and Landscape-scale Fire
There are several objectives that guide management and activities under this program which may offset impacts to this species. Objectives WUI-O-1 and PEL-O-1 would direct management activities to help restore fire to its historic role where large-scale, high-severity fires were rare and restore uplands which would benefit aquatic resources in the long-term, but could result in effects to these species habitats through short-term watershed affects such as sedimentation.

The CNF has a fire management plan (USFS 2012) that includes prescribed burns in the Peloncillo Mountains. Reducing threats of catastrophic fires, developing mosaic habitat patterns, and promoting natural ecological processes are some of the objectives of fire management for this area that would benefit New Mexico ridge-nosed rattlesnake. In addition, the CNF has implemented riparian habitat enhancement work in pine/oak canyons of the Peloncillos that should benefit the New Mexico ridge-nosed rattlesnake (BA-BO 2005).

WUI represents all vegetation communities on the CNF within those areas of human populations and developments at imminent risk from wildfire. Treatment of these areas includes thinning, removal of fuels from the landscape, or altering the fuel profile to reduce the potential for loss of property. Wildland fire can result in short-term impacts to the New Mexico ridge-nosed rattlesnake by burning its habitat or from post-fire flooding. New Mexico ridge-nosed rattlesnake may be caught and burned by these prescribed fires. Snakes may also be killed or injured during the surface disturbance and slash pile burning activities associated with prescribed fire actions. The potential exists for an increase in snake predation due to loss of ground cover and longer periods of surface exposure as more time and energy is devoted to foraging (BLM 2004). In addition, catastrophic fire has been identified as a natural stochastic threat to the New Mexico ridge-nosed rattlesnake and habitat (Smith *et al*. 2001). The treatment of WUI allows CNF the flexibility to manage landscape-scale wildland fire for resource benefit. Landscape-scale wildland fire is one of the methods for ecosystem restoration. The goal of this program is to enhance resiliency of all vegetation communities on the CNF by maintaining more sustainable fuel loads, improved habitat diversity, and watershed integrity.

Within the geographic area in which New Mexico ridge-nosed rattlesnake occupy 35% of the Ecosystem Management Area could be treated within the next 10 years (PEL-O-1). Additional objectives (VME-O-1, VPO-O-1, RIA-O-1, and SOI-O-1) would enhance the uplands by maintaining surface litter and plant cover, along with maintaining watershed stability and riparian vegetation. Watershed improvement through vegetation treatments including wildland fire use (planned and unplanned), prescribed cutting and mastication may reduce the likelihood of wildfire entering riparian habitats and future post-fire runoff. When properly applied, prescribed fires and fuels management projects should have long-term benefits to New Mexico ridge-nosed rattlesnake populations by reducing the likelihood of catastrophic wildfire. However, any fire, regardless of severity, will likely have local short-term adverse effects to this species.

This program area has standards and guidelines to reduce impacts to the species and its prey. However, vegetation treatments using wildland fire may result in short-term adverse effects impacts from post fire flooding or habitat loss from projects occurring in, or adjacent to, their habitats. Long-term effects from mechanical thinning, firebreaks, and other activities to reduce fuels would potentially be positive resulting from reducing fuel loading, thereby reducing the changes of catastrophic wildfires.

Biophysical Features
Biophysical features include geological features such as caves, cliffs, and talus slopes. Protection of cliffs and rock outcrops supporting nesting, roosting, and feeding habitats of birds of prey, provide habitat for desert bighorn sheep, bats, snails, western barking frogs, and other species is one desired condition for this program which would provide habitat for New Mexico ridge-nosed rattlesnake. This includes providing for recreational activities (such as rock climbing) that are compatible with the protection of resident wildlife and plant species, and do not diminish the quantity or quality of specialized vegetation and wildlife habitat. Rockslides and talus slopes are undisturbed, providing habitat for wildlife such as lizards, snakes, and land snails. Talus slopes maintain near-historic levels of moisture and are free from excessive sedimentation.

Plan components that include standard BIP-S-1 would ensure that no New Mexico ridge-nosed rattlesnake is present in cave or mine features when they are closed. The guidelines BIP-G-1, BIP-G-2, BIP-G-3, BIP-G-4, and PEL-G-3a would protect natural cave features utilized by New Mexico ridge-nosed rattlesnake for reproduction and rearing purposes. Guideline BIP-G-2 provides for the avoidance or minimization of altering of naturally occurring rocky outcroppings or cliff faces. Guideline BIP-G-3 protects caves and mines from being altered, except where necessary to protect associated natural features. Guideline BIP-G-4 would protect karst features from management activities (including drilling) that would significantly impact underground ecosystems. PEL-G-3a would require a special use permit for wildlife collection. These standards and guidelines would protect natural cave and talus features utilized by New Mexico ridge-nosed rattlesnake.

Water Resources – Natural
This program includes assessing proper functioning condition; improving and maintaining water quality through the use of best management practices, improving and protecting riparian areas and other groundwater dependent ecosystems; protecting floodplains; and planning and implementing burned area emergency response (BAER) activities. Future projects would be designed to protect and improve proper functioning condition and would employ best management practices, guidelines, and measures to protect these resources.

There are several guidelines that help reduce the impacts to New Mexico ridge-nosed rattlesnake and its habitat. Guideline NWS-G-1 minimizes sediment to streams from upland habitat projects. NWS-G-2 protects and/or enhances the water quality, quantity and aquatic habitat at natural springs and seeps. NWS-G-3 provides for the reduction of fuel buildup around natural water sources to protect them from uncharacteristic fire effects. NWS-G-4 provides that soil moisture recharge at outflows will not be impaired during management activities. These guidelines protect the habitat around natural water sources thereby providing for habitat and prey species for the New Mexico ridge-nosed rattlesnake.

Animal and Rare Plants
This program includes inventory and monitoring, habitat assessments, habitat improvements through land treatments and structures, species reintroductions, development of conservation strategies, administrative studies, collaboration with research, and information and education. Activities in this program area that could affect New Mexico ridge-nosed rattlesnake include habitat improvements through land treatments and structures, species reintroductions, and development of conservation strategies. Guideline ARP-G-1 would implement recovery plans

associated with the federally-listed species and guideline PEL-G-3a would require a permit for collection of any species.

Soil Management
This program area is tasked with stabilizing soil, which would help improve prey habitat and potentially prey populations for this species. SOI-O-1 requires that vegetation treatments enhance or restore soil condition indicators which would help maintain prey species foraging habitat which would result in beneficial impact to New Mexico ridge-nosed rattlesnake.

Minerals Management
This program area has the potential through land or facility development or activities to impact the New Mexico ridge-nosed rattlesnake and its prey, often through disturbance and potential loss/fragmentation of habitat. Access roads and the accompanying vehicle traffic are a necessary component of mineral activities, which could result in direct mortality to these species from being run over by vehicles. In addition surface occupancy causes direct habitat loss and the addition of human occupation increases the chances for harassment and mortality. The guideline MIN-G-1 (talus slopes should not be used as a common variety mineral materials source where disturbance would destabilize the talus slopes and alter any endemic or rare species habitat or presence) would protect natural features utilized by New Mexico ridge-nosed rattlesnake for reproduction and rearing purposes.

In most cases mineral removal also requires the use of water resources. Previous mineral extraction activities have been shown to dewater springs and streams that provide habitat for this species, which would result in an adverse effect to the species. There is a potential for mining operations to be excavated to a depth greater than that of the regional aquifer and water would drain from storage in the aquifer into the pit. The need to dewater the pit during mining operations would result in ongoing water removal via pumping of aquifer water storage. Upon cessation of mining, a pit lake would form, and evaporation from this water body would continue to remove water from storage in the regional aquifer.

At present, CNF is unaware of any mineral projects within the Ecosystem Management Area where New Mexico ridge-nosed rattlesnake occur.

Motorized Transportation System
Although there are minimal roads and trails within the New Mexico ridge-nosed rattlesnake habitat in the Peloncillo Ecosystem Management Area, transportation projects could have localized and short-term adverse effects to this reptile from actions taken near or in-stream or aquatic habitats or talus slopes or rocky outcrops within their habitat. Effects from the motorized transportation system to New Mexico ridge-nosed rattlesnake would be similar to those discussed in the Sonoran tiger salamander, Chiricahua leopard frog , and northern Mexican gartersnake section and will be incorporated by reference.

Roads through New Mexico ridge-nosed rattlesnake habitat pose a risk of habitat loss and direct impacts to individuals. MTS-S-1 requires that all travel is limited to system roads, essentially mitigating the potential for impacts to individuals and additional loss of habitat beyond the existing road system itself. Management direction (MTS-O-1) involves the closure and revegetation of roads that are no longer needed. Such direction has a positive effect on New Mexico ridge-nosed rattlesnake by reducing road density and minimizing threats to the subspecies.

Recreation Management
This program area has the potential through recreation activities to impact New Mexico ridge-nosed rattlesnake or its prey, through disturbance and potential loss/fragmentation of habitat as stated under the Natural Water Resources section above. The use of both on and off-highway motorized vehicles represents a popular and growing form of recreation on the CNF. Under the Standard MTS-S-1, motor vehicle use is restricted to existing roads, which would reduce the chances of New Mexico ridge-nosed rattlesnake being harmed by vehicles. The guideline REC-G-6 would minimize use within New Mexico ridge-nosed rattlesnake habitat and prey habitat from overuse by recreationalists. Potential harassment and/or harm from recreational activities are a risk to the species. REC-G-2 may help to minimize this in certain areas of high visitor use where the rattlesnake occurs by not causing unacceptable resource damage to the landscape. Even with these measures, there is still the potential for adverse effects under this program.

In addition, recreational facilities can cause direct habitat loss and the addition of human occupation increases the chances for harassment and mortality.

Range Management
Grazing within the Peloncillo Mountains, where the New Mexico ridge-nosed rattlesnake is currently known to occur, is primarily managed at grazing Levels C and D. Grazing Levels of C and D are designed to manage for higher forage use levels and require higher density water developments and interior fencing. Loss of ground cover may have a negative effect on the snakes by causing them to move move during foraging or mating, reducing prey availability, as well as increasing their risk of predation. Snakes could be directly injured or killed by livestock trampling or from ranch hands or CNF employees harassing, injuring or killing snakes during livestock management activities, including driving roads, and installing and maintaining structural improvements. Adverse effects are expected to be infrequent because of the low density of snakes in the Peloncillo Mountains relative to other mountain ranges where the species occurs. The guidelines RAM-G-4, RAM-G-6 and RAM-G-7 would provide for growth and reproduction of desired plant species while maintaining or enhancing habitat for New Mexico ridge-nosed rattlesnake.

Gila Chub. Yaqui Chub, Gila Topminnow, Gila Trout, Apache Trout, Spikedace, Loach Minnow, Sonora Chub, Desert Pupfish, Yaqui Catfish, Roundtail Chub

Specific habitats used by these species may not be identical; however, the effects of implementing projects under the LRMP are similar to all eleven species and their critical habitats. Effects to listed fishes and their critical habitat could occur due to Wildland-Urban Interface and Landscape-scale Fire, water resource, animal and rare plant, invasive species management, forest products, minerals management, motorized transportation, recreation and range management programs. Projects are expected to occur in all watersheds where these species occur. For the spikedace, loach minnow, desert pupfish and Yaqui catfish, all of which occur downstream off forest, there would be no direct impacts, however indirect impacts (i.e., increased sedimentation from roads and fires) could occur.

The current extended drought in the southwest and climate change are likely to negatively impact many system components within the listed species habitats on the CNF through: changes in upland vegetation and fire regime; higher ambient and water temperatures; increased variability in stream hydrographs; and more frequent severe climatic events (such as storms, droughts, wildfires, etc.).

Wildland-Urban Interface and Landscape-scale Fire
Treatment of these program areas includes thinning, removal of fuels from the landscape, or altering the fuel profile to reduce the potential for loss of private property. Wildland fire use (planned and unplanned) may reduce the likelihood of future wildfires from entering riparian and aquatic habitats and limiting post-fire runoff into listed fish habitat/critical habitat. Fire use and other treatments can result in short-term adverse impacts to listed fish habitat (e.g., temporary inputs of sediment into occupied habitat, loss of streamside or adjacent flood plain vegetation), as a result of post-fire flooding.

This program does not have standards or guidelines that specifically address listed fish or their habitats. However, objective RIA-O-1 would treat 2,500 to 10,000 acres of uplands every 10 years to maintain watershed stability and function of streams, flood plains, and riparian communities. This objective could help reduce or minimize short term impacts that may result from wildland fire use and other fuel reduction activities by not treating substantial portions of listed fish-occupied watersheds at one time. This would help limit runoff and sediment from any one future wildfire event in the uplands above occupied or potentially occupied listed species habitat. However, with only 1,000 acres treated annually, the likelihood of previously treated areas to be within a wildfire is small. Wildland fire use projects would generally not burn in wetland habitat; however it has the potential to burn adjacent upland habitats causing indirect effects on riparian habitat. Effects include increased runoff from watersheds, adding to flood flows and deposition of debris and sediment originating in the burned area. Intact upland vegetation will reduce indirect effects from runoff and erosion by holding the soil.

There may be adverse effects from implementing this program if there is inadequate ground cover to prevent excessive sediment from being transported into their aquatic habitats, above what is tolerable to listed fish at different life stages. Guidelines RIA-G-3 and 4 and TUM-G-1 would retain large woody debris, snags and large trees in or near stream channels and on side slopes of ephemeral and perennial streams. This would help to maintain soil and stream bank stability, prevent excessive sediment input into stream channels, and provide important fish habitat. In addition, guidelines NWS-G-1, 2, 3, 4, and 5 and TUM-G-1 require projects to minimize sediment, protect aquatic habitat and water quality and quantity at springs and seeps, reduce fuel buildup and maintain soil moisture around natural water sources, leave microenvironments intact, and allow for natural movement of native fish within and around water sources.

Reducing vegetation within watersheds could increase runoff from floodwaters, deposition of debris and sediment from burned areas. Negative impacts on species critical habitat PCEs include increased water temperatures, reduced water quality, changes in aquatic insect food base, and changes in habitats needed for various life stages.

Projects would have short-term adverse effects to the species and their critical habitats, including short-term indirect effects (i.e., increased sedimentation) in habitats downstream, including off the Forest, where these species occur. However, there would also be long-term beneficial effects as watersheds, aquatic, and riparian habitats move towards desired conditions.

Water Resources – Natural and Constructed
Overall, the Water Resources (natural and constructed) program plan components are positive for all of the listed fishes and their habitats in the long-term and would maintain or improve watershed condition indicators relative to water quality, non-native species, soils, riparian vegetation, and rangeland vegetation. However, these projects (i.e.: protecting or enhancing water quality, quantity and aquatic habitat; maintaining soil moisture; minimizing sediment, etc.) may have localized, short-term adverse effects such as streamflow and streambank alteration, and excess sediment erosion or deposition. These adverse effects could alter water quality and affect habitat amount; however; we would expect them to be short in duration and intensity.

In most cases, projects would be limited in extent and amount of ground disturbance. Overtime, projects in the riparian areas would improve aquatic and riparian conditions and are expected to reduce sediment deposition into aquatic habitats, which would maintain or improve water quality and healthy macroinvertebrate populations. They would also promote recruitment and maintenance of native riparian vegetation, which would maintain suitable water temperature for listed fishes and attenuate floods and sediment in the streams. All activities would implement standards and guidelines and best management practices as described in the BA (USFS 2016a). Projects would have short-term adverse effects to the species and habitat but would have long-term beneficial effects as watersheds, aquatic, and riparian habitats become more resilient to natural and other disturbances, including climate change. There should be no direct impacts to the spikedace, loach minnow, desert pupfish, Yaqui catfish, or roundtail chub from activities within this program area, since these species are currently not known to occur on the CNF.

CNF's management actions needed to support listed fish restoration could include approval of the construction and maintenance of fish barriers (Guideline NWS-G-5) to preclude the movement of non-native species, as well as other projects that may affect aquatic habitat. Actions resulting in disturbance to individual fish can alter their breeding, sheltering, or feeding behaviors and increase their risk of predation. Project activities would be minimized by the guidelines described below, listed in the proposed action, and additional actions Service and AGFD typically conduct with fish restoration projects. There should be no direct effects to the loach minnow, spikedace, desert pupfish, Yaqui catfish, or roundtail chub since they currently do not occur on the CNF.

There are four relevant objectives that guide management and activities to sustain and maintain suitable habitat by providing adequate in-stream flow water rights and proper ecosystem functions (USFS 2016a, 2016b, 2017):

- NWS-O-1 prioritizes water right applications that sustain native fish populations and species of conservation concern,
- NWS-O-2 and NWS-O-3 reconstructs and restores springs and streams, and
- RIA-O-1 maintains structure and functions of streams, floodplains and riparian vegetation.

The BA does not specify the watersheds, riparian or stream areas that would be treated under the LRMP. The objectives improve watershed condition and function, and riparian conditions across the planning area. The objectives provide for a treatment, which will improve the overall conditions for the watersheds and riparian areas receiving treatments.

Objective goals are expected to have long-term beneficial impacts, if implemented in streams or watersheds occupied by listed fish, through maintenance or restoration of hydrologic conditions and functions. Short-term adverse impacts associated with project implementation could result, including increases in sedimentation, soil compaction, alterations in hydrologic conditions and functions, and changes in water quality. Conservation measures that minimize or reduce adverse effects would be implemented at the project level based on site conditions and timing.

Several guidelines ensure stream and water quality protection:

- Guideline NWS-G-1 could minimize impacts to soil resources which would reduce sediment flow into listed fish habitat;
- NWS-G-2, NWS-G-3, NWS-G-4, and NWS-G-5 require projects to protect water quality and quantity, and aquatic habitat, reduce fuel buildup, maintain soil moisture and allow for natural stream movement of native fish passage in construction projects, including roads; and
- TUM-G-1 leaves mesic microenvironments at riparian areas.

Vegetation treatments implemented under this program that involve ground disturbance and are of sufficient size may cause short-term increases in flood runoff, scouring and sediment deposition into listed fish habitats. This is expected to affect listed fish until adequate ground cover has re-established on the treatment site and any excess sediment moves through the system. The standards and guidelines required under this program are intended to reduce this impact on listed fish and their habitats. We expect that over the life of the LRMP projects implemented under this program may result in short-term adverse effects to the species and habitat but would have long-term beneficial effects to listed fish and their habitats. Vegetation treatments are not expected to have an effect on the spikedace, loach minnow, desert pupfish, Yaqui catfish, or roundtail chub because of their remote locations downstream of forest actions.

Animal and Rare Plants Program

This program area includes inventory and monitoring, habitat assessments, habitat improvements through land treatments and structures, species reintroductions, conservation strategy development, administrative studies, research collaboration, and information and education. The CNF has the highest biological diversity of any national forest in the western United States, as it is situated at a convergence zone of ecological regions, and is host to a wide variety of vegetation communities.

The CNF assessed Gila chub, Yaqui chub, Gila topminnow, and Sonora chub in the FS Species Diversity and Viability Report (USFS 2016a). The analysis (USFS 2016a) found that programmatic direction under the LRMP would provide for long-term viability for these listed species. The viability report determined that Gila chub and Sonora chub populations were stable, Yaqui chub populations were dynamic and Gila topminnow populations were unknown. Habitat trends for all four species were positive. Guideline ARP-G-1 would ensure that any forest program activity occurring in listed fish habitats would be consistent with existing recovery plans.

New fish surveys providing population status and locations would help reduce the effects of other forest projects on listed fish species. Streambank and stream bed disturbance and disturbance to individual listed fish could result from surveys and habitat assessments, although effects would be insignificant and discountable. Habitat improvement projects such as riparian fencing to protect habitat could also have short-term vegetation and soil impacts in occupied habitat and adjacent uplands (e.g., vehicles delivering/laying out materials, fences being constructed across or alongside occupied habitats). Reintroduction of new populations would increase the number of populations potentially affected by the proposed action. Construction of fish barriers will help preclude the movement upstream of non-native fish species.

Habitat improvements should ultimately result in improved stream conditions, resulting in less sedimentation and erosion downstream, where spikedace, loach minnow, Yaqui catfish, desert pupfish, and roundtail chub occur off CNF. Therefore, these activities may result in beneficial effects.

Invasive Species Management

This program area has the potential to benefit listed fish species by removing non-native invasive species. The guideline ISM-G-1 directly benefits listed fish species by recommending the removal of non-native invasive animals in or near occupied habitat. Guideline RAM-G-6, which implements treatments to restore rangelands, will restore native plant species. Pesticide treatments are expected to continue under this plan as they have under the previous forest plan (USFS 2016a). Pesticide use can have adverse effects on listed fish. Any potential future projects proposed would be assessed on a case by case basis to determine potential effects on individual species and and make recommendations on how to minimize them. Pesticide uses may impact the forage base for individual fish species. Pesticide drift could have direct effects on listed species depending on distance to occupied habitat; however, the indirect effect of a reduced forage base could cause indirect effects to listed species downstream.

Forest Products

Upland project impacts would include increased runoff and sediment movement from vegetative cover removal during treatments. Projects in the uplands would be limited spatially and temporily to reduce these watershed impacts. However, there may still be short-term adverse effects before adequate vegetation cover has returned.

There are six relevant guidelines that would affect listed fish and their habitats:

- Guidelines RIA-G-3 and RIA-G-4 would retain large woody debris, snags and large trees within riparian areas, thus maintaining soil stability and reducing sediment into stream channels. There may be short-term adverse effects if there is inadequate ground cover to prevent excessive sediment, above what is tolerable to listed fish at their different life stages, from being transported into their habitats;
- Guidelines NWS-G-1, NWS-G-2, NWS-G-3, and NWS-G-4 require projects to minimize sediment, protect water quality, quantity and aquatic habitat, reduce fuel buildup, and maintain soil moisture, within and around water sources.

Vegetation treatments implemented under this program may cause short-term increases in flood runoff, stream channel scouring or sediment deposition into listed fish habitat. The guidelines described above are intended to reduce this impact on listed fish and their habitat.

Minerals Management

The FS role in minerals management is to administer mining, oil, gas, and geothermal activities, while providing protection of surface resources (36 CFR 228), such as vegetation and aquatic resources. Authorized activities associated with mineral extraction may impact listed fish and/or their habitats by affecting water quality or impacting stream bodies. Potential impacts can occur as a result of mining infrastructure including but not limited to roads, buildings, water sources, processing plants, and tailings piles (USFS 2016a). Impacts due to the future minerals management activities, including groundwater reduction, increased sedimentation, and removal of vegetation, within designated critical habitat and occupied areas of the listed fish species are reasonably certain to occur, and thus will negatively affect Gila chub, Yaqui chub, Gila topminnow, Gila trout, Apache trout, spikedace, loach minnow, Sonora chub, desert pupfish, Yaqui catfish, and roundtail chub.

The CNF has currently authorized approximately 24 mineral projects within Ecosystem Management Areas where Gila chub, Yaqui chub, Gila topminnow, Gila trout, Apache trout, Sonora chub, roundtail chub, and desert pupfish occur (USFS 2016a). These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Mineral-related proposals submitted to CNF are required to be in compliance with laws, regulations and the forest plan. Actual mining infrastructure and disturbance would be impossible to predict at the time of this document. Minerals exploration is currently ongoing at 17 projects. Five projects are expected to occur in the foreseeable future and two are completed (USFS 2016a).

Motorized Transportation System

Motorized vehicle use represents a popular and growing form of recreation on the CNF (USFS 2016a). Although occurring across the entire forest for the length of the plan, transportation projects could have localized adverse effects to listed fish and their habitat from actions taken near or in-stream. Long-term effects to the species include disturbance, loss/fragmentation of habitat and erosion from roads that deposit sediment or concentrate runoff into streams. Potential downstream effects of this program area could result in increased sedimentation from forest roads in listed fish habitats and their critical habitats. Roads crossing or being adjacent to streams can remove and alter riparian vegetation, impact stream channel function and structure, and alter and degrade aquatic habitat through changes in water quality and increases in erosion and sediment deposition. Improperly designed culverts can create barriers to fish movement and effect habitat by causing downstream erosion and upstream sediment deposition during high flow events from the backwater effects of improperly sized culverts.

Projects improving soil and vegetation condition in the uplands could improve or minimize this program's impacts to aquatic and riparian conditions along streams where listed fish species and their critical habitats occur. There are several relevant objectives, standards and guidelines that would affect listed fish and their habitats:

- Objectives MTS-O-1 and MTS-O-2 would improve road conditions and reduce sedimentation by maintaining high-clearance and passenger car roads. Best management practices such as filter strips buffers and broad-based dips, can help minimize increased erosion conditions.
- Objective MTS-O-3 decommissions, closes and/or restores unneeded non-system roads. This would be expected to improve upland soil conditions and reduce

excessive sediment deposition into listed fish habitats. There could be short-term adverse impacts during the restoration period when vegetative cover may be minimal. If these decommissioned and restored roads are within riparian areas or cross stream channels within listed fish species habitat, it will have long-term beneficial impacts; and

- Objectives MTS-O-4 and MTS-O-5 would ultimately improve water quality by hardening road surfaces at drainage crossings, and removing or realigning roads within wetlands or meadows, although short-term increases in sedimentation may result from these projects. However, contaminants could be added from materials and equipment used, resulting in potential indirect impacts to the fish and their habitat.
- Standard MTS-S-1 restricts motor vehicle use to existing roads and trails. This standard also ensures that sedimentation from vehicles is reduced.
- Guideline MTS-G-3 helps to sustain natural water flow and maintain native vegetation communities.
- Guideline RIA-G-1 directs that new road construction should be avoided in riparian areas except to cross drainages, unless alternate routes have greater overall resource impacts. If needed, location and design will minimize effects to the resources as determined at the project-specific level.

Ongoing activities within the transportation program include the operation and maintenance of the transportation system on the CNF, which consists of roads and trails that provide access to areas on the forest including: private land, structures and improvements under special use permit, recreational opportunities, and facilities that support land and resource management activities. We would expect that over the life of the project, there could be additional new and temporary road construction, to help support forest activities and provide access to inholdings, which may result in both short and long-term adverse effects to listed fish and their habitat. Species occurring off forest, but downstream of these activities, spikedace, loach minnow, desert pupfish, Yaqui catfish, and roundtail chub, could be indirectly impacted due to increased sedimentation caused by road maintenance and other transportation activities.

Recreation Management

Although limited on the CNF, reservoirs, streams and adjacent riparian areas receive many types of recreational activities. The user demands and concentrated uses in these areas can alter vegetation, riparian areas, water quality, and aquatic habitat. Recreation sites and developments and their associated uses and activities can present threats to maintaining, restoring and recovering listed fish and their critical habitats. Recreational sites and activities can degrade upland and watershed conditions and function, alter riparian vegetation and function, and reduce water quality and increase sediment into streams. The concentration of recreational activities within and adjacent to riparian areas and streams can also increase the risk of introductions and spread of invasive or undesirable plants and animals.

Three guidelines are included in the LRMP that can address potential impacts of recreation to listed fish and their habitats.

- REC-G-2 ensures recreation areas are managed in a way that do not cause unacceptable resource damage, which includes aquatic systems;

- PSR-G-1 discourages cross-country travel (hiking) within Pusch Peak Wilderness area, which in turn reduces impacts to the aquatic and riparian systems within and adjacent to the area; and
- WSA-G-8 prohibits new road construction in wilderness study areas, which would eliminate potential sedimentation to riparian and stream areas occupied by listed fish species.

The LRMP includes guidelines to reduce the impacts to listed fish from recreation activities; however, there is also direction in the LRMP to increase and/or improve recreational opportunities. Over the life of the LRMP, this could result in adverse impacts to listed fish and their habitat through multiple mechanisms.

Range Management
Range management program activities include the production of forage for grazing and browsing livestock and wildlife. Livestock grazing is permitted on about 90 percent of the CNF. Grazing use is administered through a grazing permit system on designated livestock grazing allotments.

Livestock grazing would continue throughout suitable rangelands on forest lands within the planning area. Many segments of listed fish habitat have limited livestock grazing or are protected from grazing by exclosure fences along streams or have limited accessibility due to steep terrain. Adverse livestock management effects to listed fish and their habitats would primarily be indirect effects associated with habitat disturbance in upland areas and resulting sedimentation. Livestock accessible areas of listed fish habitat and critical habitat may experience adverse effects to streambanks, riparian vegetation, and water quality.

The BA did not provide riparian or aquatic habitat condition information for listed fish-occupied streams or their critical habitats. Current range conditions on the CNF are reflective of past and ongoing grazing activities. Condition classes of 6th HUC watersheds on CNF show 73 percent functioning properly (watersheds exhibiting high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition) and 27 percent functioning at risk (watersheds exhibiting moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition), with no watersheds impaired (watersheds exhibiting low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition) (USFS 2013).

There are five relevant guidelines for rangeland management in listed fish habitat.

- ARP-G-1 ensures that approved listed fish recovery plan habitat management objectives and species protection measures are applied to all activities within federally listed species habitat;
- RIA-G-2 allows for grazing only when there are no significant deleterious effects to riparian structure or function;
- RAM-G-2 provides for sufficient deferment of grazing following burning (wildfire or proscribed) to recover plant growth and vigor, thus reducing sediment into stream channels;
- RAM-G-5 uses structures (fencing, etc.) in a way that it doesn’t conflict with riparian functions and processes; and

- RAM-G-7 limits grazing intensity to provide for desired plant species growth, which helps maintain proper watershed functions. These guidelines protect or restore riparian or wetland habitats and the uplands that may influence listed fish habitat.

Effects from livestock grazing contributes to both direct and indirect effects to listed fish habitat; however these effects are minimized by use of riparian exclosures, limited pasture use, or timing restrictions for livestock use in riparian areas where it occurs. Livestock grazing may still adversely affect important habitats needed by listed fish outside of these protected or specially-managed areas. The guidelines listed above are expected to minimize these adverse effects by limiting grazing intensity, maintaining riparian vegetation, reducing sedimentation, and maintaining riparian functions. However, over the life of this consultation, we expect that implementation of the Rangeland Program could result in adverse effects to listed fish and their habitats.

Projects related to improving watershed and soils conditions include direction to implement projects to counter critical threats to riparian functionality during the 10 to 15 years following plan approval. Activities could include, but are not limited to, vegetation reestablishment, non-native invasive plant treatments, erosion control, instream habitat improvement, adjusting the timing and season of grazing, or fencing exclosures. In most cases, projects would be limited in extent and amount of ground disturbance. Projects in the riparian and stream zones would have localized, short-term effects including streambank disturbance, vegetation reduction, sedimentation into the stream, and disturbance to listed fish. These projects will occur for the life of the plan; therefore the short-term impacts would continue at numerous locations. All activities would implement the standards, guidelines, and best management practices as described in the BA (USFS 2016a). Additionally, projects would have long-term beneficial effects as watersheds and aquatic and riparian habitats move towards a sustainable landscape that is healthy, diverse, resilient, and functioning, with stable soils, functional hydrology, and biotic integrity, and supporting healthy, diverse populations of native wildlife.

Range projects, such as fencing, within riparian areas could improve aquatic and riparian conditions and are expected to reduce sedimentation to aquatic habitats, which would maintain or improve water quality and healthy macroinvertebrate populations. They would also promote recruitment and maintenance of native riparian vegetation, which would help to maintain suitable water temperature for listed fishes in the streams. However, if the projects include water gaps or cattle crossing lanes, there will be long-term negative effects from the disturbance and increased sedimentation caused by the concentrated cattle. This increased sedimentation has the potential to reach occupied habitats of the listed species that only occur off Forest, including loach minnow, spikedace, desert pupfish, Yaqui catfish, and roundtail chub, resulting in indirect effects.

Gila Chub, Spikedace, Loach Minnow, and Sonora Chub Designated Critical Habitat
There may be localized, short-term adverse effects to the primary constituent elements of critical habitat from projects in or near riparian zones such as streambank disturbance, vegetation reduction, invasive species control, and sediment input to the streams. Projects related to springs and seeps within critical habitat would have similar effects to the primary constituent elements. These projects may temporarily reduce the function of critical habitat through diminished water quality, breeding habitat, and prey base; however, we anticipate that these primary constituent

elements of critical habitat would be maintained or improved in the long-term. We do not anticipate that these activities would diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

CNF management actions needed to support native fish restoration could include construction and maintenance of fish barriers and projects to improve aquatic habitat for the species. These projects could have localized, short-term adverse effects to the primary constituent elements of critical habitat, including streamflow and streambank alteration, decreased water quality from sedimentation, and disruption of prey base from construction and maintenance of structures such as fish barriers. Project activities would be minimized by implementation of guidelines listed above and in the BA.

Overall, the Animal and Rare Plants program and other program components are positive for critical habitat in the long-term and would maintain or improve watershed condition indicators related to the primary constituent elements of water quality, non-native species, breeding habitat, and prey base. We do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of Gila chub, spikedace, loach minnow, and Sonora chub.

Localized short-term adverse effects to critical habitat from roads in and adjacent to critical habitat that affect water quality, food base, and riparian vegetation and streambanks are likely to occur as a result of transportation-related projects. In the long-term, projects are expected to improve soil and vegetation condition in the uplands and will likely improve or at least minimize impacts to aquatic and riparian conditions along streams. Implementation of standards and guidelines previously described are anticipated to reduce the effects of ongoing roads maintenance and future projects in the subwatersheds. Despite the short-term adverse effects that may result from transportation-related projects, we expect that over the long-term, the function of critical habitat for the species will be retained. We do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of Gila chub, spikedace, loach minnow, and Sonora chub.

Segments of critical habitat are protected from livestock grazing by exclosure fences, pasture closures, or have limited accessibility due to steep terrain. Areas accessible to livestock within critical habitat could result in short-term adverse effects to streambanks, riparian vegetation and water quality from livestock waste in or near habitat. Impacts to water quality would be greatest during seasonal low flow periods and during droughts. Overall, the Rangeland Program plan components could result in short-term adverse effects to water quality in critical habitat from livestock grazing, but we anticipate that that these activities will be limited in location, duration, and frequency and would not decrease the functionality or conservation potential of critical habitat over the long-term. We do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

Gila Chub Designated Critical Habitat

PCE 1: Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies all found in headwaters, springs, and cienegas, generally of smaller tributaries.

EFFECT: There may be localized, short-term adverse effects to this PCE from watershed improvement projects, roads and trails, livestock grazing, and minerals projects in aquatic habitats such as streambank disturbance and sediment input which may deposit in important pool habitats. These projects may temporarily reduce the function of critical habitat through diminished pool habitat, which serve as refuges in hot weather; however, we anticipate that this PCE would be maintained or improved in the long-term. In the long-term, projects are expected to improve soil and vegetation condition in the uplands and will likely improve or at least minimize impacts to aquatic and riparian conditions along streams. Implementation of standards and guidelines previously described are anticipated to reduce the effects of forest programs in the sub-watersheds occupied by Gila chub.

PCE 2: Water temperatures for spawning and seasonally appropriate temperatures for all life stages.
EFFECT: The effects described under PCEs 1 and 3 indirectly address water temperature thresholds required to meet Gila chub life cycle needs.

PCE 3: Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH, dissolved oxygen, and conductivity (100 to 1000 millimhos).
EFFECT: Areas accessible to livestock within critical habitat could result in short-term adverse effects to streambanks, riparian vegetation and water quality from animal waste in or near habitat. Impacts to water quality would be greatest during seasonal low flow periods warm weather and during droughts. The Rangeland Program may cause short-term adverse effects to water quality-related PCEs, but we anticipate that that these activities will be limited in location, duration, and frequency and would not decrease the functionality or conservation potential of critical habitat over the long-term. In addition, there are numerous program desired conditions, objectives, standards, and guidelines that address preventing excessive sediment, fuel, and other contaminants from entering aquatic habitats. We do not anticipate that livestock activities would diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

PCE 4: Food base consisting of invertebrates and aquatic plants.
EFFECT: These effects are discussed under PCEs 2 and 3. The aquatic insect food base relies on adequate water quality (temperature, dissolved oxygen, contaminant-free water) for numerous life cycle stages. Programs that involve mechanized equipment have guidelines that prevent fuels and other contaminants from entering aquatic habitats. Forest program objectives that improve riparian vegetation would increase the availability terrestrial organic matter that many aquatic and terrestrial insects, which are prey for Gila chub, require.

PCE 5: Sufficient cover.
EFFECT: This PCE may be affected by large magnitude floods that scour cover structure from the stream channel. All forest programs have desired conditions, objectives, standards, and guidelines that would minimize effects from authorized activities in the watershed or stream channel. The availability of cover depends upon the presence of woody riparian vegetation growing along the stream channel. The LRMP has numerous plan decisions that protect or promote the growth of riparian vegetation along stream habitats that include Gila chub critical habitat.

PCE 6: Nonnative aquatic species.

EFFECT: While non-natives may already be present in some streams, the CNF is implementing conservation measures to ensure that actions implemented under the LRMP do not result in the incidental movement of non-native species into critical habitat.

PCE 7: Streams that maintain a natural flow pattern including periodic flooding.
EFFECT: Actions implemented under the LRMP are expected to retain and recover this PCE for Gila chub. There are desired conditions, objectives, standards, and guidelines to ensure that areas supporting listed species are not dewatered or impaired to the point that they cannot support Gila chub. These plan decisions also protect instream flow, consistent with existing water rights and laws, that are expected to retain and protect this PCE.

Loach Minnow Designated Critical Habitat

PCE 1: Habitat to support all egg, larval, juvenile, and adult loach minnow which includes*:*

PCE 1a. Perennial flows.
EFFECT: Actions implemented under the LRMP are expected to retain and protect this PCE. There are standards and guidelines to ensure that areas supporting listed species are not dewatered or impaired to the point that they cannot support loach minnow. Actions implemented under the LRMP have required standards and guidelines to protect instream flow, consistent with existing water rights and laws, that are expected to retain and protect this PCE.

PCE 1b. Appropriate microhabitat types including pools, runs, riffles, and rapids.
EFFECT: There may be localized, short-term adverse effects to this PCE from watershed improvement projects, roads and trails, livestock grazing, and minerals projects in aquatic habitats such as streambank disturbance and sediment input. We anticipate that this PCE would be maintained or improved in the long-term. In the long-term, projects are expected to improve soil and vegetation condition in the uplands and will likely improve or at least minimize impacts to aquatic and riparian conditions along streams. Implementation of standards and guidelines previously described are anticipated to reduce the effects of forest programs in the sub-watersheds occupied by loach minnow.

PCE 1c. Appropriate stream gradient of less than 2.5 percent.
EFFECT: Activities that may potentially increase stream gradients above the 2.5 percent threshold include those in the watershed that greatly increase flood magnitude so that stream channel downcutting and straightening occurs. In-channel activities, such as sand and gravel extraction, may cause gradient increases if channel incision and straightening occurs as a result of head cut forming and moving upstream. All forest programs have standards and guidelines that would prevent these affects from occurring as a result of authorized activities in the watershed or stream channel.

PCE 1d. Appropriate water temperatures.
EFFECT: The effects described under PCEs *1a*, *1b*, and 6 discuss water quantity and quality which may indirectly address temperature thresholds required to meet loach minnow life cycle needs. Actions implemented under the LRMP are expected to retain or recover this PCE for the loach minnow.

PCE 2. An abundant aquatic insect food base.
EFFECT: The aquatic insect food base relies on adequate water quality (temperature, dissolved oxygen, contaminant-free water) for numerous life cycle stages. Programs that involve mechanized equipment have guidelines that prevent fuels and other contaminants from entering aquatic habitats. Forest program objectives that improve riparian vegetation would increase the availability of organic matter that many aquatic insects require as a food source.

PCE 3. Streams with no or no more than low levels of pollutants.
EFFECT: Programs that involved mechanized equipment have guidelines that prevent fuels and other contaminants from entering aquatic habitats. Pesticide use, to control invasive and noxious plants and animals, would be done to minimize impacts on non-target species.

PCE 4. Perennial flows, or interrupted stream courses that serve as connective corridors between occupied or seasonally occupied habitat.
EFFECT: Actions implemented under the LRMP are expected to retain and recover this PCE for loach minnow. There are standards and guidelines to ensure that areas supporting listed species are not dewatered or impaired to the point that they cannot support fish, which would include the loach minnow.

PCE 5. Nonnative aquatic species.
EFFECT: The CNF is implementing conservation measures to ensure that actions implemented under the LRMP, particularly movement of water under the fire, vegetation and range management programs do not result in the incidental movement of non-native species into critical habitat.

PCE 6. Streams with a natural, unregulated flow regime or, if flows are modified or regulated, a flow regime that allows for flows capable of transporting sediments.
EFFECT: Actions implemented under the LRMP are expected to retain and recover this PCE for loach minnow. There are standards and guidelines to ensure that areas supporting listed species are not dewatered or impaired to the point that they cannot support fish, which would include the loach minnow. Actions implemented under the LRMP have required standards and guidelines to protect instream flow, consistent with existing water rights and laws, that are expected to retain and protect this PCE.

Spikedace Designated Critical Habitat

The PCEs of spikedace critical habitat are very similar to those developed for the loach minnow. The effects of the proposed action to these PCEs would be the same as those described above under loach minnow.

Sonora Chub Designated Critical Habitat

There were no primary constituent elements identified for the critical habitat; however the final rule (USFWS 1986c) discussed the types of activities that could modify critical habitat, implying that these were critical elements (CE). Those activities area summarized below:

CE 1. Any activity that depletes flows or significantly alters the natural flow regime in the critical habitat reaches.

EFFECT: Actions implemented under the LRMP are expected to retain and recover this CE for Sonora chub. There are standards and guidelines to ensure that areas supporting listed species are not dewatered or impaired to the point that they cannot support fish, which would include the Sonora chub. Actions implemented under the LRMP have required standards and guidelines to protect instream flow, consistent with existing water rights and laws, that are expected to retain and protect this CE.

CE 2. Any activity that would extensively alter the channel morphology of the critical habitat reaches.
EFFECT: There may be localized, short-term adverse effects to this CE from watershed improvement projects, roads and trails, livestock grazing, and minerals projects in aquatic habitats such as streambank disturbance and sediment input. These projects may temporarily reduce the function of critical habitat through diminished pool capacity; however, we anticipate that this CE would be maintained or improved in the long-term. In the long-term, projects are expected to improve soil and vegetation condition in the uplands and will likely improve or at least minimize impacts to aquatic and riparian conditions along streams. Implementation of standards and guidelines previously described are anticipated to reduce the effects of forest programs in the subwatersheds occupied by Sonora chub.

CE 3. Any activity that would significantly alter the water chemistry of the critical habitat reaches.
EFFECT: Areas accessible to livestock within critical habitat could result in short-term adverse effects to streambanks, riparian vegetation and water quality from livestock waste in or near aquatic habitat. Impacts to water quality would be greatest during seasonal low flow periods, warm weather, and during droughts. The Rangeland Program may cause short-term adverse effects to water quality-related PCEs, but we anticipate that that these activities will be limited in location, duration, and frequency and would not decrease the functionality or conservation potential of critical habitat over the long-term. In addition, there are numerous program desired conditions, objectives, standards, and guidelines that address preventing excessive sediment, fuel, and other contaminants from entering aquatic habitats. We do not anticipate that livestock activities would diminish the ability of critical habitat to contribute to the conservation and recovery of the species.

CE 4. Any activity that introduced exotic fish (and associated parasites) to the critical habitat reaches.
EFFECT: The CNF is implementing conservation measures to ensure that actions implemented under the LRMP, particularly movement of water under WUI and Landscape-scale Fire and range management programs do not result in the incidental movement of non-native species into critical habitat.

Huachuca Water Umbel and Designated Critical Habitat

Wildland-Urban Interface and Landscape-scale Fire

Treatment of vegetation communities within areas of human populations and developments at imminent risk from wildfire includes thinning, removal of fuels from the landscape, or altering the fuel profile to reduce the potential for loss of property. The treatment of WUI allows the Forest the flexibility to manage landscape-scale wildland fire for resource benefit.

There are six relevant objectives and one guideline that guide the management and activities under this program with the potential to effect the Huachuca water umbel and its habitat. Objectives WUI-O-1, VGC-O-1, VIC-O-1, VME-O-1, VMP-O-1, and RIT-O-1 provide for treating the landscape with wildland fire, prescribed cutting, mastication and other mechanical treatments, which could negatively impact the taxon habitat. However, the water umbel grows in habitats that are not likely to burn, although the habitat may be altered by the post burn runoff and sedimentation in occupied habitat. When properly applied, prescribed fires and fuels management projects should have long-term benefits for the taxon and its habitat by reducing the likelihood of catastrophic wildfire.

With upland restoration treatments maintaining watershed stability, the objective (RIA-O-2) has the potential to result in lower intensity fires and ground cover that readily resprouts after fire. This would help limit runoff and sediment from any one fire event in the uplands above occupied or potentially occupied habitat. Fires would generally not burn in wetland habitat, however it has the potential to burn adjacent upland habitats causing indirect effects on Huachuca water umbel and its habitat. Effects include increased runoff of floodwaters, deposition of debris and sediment originating in the burned area, and potential for scouring individuals and habitat (USFWS 2014c). The guideline VLS-G-2 states that only native plant species or short-lived, non-persistent, non-native species be used for post fire wildfire treatments. This would reasonably ensure that non-native species would not out compete native species that are trying to reestablish. Whenever possible, locally sourced native plant species should be used for restoration efforts. The guideline NWS-G-3 adds a protection measure from uncharacteristic fire effects of additional fuel buildup around natural water sources.

Wildland Fire projects that occur in watersheds that contain critical habitat are expected to have short-term adverse effects as related to water quality. These may include increased sediment input into occupied cienegas, rivers, streams, and springs. These effects may be minimized by standards and guidelines as previously discussed.

Water Resources – Natural

Methods used in this program area include assessing proper functioning condition; improving and maintaining water quality through the use of best management practices; improving and protecting riparian areas and other groundwater dependent ecosystems; protecting floodplains; and planning and implementing burned area emergency response activities. Future projects would be designed to protect and improve proper functioning condition and would employ best management practices, guidelines, and measures to protect these resources. These activities promote recruitment and maintenance of native riparian vegetation and habitat for Huachuca water umbel.

There is the potential to impact Huachuca water umbel and its habitat through associated recreation or grazing activities by trampling or changing riparian and floodplain/streambank vegetation. Over the next 10 years there will be benefits to this taxon's habitats by implementing objectives NWS-O-1, NWS-O-2, and NWS-O-3. These objectives would have the CNF apply for 10 instream flow rights per decade to ensure water for aquatic species, reconstruct three developed springs to provide for recovery of species and complete stream restoration to benefit aquatic species of conservation concern. Wetland objective WET-O-1 would restore native vegetation and natural waterflow patterns at wetlands sites, thus improving habitat for the taxon.

Riparian guidelines (RIA-G-1 and RIA-G-2) restrict new road construction to minimize effects and restrict livestock grazing if there are significant deleterious effects in riparian area, thus, improving the habitat and limiting runoff and sedimentation. Guideline NWS-G-4 would be beneficial to the taxon and its habitat by maintaining soil moisture at water source outflows. Guidelines MOM-G-1 and 2 would direct that no new water diversions would occur and restrict staging areas within meadows which would maintain habitat for the taxon. Standard WET-S-1 restricts the loss of wetland habitat during activities, while guideline WET-G-1 only allows livestock grazing in wetland areas if there would be no significant deleterious effects to the function of the wetland. During late spring/early summer when livestock congregate in the small waterholes that are remaining, water umbel is at risk from being trampled, as well as from changes in aquatic habitat conditions due to livestock use in these areas. Guidelines LOA-G-3b and 3d guide non-Federal land acquisition where there is vital T&E or other wildlife habitat and/or wetlands, riparian area and other water-oriented lands, thus acquiring possible additional suitable lands for this taxon.

Soil Management
This program area has direction to stabilize soil which would help improve habitat for this taxon. The objective, SOI-O-1 would help maintain habitat needs for aquatic species by requiring that vegetation treatments enhance or restore soil condition indicators by requiring vegetative ground cover. This objective would result in maintenance or enhancement of the taxon and its habitat.

Soil improvement projects that involve instream improvement projects are expected to have short-term adverse effects related to Huachuca water umbel and its habitat components. There may be localized, short-term adverse effects from projects in riparian zones such as localized sediment input into habitat and temporary disturbance of habitat. However, these effects would be minimized by standards and guidelines as previously described. Furthermore, while projects related to instream habitat improvements would likely have short-term adverse effects, we anticipate that long-term benefits to primary constituent elements of critical habitat will occur by maintaining and possibly improving their ability to contribute to the conservation and recovery of the taxon.

With upland restoration treatments maintaining watershed stability, the objectives (RIA-O-2 and SOI-O-1) have the potential to result in lower intensity fires, resulting in ground cover that readily resprouts after fire and maintaining watershed stability, thereby, the structure and function of streams, flood plains, and riparian vegetation. This would help limit runoff and sediment from any one fire event in the uplands above occupied or potentially occupied habitat.

Animal and Rare Plants Program
The FS Species Diversity and Viability Report assessed Huachuca water umbel. The viability report determined that Huachuca water umbel population trend was unknown and its habitat trend was positive (USFS 2016a). However, the 5-year review states that the taxon is in decline (USFWS 2014c). The guideline ARP-G-1 provides for the continued existence of Huachuca water umbel, as well as other species that use aquatic habitats. The guideline HUA-G-4 should ensure that management activities that could potentially have an effect on rare plant populations would incorporate site specific design features and minimize impacts.

Standard SUM-S-1 protects this taxon from over-collection by requiring a special use permit for collecting plants and animals within the botanical and zoological areas on the Forest. FWS and

AGFD permits are also required for the collection of threatened and endangered species, which reduces the chances of over-collection of any T&E species. Within wilderness areas, standard WLF-S-2 requires that reintroduction only occur when a species is extirpated by human-induced events and is indigenous to the area. Although this may adversely affect the taxon in the short-term, over the long-term the taxon (if reintroduction is successful) benefit from this activity. Project implementation would follow appropriate standards and guidelines to minimize impacts to the taxon and aquatic habitat.

The critical habitat units include the stream courses and adjacent areas out to the transition to upland vegetation. The discussions above also apply to Critical Habitat. PCEs (discussed on the Status of Species section) of critical habitat also include sufficient baseflow, healthy stream channels, and maintenance of riparian vegetation. All of the program areas mentioned above also similarly affect the PCEs of the critical habitat units for the CNF. Objectives, standards and guidelines NWS-O-1, 2 and 3, WET-O-1, WET-S-1, WET-G-1, RIA-G-2, NWS-G-1, 2, 3, 4 and 5, and ARP-G-1 address PCE 1 and 2. ARP-G-1 and RAM-G-6 address PCE 3. There are no plan components that specifically direct development of “refugia” in watershed supporting this plant taxon, however there are a number of components as discussed above that encourage management of healthy riparian and aquatic habitat that would tend to promote development of such refugia.

Invasive Species Management
This program area has the potential to help with removing invasive non-native species. The guideline RAM-G-6 benefits this taxon by restoring native plant species. Herbicide and pesticide treatments are expected to continue under this plan as they have under the previous forest plan. The use of herbicides and pesticides can have adverse effects on this aquatic taxon. Use of these chemicals in occupied habitat is likely to result in mortality to the taxon. Any potential future projects implemented under this plan would be assessed on a case by case basis to determine potential effects on individual taxon and to minimize them.

The objective HUA-O-1 would treat vegetation on at least 25% of the Huachuca Ecosystem Management Area to create resiliency to disturbance. Treatments will be consistent with the objectives for forest-wide vegetation communities and resources and because of ARP-G-1 projects will be designed to comply with existing recovery plans for this taxon. Additionally, HUA-G-4 ensures that treatments would avoid adverse impacts to the Huachuca water umbel. Moreover, ISM-G-1 states that invasive species treatments next to water sources would consider native fish and frogs which would also benefit all aquatic species including these plants.

Guideline VLS-G-2 ensures only native plant or short lived, non-persistent, non-native species will be used for wildfire treatments, which will help reduce the chances of invasive species moving into the area. Whenever possible, locally sourced native plant species should be used for restoration efforts. Management Areas-ISM-G-1 allows for the use of human controls to protect threatened and endangered species. Huachuca water umbel, with its shallow root system, is a poor competitor; population numbers tend to be lower in areas with a high density of native or non-native plant species competition (Titus *et al*. 2002). As Huachuca water umbel is sensitive to interspecific competition, requiring both ample light penetration and little competition for nutrients (Zuhlke *et al*. 2002, Vernadero 2011, USFWS 2001), competition from Bermuda grass will hasten the decline of the listed species in sites where alluvial groundwater levels have declined but still occasionally remain within the range that would otherwise support a hydric herbaceous perennial plant community. Johnson grass, watercress, giant reed, Bermuda grass, along with other non-native plant species are increased stressors on Huachuca water umbel (USFWS 2014c). As the presence of exotic plants in aquatic habitats continue to become more prevalent in southeastern Arizona (USFWS 2014c), controlling invasive plants in these habitats would likely benefit Huachuca water umbel.

Minerals Management

This program area has the potential through land or facility development or activities to impact Huachuca water umbel, often through disturbance, potential loss/fragmentation of habitat, and dewatering. Effects to Huachuca water umbel from the activities of this program are similar to the effects of roads. Access roads and the accompanying vehicle traffic are a necessary component of mineral activities, which could result in direct mortality to Huachuca water umbel from being run over by vehicles. In most cases mineral removal also requires the use of water resources. Previous mineral extraction activities have been shown to dewater springs and streams that provide habitat for the taxon, which would have an adverse effect on Huachuca water umbel. In addition, surface occupancy causes direct habitat loss and the addition of human occupation increases the chances for plant mortality, due to trampling of plants and increased sedimentation into aquatic habitats.

Open pit mining, as well as, sand and gravel mining removes riparian vegetation and destabilizes the ecosystem, which could cause habitat losses both upstream and downstream from the mining. These mines also pump groundwater for processing, and could locally affect groundwater reserves and perennial stream base flows (USFWS 2014c).

Guideline VLS-G-2 ensures only native plant or short lived, non-persistent, non-native species will be used for mine reclamation. Use of locally sourced native plant species should be used for restoration efforts to reduce non-native invasive species infestations in the area. The CNF is currently aware of approximately 12 mineral projects within Ecosystem Management Areas where Huachuca water umbel occur (USFS 2016a). These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Actual mining infrastructure and disturbance would be impossible to predict at the time of this document. These twelve projects occur on the Sierra Vista Ranger District within the Huachuca Ecosystem Management Area.

Motorized Transportation System

Transportation projects could have localized and short-term adverse effects to Huachuca water umbel and its habitat from actions (such as road maintenance, road realignment, and hardening drainage crossings) occurring near or within aquatic habitats. Disturbance, loss/fragmentation of habitat and erosion from roads that deposit sediment or concentrate runoff into riparian areas may impact the listed species. Roads crossing or adjacent to streams can remove and alter riparian vegetation, impact stream channel function and structure, and alter and degrade aquatic habitat through changes in water quality and increases in sediment deposition, having an impact on the Huachuca water umbel.

Impacts to this taxon from off-road vehicle traffic include direct mortality from being run over by vehicles, increased avenue for possibility of collection, and direct habitat loss and/or fragmentation. MTS-O-4 would result in addition of one hardened road crossing per year to reduce effects to water quality and habitat. Similarly, MTS-O-5 would realign or remove two miles of roads from aquatic or meadow habitat in a decade to improve habitat conditions for aquatic species.

Projects improving soil and vegetation condition in the uplands would improve or minimize this program's impacts to aquatic and riparian conditions where listed species occur and within their critical habitats. Objectives MTS-O-1 and 2 improved road conditions and reduce sedimentation by maintaining high-clearance and passenger car roads. By decommissioning, closing and restoring unneeded non-system roads, MTS-O-3 also improves conditions and reduces sedimentation, although there could be short-term negative impacts during the restoration period when vegetation may be minimal. In addition, if some of these decommissioned and restored roads are within habitat occupied by Huachuca water umbel, it will have long-term beneficial impacts. MTS-O-4 and MTS-O-5 improve water quality by hardening road surfaces at drainage crossings and removing or realigning roads within wetlands or meadows. Decommissioning, closing, and restoring existing roads would have the potential to beneficially affect the Huachuca water umbel if the roads are in areas where the taxon are located.

Under the Standard MTS-S-1, motor vehicle use is restricted to existing roads and trails. Guideline MTS-G-3 helps to sustain natural water flow and maintain native vegetation communities. RIA-G-1 directs that new road construction should be avoided in riparian areas except to cross drainages, unless alternate routes have greater overall resource impacts. If needed, location and design will minimize effects to the resources.

Ongoing activities within the Transportation Program include the operation and maintenance of the transportation system on the CNF, which consists of roads and trails that provide access to areas on the forest including: private land, structures and improvements under special use permit, recreational opportunities, and facilities that support land and resource management activities. We would expect that over the life of the project, there could be additional new and temporary road construction to help support forest restoration activities which may result in short and long-term adverse effects to the listed Huachuca water umbel and its habitat.

Recreation Management
This program area has the potential through recreation activities to impact Huachuca water umbel, through potential loss/fragmentation of habitat as stated under the Natural Water Resources section above. The Forest Plan does not include any Objectives, Standards, or Guidelines related to recreation for Huachuca water umbel. Under the Standard MTS-S-1, motor vehicle use is allowed only on the designated system of roads and motorized trails except where allowed on Motor Vehicle Use Maps. Motor vehicle use map allow motorists to drive up to 300 feet off a designated road for the purposes of camping and parking. The 300 foot allowance within occupied Huachuca water umbel habitat could result in impacts to individual plants or habitat.

Range Management
This program area has the potential through grazing activities to impact Huachuca water umbel and its habitat, often through livestock trampling of individual plants and changed riparian and aquatic conditions. Several exclosures have been put into place on the Forest to exclude grazing for Huachuca water umbel sites. RAM-G-5 recommends that grazing structures within riparian areas be located so as to avoid conflict with riparian functions and processes and RAM-G-3 contains guidelines on fencing structures to provide safe wildlife passage. Additional guidelines

RAM-G-2, RAM-G-6 and RAM-G-7 provide for plant growth and vigor. The guideline RAM-G-4 would maintain or promote ground cover providing for soil moisture and stability beneficial for the Huachuca water umbel habitat. Guideline RIA-G-1 limits grazing in riparian areas where there would be no significant deleterious effects to riparian area form or function. Grazing season, timing, intensity, grazing period and frequency will be considered when determining stocking rates. The guideline WET-G-1 recommends that livestock grazing not result in deleterious effects to wetlands and RAM-G-7 guides grazing practices to emphasize reproduction of desired plant species.

Livestock grazing can affect the habitat as a result of movement along the streams, trampling streambanks, contributing to sedimentation, and adding waste deposits that can impair water quality. Impacts to water quality would be greatest during seasonal low flow periods, warm weather, and during droughts. Implementation of rangeland management standards and guidelines, as described above and in the BA, provide guidance to reduce livestock grazing impacts to riparian areas. We do not anticipate that these activities will diminish the ability of critical habitat to contribute to the conservation and recovery of the taxon.

Livestock grazing can affect critical habitat as a result of movement along the streams, trampling streambanks, contributing to sedimentation, and livestock waste deposits that can impair water quality. Rangeland Management standards and guidelines, as described above and in the BA, provide guidance to reduce livestock grazing impacts to riparian areas. To reduce grazing impacts to this taxon, cattle need to be removed from riparian areas during dry springs, pasture and exclosure fences need to be maintained, and trespass cattle need to be removed from exclosures. In addition, the standards and guidelines, discussed above that prevent the spread of non-native invasive plant species during project implementation is expected to benefit the PCEs.

Pima Pineapple Cactus

Wildland-Urban Interface and Landscape-scale Fire

This program encompasses all vegetation communities on the CNF within those areas of human populations and developments at imminent risk from wildfire. Treatment of these areas incudes thinning, removal of fuels from the landscape, or altering the fuel profile to reduce the potential for loss of property. The treatment of WUI allows the Forest the flexibility to manage landscape-scale wildland fire for resource benefit. Landscape-scale wildland fire is one of the methods for ecosystem restoration. The goal of this program is to enhance resiliency of all vegetation communities on the CNF by maintaining more sustainable fuel loads, improved habitat diversity, and watershed integrity.

Introduction of invasive Lehmann lovegrass (*Eragrostis lehmanniana*) has resulted in approximately 75 percent of Pima pineapple cactus habitat being altered due to this invasive grass out competing native grasses and creating monotypic stands. This results in an abundance of fine fuels which burn very hot and carry fire rapidly through the area. PPC and other cacti do not tolerate hot fires and could be damaged or killed.

The objectives RIT-O-1, HUA-O-1, and TUM-0-1 are to treat 20-25% of the of the Santa Rita, Huachuca, and Tumacacori Ecosystem Management Areas every 10 years using prescribed burning and mechanical treatment methods. These treatments could result injury or death to PPC. Disturbances, such as fire, tend to promote the spread of these invasive species, resulting in loss of native habitat. However, guidelines RIT-G-2, HUA-G-4 and TUM-G-4 would minimize the impacts from ground disturbance and/or vegetation management to rare plant populations, by incorporating site-specific design features that benefit habitat and avoid impacts to these rare plant populations. Guideline VDC-G-2, directs the use of fire in desert communities be used only as a strategy for controlling invasive vegetation, thus improving the habitat for the cactus.

Animal and Rare Plants Program

The FS Species Diversity and Viability Report assessed the PPC and determined that PPC population trend is negative and that the habitat trend was unknown (USFS 2016a). However, we feel that the habitat for Pima pineapple cactus on the CNF is declining as well (J. Crawford, USFWS, pers. comm. 2016). Standards require FS special use permits for any plant collection, in addition to State and Federal permit requirements, thus reducing the risk of private collection of the taxon. The guidelines RIT-G-2, HUA-G-4 and TUM-G-4 provide direction that management activities should incorporate, site-specific design features to benefit habitat or minimize impacts to the PPC. Guideline ARP-G-1 would implement recovery plans associated with the federally-listed taxon.

Invasive Species Management

This program area has the potential to help with removing invasive non-native species. Non-native grasses, particularly Lehmann lovegrass and buffelgrass (*Pennisetum ciliare*), pose the greatest risk to this taxon and much of its known range is affected by these non-native grasses. The abundance of grass creates fuel loading that supports extreme fire conditions that native plants are not adapted to survive. The plan includes the objectives VDC-O-1 and VGC-O-1 to treat 72,500 acres of desert communities using spot herbicide treatments to control buffelgrass and other invasive species. Impacts to PPC could result from misapplication of herbicide, however RIT-G-2, HUA-G-4, and TUM-G-4 provide direction in that management activities should incorporate, site-specific design features to benefit habitat or minimize impacts to the PPC. Use of 5 gallon buckets covering individual Pima pineapple cactus prior to herbicide application would help ensure chemicals do not interact with the cactus.

This program area has the potential to help with removing invasive non-native species. The guideline RAM-G-6 will help in restoring native plant species. Herbicide and pesticide treatments are expected to continue under this plan, as they have under the previous forest plan. The use of herbicide and pesticides can have adverse effects on the taxon. Any potential future projects implemented under this plan would be assessed on a case by case basis to determine potential effects on individual taxon and to minimize them.

Minerals Management

This program area has the potential to impact PPC, often through disturbance and potential loss/fragmentation of habitat. Access roads and utility corridors are a necessary component of mineral activities, which could result in direct mortality to Pima pineapple cactus and loss of habitat. This permanent disturbance will remove portions of the seed bank, and areas of associated temporary disturbance could alter the taxon’s seed bank. Locally, loss of individual cacti reduces the genetic diversity available in the population. This decreases the adaptive potential of the population to respond to changing conditions.

Disturbance of soils can change water infiltration, compact soil, and change local site conditions. Recently disturbed areas have an increased potential to be invaded by non-native invasive species (e.g., Lehmann lovegrass), which can negatively affect Pima pineapple cactus. Pima pineapple cactus can be found in areas of recent disturbance, as competition with other plants for nutrients and light are reduced. Although some areas of temporary disturbance may recover, it may take many years before full recovery is achieved. Vasek *et al*. (1975) found that desert vegetation is fragile and easily destroyed, but does have a long-term potential (probably measured in centuries) to recover from substantial disturbance such as that associated with the construction of a utility corridor. In addition, surface occupancy causes direct habitat loss and the addition of human occupation increases the chances for illegal collection. The standard MIN-S-2 would ensure that disturbed sites would be reseeded with only native or non-persistent seed sources benefiting PPC habitat and reducing invasive species. Whenever possible, locally sourced native plant species should be used for restoration efforts.

The CNF is currently aware of approximately 19 mineral projects within Ecosystem Management Areas where PPC occur. These projects are exploration only and any future mineral operations would be dependent on the results of those explorations. Actual mining infrastructure and disturbance would be impossible to predict at the time of this document. Twelve of these projects are active and currently in place, while two projects are expected to occur in the foreseeable future, one is completed and four are withdrawn from consideration at this point. Seven projects are located on the Nogales Ranger District within the Santa Rita Ecosystem Management Area, and twelve on the Sierra Vista Ranger District within the Huachuca Ecosystem Management Area.

Motorized Transportation System

Transportation projects could have localized and short-term and long-term adverse effects to this taxon from actions within their habitat. Disturbance and permanent loss/fragmentation of habitat may impact the listed taxon. In addition, dust from dirt roads may negatively affect plant photosynthesis, respiration, transpiration, water use efficiency, leaf conductance, growth rate, vigor, and gas exchange.

Roads through PCC habitat pose a risk of habitat loss and direct impacts to individual cactus and create avenues for non-native plant spread, illegal collection, and loss of space for the plants and their seedbanks. MTS-S-1 requires that all travel is limited to system roads thereby mitigating the potential for impacts to individuals and additional loss of habitat beyond the existing road system. Management direction (MTS-O-1) involves the closure and revegetation of roads that are not needed for further use. Such direction has a positive effect on Pima pineapple cactus by reducing road density and minimizing threats to the taxon.

Recreation Management

The populations on the CNF are somewhat disjunct from the main population of this taxon to the north. Illegal collection by hobbyists and commercial collectors, as well as increased recreational use and off-road vehicle use can affect PPC and its habitat. The cacti are small and can be covered by grass, making them difficult to see. The CNF uses signage and closures to minimize off-road vehicle use in specific areas to protect the taxon. The standards require special use permits for any collection, in addition to Federal and State permit requirements, of plants and animals, adding some protection to the taxon.

Range Management

The presence of non-native grass species has had the greatest impact on this taxon through altered ecological conditions. Livestock grazing has been shown to help remove the grass that is competing for space, water, and nutrients, and removes the standing dead grass thus reducing the fire hazard (USFWS 1993). However, there have been instances of trampled plants in areas used by livestock. Trampling that results in injury or death to an individual PPC could occur, but we anticipate that this would not be a common occurrence because individuals and small clumps are scattered and rare. Livestock are not likely to concentrate for an extended period of time in PPC locations unless there is a water or mineral lick nearby, in which case trampling may limit or eliminate that specific individual or cluster of cacti. Habitat conditions may be altered through livestock grazing by decreasing cover, increasing soil compaction, destruction of cryptobiotic crusts, increasing erosion, and increasing non-native grasses and other plants (with changes in fire frequency and intensity). These effects may decrease the suitability of a site to maintain cacti in the long-term.

RAM-G-6 guides range-related treatments for rangeland restoration to emphasize and perpetuate native plant species. Any treatments planned would also be guided by RIT-G-2 and HUA-G-4 that specifically address PPC.

Currently on the CNF, over 50% of Pima pineapple cactus are protected from livestock grazing with exclosures (USFS 2016a), to reduce the impacts from trampling, erosion, changes in hydrology and microclimate and invasion of exotic plant species. This protection helps minimize losses of cactus and their habitat. RAM-G-1 guides foraging utilization so that it is at light to moderate intensity, which helps with the recovery and continues existence of the listed taxon. Construction or maintenance of range improvements may also affect PPC directly by killing or injuring individuals. However, this is unlikely to occur because CNF has surveyed much of the suitable PPC habitat on the Forest.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under section 7 of the Act.

Many lands within the action area are managed by Federal agencies; thus, many activities that could potentially affect these listed species are Federal activities that are subject to additional section 7 consultation. The effects of these Federal activities are not considered cumulative effects. However, a portion of the action areas for the species also occurs on state and private lands. Residential and commercial development, road construction, farming, livestock grazing, mining, off-highway vehicle use, and other activities occur on these lands and are expected to continue into the foreseeable future.

Jaguar, Ocelot, and Jaguar Designated Critical Habitat

A portion of the action area for the jaguar and ocelot also occurs on state, tribal, local, and private lands. Residential and commercial development, road construction, farming, livestock grazing, mining, off-highway vehicle use, and other activities occur on these lands and are expected to continue into the foreseeable future. These actions, the effects of which are considered cumulative, may result in fragmentation, loss, or degradation of jaguar and ocelot habitat and disturbance to jaguars and ocelots. Additionally, population growth on State and local lands in southeast Arizona is likely to result in an increase in recreational activities in the region. Increased recreation may increase the potential for human disturbance to jaguars and ocelots, as well as degradation or loss of habitat for both the species and their prey (e.g., from wildfires, off-road vehicle use). Although not documented recently in the U.S., illegal hunting of jaguars and ocelots adversely affects these species. Illegal activities associated with cross-border smuggling and illegal immigration (e.g., human traffic, deposition of trash, creation of trails and routes, and increased fire risk from human traffic) also occur in the action area. These activities can also degrade jaguar and ocelot habitat and disturb the species.

Livestock grazing on State and private land adjacent to the project area is expected to continue. Most of the adjacent lands use similar livestock management and operations, thus, we expect naturally occurring water sources and developed water sources to not exclude jaguar or ocelot use or impede its movement throughout these lands to maintain connectivity. We do not anticipate the management of adjacent lands to change in the foreseeable future.

Private land development on the CNF boundary is expected to continue to meet demands. Rates of future development are difficult to predict, but given the relatively remote location of the CNF, urban development around the CNF boundary will likely be limited to expanding cities. Tucson, Oracle, Nogales, Patagonia, Sierra Vista, and Huachuca City are all expanding populations with increasing land development. We also expect minimal development in more remote locations because water is limited. Developments around the CNF will not likely be built in rugged areas but rather on the moderate to flat topography. However, because the species will disperse long-distance and occupy large home ranges, human development can be expected to further limit jaguar and ocelot connectivity and/or result in additional human interactions.

Recreational activities such as hiking, hunting, and off-highway vehicle driving are expected to continue on the state and private lands adjacent to and within CNF over the life of the project. Most hiking is on developed trails which are few and not highly used. Hunting for deer, javelina, and other species does occur, typically during the spring and fall, but hunting is regulated by Arizona Game and Fish Department and New Mexico Department of Game and Fish and is restricted to relatively few hunters. Off-highway vehicle use is year-around, but levels of activity are low and confined to a few roads. Most of these activities occur during daylight hours when jaguars are less active and less likely to be disturbed; however, both species may be disturbed by hunting and off-highway vehicle use where these activities occur within the range of jaguars or ocelots.

Mining has been occurring on state and private lands around CNF for over a century. These mines range in size of infrastructure footprint and associated interspace of 5 acres (single mine shaft) to >1,000 acres (open pit mine). Mining operations can also expand infrastructure outside the immediate mine site with the construction of roads, power lines, pipelines, mine tailings, or impermeable fences. These changes can directly affect jaguars and ocelots, their prey species, and their habitat by removing vegetation cover, reducing water sources, and increasing human presence. Vehicular traffic associated with mining can also lead to direct impacts, including increased mortality.

Jaguar Critical Habitat Units 2, 3, and 4 are closer to rapidly expanding urban areas than other units and, therefore, more vulnerable to loss of connectivity. Tucson, Nogales, Patagonia, and Sierra Vista are all expanding populations with increasing land development. On the eastern flank of the Whetstone Mountains near Benson is the proposed development of Las Villages de Vignetto, which may house 80,000 people in 24,000 homes. Immediately southwest of the Mustang Mountains (Subunit 4c) is the proposed Rain Valley development. On the other (east) side of the Mustang Mountains, the community of Huachuca City is poised for additional development with the impending completion of a new wastewater treatment plant. The proposed Villages at Vignetto near Benson could result in approximately 8,000 to 15,000 acres of suburban development east of the Whetstone Mountains. Subunit 4b, through the Empire Mountains, lies between expanding growth both to the north (Tucson) and the south (Patagonia and Sonoita). The aforementioned actions, the effects of which are considered to be cumulative, may result in fragmentation, loss, or degradation of jaguar habitat and disturbance to jaguars.

Mount Graham Red Squirrel and Designated Critical Habitat

The Forest manages lands (except private) in the Pinaleño Mountains and administers projects and permits on those lands; thus, almost all activities that could potentially affect Mt. Graham red squirrels in the action area are Federal activities and subject to additional section 7 consultation under the Act.

The AGFD manages sportfish and wildlife resources in the Pinaleño Mountains. Some of these actions have Federal funding through the Sportfish and Wildlife Restoration Programs of the FWS and are subject to section 7 consultation. Other activities to remove introduced Apache trout and replace them with Gila trout in several streams also has a Federal nexus and section 7 consultation is required for these actions. The Arizona Department of Transportation has jurisdiction over the paved portions of Swift Trail (Highway 366), and therefore could propose projects along this route that may or may not receive Federal funding; therefore, a Federal nexus and section 7 consultation may be required in some cases, but not in others. No additional cumulative effects are anticipated for this action.

All Mount Graham red squirrel critical habitat is located on CNF, therefore there should be no cumulative effects to critical habitat from non-Federal actions.

Lesser Long-Nosed Bat

The CNF and BLM manage approximately 45 percent of the lands within the action area and administer projects and permits on those lands; therefore, some of the activities that could potentially affect lesser long-nosed bats are likely Federal activities subject to additional section 7 consultation under the ESA. The effects of these Federal activities are not considered cumulative effects.

Residential and commercial development, farming, livestock grazing, actions resulting in the invasion of buffelgrass, surface mining and other activities occur on these lands and, while difficult to predict and quantify, are expected to continue into the foreseeable future. Other non-Federal actions expected to occur include continued road construction and maintenance, grazing activities, and recreation in the action area, current and future development, nearby mining projects, and unregulated activities on non-Federal lands, such as trespass livestock and inappropriate use of off-road vehicles, which can cumulatively adversely affect the lesser long-nosed bat. Additional cumulative effects on lesser long-nosed bats include recreation without a Federal nexus and cross-border activities that include the following: human traffic; deposition of trash; new trails from human traffic; increased fire risk from human traffic; and water depletion and contamination. The Borderlands Restoration is trying to determine if removing individual agaves from clumps of agaves allows the remaining agaves to be more vigorous and to flower earlier.

These actions, the effects of which are considered cumulative, may result in loss or degradation of lesser long-nosed bat foraging habitat, and potential disturbance of roosts, and are reasonably certain to occur in the action area considered in this BO.

Mexican Spotted Owl and Designated Critical Habitat

The main non-Federal activities that may impact the Mexican spotted owl habitat are loss of habitat through development of private inholdings for home sites and related disturbance at these properties. Within these private lands, there is the potential for activities that create disturbance or removal of Mexican spotted owl habitat components on private lands, such as roads, grazing, mining, recreation activities, and fuel treatments. Mexican spotted owl critical habitat has not been designated on non-Federal lands; there are no anticipated cumulative effects to Mexican spotted owl critical habitat from non-Federal actions.

Western Yellow-billed Cuckoo and Proposed Critical Habitat

Future non-Federal activities contributing cumulative effects to western yellow-billed cuckoo and its critical habitat may include displacement from habitat by actions occurring on state, tribal, or private lands that result in disturbance to nesting birds or loss of riparian and Madrean evergreen woodland drainage habitats. These activities include livestock grazing (including trespass livestock grazing), irrigated agriculture, groundwater pumping, stream diversions, bank stabilization, channelization, right-of-way vegetation maintenance activities, unleashed and feral dogs and cats, off-road vehicle use, illegal introduction of non-indigenous aquatic species, land development, intentional or accidental wildfire and recreation. Continued and future conversion of floodplains and riparian habitats reduce the habitat available for yellow-billed cuckoo nesting. Water developments and diversions on non-CNF lands will likely continue to reduce surface water and influence flood regimes necessary to develop and maintain suitable riparian woodland habitat for yellow-billed cuckoo nesting. The primary cumulative effects to the riparian vegetation and Madrean evergreen woodland drainages (including within proposed critical habitat) where yellow-billed cuckoos occur are the stresses associated with decreases in water availability due to non-Federal actions.

The U.S. Census predicts that Arizona will be the second fastest growing state in the country through 2030, adding an additional 5.6 million people (U.S. Census 2005). During the 2010 Census, Arizona maintained its standing as having the second fastest population growth rate by growing more than 20 percent between 2000 and 2010 (Pollard and Mather 2010). If these predictions hold true, already severe threats to yellow-billed cuckoo and its habitat will worsen, primarily due to increased human demand for surface and ground water and decreased supply. Water demands will increase as the population increases. Most of Arizona’s developed areas groundwater is pumped out faster than the aquifer can recharge (U.S. Environmental Protection

Agency 2011). Groundwater pumping is likely to be the greatest impact cumulatively, since it is minimally regulated by the State.

Additionally, the numerous lands in the yellow-billed cuckoo action area are Arizona State Trust Lands, most of which are currently leased for cattle grazing. The Arizona State Constitution mandates that State Trust Lands produce the maximum economic benefit for the beneficiaries of the Trust, most of which are school districts. One of the primary ways in which the State Land Department raises funds is to auction its Trust Lands for commercial or residential development (Hanson and Brott 2005). Activities on residential and commercial inholdings within watersheds containing yellow-billed cuckoo can adversely affect the species through poor land management practices and water withdrawal. These effects have not been well quantified within the action area.

Some private landowners are also actively working to control non-native vegetation and reestablish native riparian species. These efforts should benefit cuckoos through habitat restoration and protection.

Sonoran Tiger Salamander

Many lands within the action area are managed by Federal agencies; thus, many activities that could potentially affect Sonoran tiger salamanders are Federal activities that are subject to section 7 consultation. However, some occupied breeding localities are on private lands or state lands in the center of the San Rafael Valley. Population growth on State and local lands in southeast Arizona is likely to result in an increase in recreational activities in the Santa Cruz and San Pedro River regions, including the CNF. Increased recreation may increase the potential for degradation or loss of habitat for the salamander (e.g., from wildfires, off-road vehicle use, etc.). Illegal activities associated with cross-border smuggling and illegal immigration (e.g., human traffic, deposition of trash, creation of trails and routes, and increased fire risk from human traffic) also occur in the action area. These activities can also degrade salamander habitat.

Private lands are used primarily for grazing, but potentially could be used for other purposes. Effects from the current use of lands for grazing could result in improper livestock grazing on private range land leading to degraded cover habitat for terrestrial Sonoran tiger salamanders, degraded water quality for aquatic larvae and branchiate adults, and trampling of various life stages by cattle. Other land uses that could be implemented on private land could include: housing subdivisions, oil and gas exploration and extraction, mining, agriculture, and division into ranchettes. The largest private parcel in the center of the valley (San Rafael Ranch) is covered by a conservation easement that prohibits most of these activities. In addition, there is the potential for anglers on private land to collect salamanders as bait or contribute to the spread of non-native predators, although these activities are prohibited by state law. Furthermore, anglers may contribute to the spread of disease on private lands by moving contaminated bait or equipment between aquatic sites.

Additional cumulative impacts to the Sonoran tiger salamander may result from cross-border activities along the U.S./Mexico border. Cross-border activities include, but may not be limited to the following: human traffic, deposition of trash, new trails from human traffic, soil compaction and erosion, increased fire risk from human traffic, water depletion and contamination, introduction and spread of disease, and interference with survey, monitoring, and research efforts.

Chiricahua Leopard Frog and Designated Critical Habitat

Unregulated activities on non-Federal lands, such as trespass livestock, inappropriate use of off-highway vehicles, and illegal introduction of non-indigenous aquatic species are cumulative effects and can adversely affect the species through a variety of avenues. Illegal introductions of non-native fishes and other aquatic invasive species are routinely made by the public (e.g., topminnow, red shiner, and guppies).

Cumulative effects to native aquatic animals include ongoing activities in the watersheds in which the species occurs such as livestock grazing and associated activities outside of Federal allotments, irrigated agriculture, groundwater pumping, stream diversion, bank stabilization, channelization, and recreation without a Federal nexus. Some of these activities, such as irrigated agriculture, are declining and are not expected to contribute substantially to cumulative long-term adverse effects to native aquatic animals. Other activities, such as recreation, are increasing. Increasing recreational, residential, or commercial use of the non-Federal lands near the riparian area and ciénega would likely result in increased cumulative adverse effects to occupied, as well as potentially occupied native aquatic animal habitat through increased water use, increased pollution, and increased alteration of the stream banks through riparian vegetation suppression, bank trampling, changing flow regimes, and erosion.

Regional population growth coupled with urban development continues to encroach on amphibian habitats in foothill grassland habitats on State and local lands in the action area. With this growth, the frequency of intentional and unintentional introductions of non-natives is likely to increase. Well-intentioned, but misguided, individuals are known to intentionally release unwanted pets in aquatic systems. Backyard pond enthusiasts could unintentionally create a conflict between native and non-native species, because these ponds are usually stocked with non-native plants (e.g., lilies), fish (primarily goldfish and their relatives), and bullfrogs. Increased growth is also likely to result in an increase in recreational activities in the region, including the CNF. Increased recreation may increase the potential for degradation or loss of habitat for Chiricahua leopard frogs (e.g., from wildfires, off-road vehicle use). Illegal activities associated with cross border smuggling and illegal immigration (e.g., human traffic, deposition of trash, creation of trails and routes, and increased fire risk from human traffic) also occur in the action area. These activities can also degrade Chiricahua leopard frog critical habitat.

Northern Mexican Gartersnake and Proposed Critical Habitat

Cumulative effects to the northern Mexican gartersnake and proposed critical habitat include residential home and commercial development on private lands and the resulting impacts to watershed integrity. Off-forest water uses are affecting streamflows on the Forest and are expected to have a greater impact with increasing population and groundwater demands. Continued use of ground and surface water will result in altered hydrologic regimes and increased sedimentation and pollutant to stream systems.

Demand for outdoor recreation is also expected to grow concurrently with increasing population and more visitor use of the Forest. Aquatic and riparian resources are major attractants for recreational activities, and increased recreation in these areas is likely to result in impacts that remove or alter some stream-side habitat. Other land uses such as livestock grazing, mining, and vegetation treatments are occurring on State, private, and tribal lands.

New Mexico Ridge-Nosed Rattlesnake

All known New Mexico ridge-nosed rattlesnake sites within the action area are located on USFS lands. Small, privately owned lands are intermixed with federally-administered lands in the lower elevations of the Peloncillo Mountains. Illegal collection; habitat and snake disturbance; snake injury or mortality; and habitat fragmentation, degradation, or destruction from grazing and recreation activities on these non-Federal lands could affect the small, disjunct populations of New Mexico ridge-nosed rattlesnake within the action area. Conversely, fuel reduction and fire management activities, although having short-term adverse effects, could contribute longer-term positive effects by reducing the potential for catastrophic wildfires, particularly in those situations where a fire spreads from private to Federal lands. The closure of a private section of the access road to Skeleton Canyon has restricted public access to several known occupied sites within the action area. This road closure should reduce the amount of incidental recreation effects, the potential for poaching, and human-caused fire.

Gila Chub, Yaqui Chub, Gila Topminnow, Gila Trout, Apache Trout, Spikedace, Loach Minnow, Sonora Chub, Desert Pupfish, Yaqui Catfish, Roundtail Chub, and Designated Critical Habitats

Cumulative effects that could adversely affect listed fish, their habitat and their critical habitat include continued residential development and water withdrawal on lands within watersheds containing habitat for these species. Development would likely result in an increase in recreational use on the Forest that would have some impact to the fish and their habitats. Increasing recreational or residential use of the non-Federal lands near the riparian areas would likely result in additional cumulative effects to occupied, as well as potentially-occupied habitat through increased water use, increased pollution, and increased alteration of the streambanks through riparian vegetation suppression, bank trampling, and erosion.

Unregulated activities on Federal and non-Federal lands, such as trespass livestock, inappropriate use of off-road vehicles, illegal introduction of non-native aquatic species, illegal cross-border activities, and residential and commercial development on lands within watersheds containing threatened and endangered aquatic animals, are cumulative effects and can adversely affect the species through a variety of avenues. Other cumulative effects to the listed fish, their habitats and their critical habitats include ongoing activities in their watersheds such as livestock grazing and associated activities outside of federally-managed allotments, irrigated agriculture, groundwater pumping, stream diversions, bank stabilization, and channelization that can reduce stream flows and degrade riparian and aquatic habitats. Stock ponds pose a continual threat of contamination of listed fish habitat with non-native fishes. Lastly, the right-of-way vegetation maintenance activities conducted by Tucson Electric Power, which result in nearly complete removal of riparian vegetation in the affected area (Pima County Regional Flood Control District 2009), are also a cumulative effect.

Cumulative effects to the native listed fish include ongoing activities in the watersheds in which the species occurs such as livestock grazing and associated activities outside of Federal allotments, irrigated agriculture, groundwater pumping, stream diversion, bank stabilization, channelization without a Federal nexus, and recreation.

There are many conservation actions being considered by the AGFD for native fish and frogs. Two important conservation actions are the approved Safe Harbor Agreements for the Chiricahua leopard frog, Gila topminnow and desert pupfish. While these two agreements and any other conservation actions taken by AGFD are likely to be federally funded or approved, it is likely some of them will have no Federal nexus.

The U.S. Census predicts that Arizona will be the second fastest growing state in the country through 2030, adding an additional 5.6 million people (U.S. Census 2005). During the 2010 Census, Arizona maintained its standing as having the second fastest population growth rate by growing more than 20 percent between 2000 and 2010 (Pollard and Mather 2010). If these predictions hold true, already severe threats to all listed species and their habitat will worsen, primarily due to increased human demand for surface and ground water and decreased supply. Water demands will increase as the population increases, in line with current trends. In most of Arizona's developed areas, groundwater is pumped out faster than the aquifer can recharge (U.S. Environmental Protection Agency 2011). Groundwater pumping is likely to be the greatest impact cumulatively, since it is minimally regulated by the State.

Additionally, numerous lands are Arizona State Trust Lands, most of which are currently leased for cattle grazing. The Arizona State Constitution mandates that State Trust Lands produce the maximum economic benefit for the beneficiaries of the Trust, most of which are school districts. One of the primary ways in which the State Land Department raises funds is to auction its Trust Lands for commercial or residential development (Hanson and Brott 2005). Activities on residential and commercial inholdings within watersheds containing Gila chub, Yaqui chub, Gila topminnow, Gila trout, Apache trout, spikedace, loach minnow, Sonora chub, desert pupfish, Yaqui catfish, and roundtail chub can adversely affect the species through poor land management practices and water withdrawal. These effects have not been well quantified within the action area.

Huachuca Water Umbel and Designated Critical Habitat

Livestock grazing on non-Federal lands may affect the umbel through direct trampling of individuals and loss of stream bank stability which negatively impact both the umbel and its habitat. Watershed effects to the umbel and critical habitat may be occurring, as described in previous sections, but the magnitude is unknown because the condition is unknown.

Water withdrawals in the upper San Pedro subwatershed (Sierra Vista, Huachuca City, etc.) are contributing to a decline in the regional aquifer. Draw down of the aquifer can have long-lasting effects by reducing the base flow and the amount of perennial water. As a species dependent on shallow, perennial flow, umbel is expected to be one of the first species seriously impacted by ground water declines.

The upper San Pedro River is currently a heavily used corridor for cross border violators. Recent completion of a border wall with a gap at the river likely funnels traffic into the river corridor. Illegal traffic results in trail creation, trash, erosion, and fires. Because of this funneling effect, law enforcement activities have also increased along the river, with associated adverse effects.

Pima Pineapple Cactus

Within the action area for the Pima pineapple cactus, lands are primarily non-Federal, so there are many activities that could potentially affect Pima pineapple cactus that are not Federal activities and thus not subject to additional section 7 consultation under the ESA.

Activities that could result in cumulative effects to Pima pineapple cactus include road maintenance, grazing activities, the spread of invasive species, and recreation in the action area, current and future development, nearby mining projects, and unregulated activities on non-Federal lands, such as trespass livestock and inappropriate use of off-road vehicles. Adjacent open space, such as that found within the Santa Rita Experimental Range and other State Trust lands often provides recreational areas for nearby residents, and the use of these lands for recreation, off-road vehicle use, and illegal dumping of trash can ultimately lead to habitat degradation and possible loss of Pima pineapple cactus. Additional cumulative effects on Pima pineapple cactus include cross-border activities such as human traffic, deposition of trash, new trails from human traffic, increased fire risk from human traffic, and water depletion and contamination. From all of these activities, there is an increased risk of non-native invasive plant invasion, leading to both competition for limited resources and increased fire occurrence and intensity, all of which threaten Pima pineapple cactus conservation and survival.

The majority of Pima pineapple cactus habitat occurs on Arizona State lands. State lands are managed primarily for income to the State Trust and ultimately may be sold for development or other purposes. Urban development is a serious threat to the species and causes loss of individuals and fragmentation of populations, especially populations that exist on different land ownerships. Off-road vehicle use occurs on State land and illegally on CNF lands. This activity, contributes to habitat degradation and loss of plants. Erosion, leading to the formation of gullies and headcuts, can form on adjacent State lands and spread onto CNF lands. Livestock grazing on State and private lands, if not properly managed, can contribute to Pima pineapple cactus habitat degradation. Trail creation and use, off-road driving, and trash dumping associated with cross-border violotor traffic and associated law enforcement response has been observed in Pima pineapple cactus habitat. These actions increase the likelihood directly affecting individual cacti, compacts soil, and increases the likelihood of wildfire. Trails may act as vector points for the movement of invasive species into Pima pineapple cactus habitat. Illegal collection of this cactus is an additional threat with cumulative effects.

As discussed above, threats to Pima pineapple cactus continue to include habitat loss and fragmentation both for the plant and its pollinators, competition with non-native species, and inadequate regulatory mechanisms to protect this species. We conclude that residential and commercial development, and its infrastructure, is a significant threat to Pima Pineapple cactus and its habitat, and that drought, non-native plant invasion, and predation are also severe threats.

The cumulative effects mentioned above contribute to these ongoing threats to Pima pineapple cactus in the action area. The conservation of the Pima pineapple cactus population in the southern portions of Tucson, extending into the Green Valley area, is tenuous given the extent of these threats and the likelihood that these threats will continue into the foreseeable future.

Consideration of the conservation needs of Pima pineapple cactus is included in the habitat conservation plans being developed by the City of Tucson and Pima County, and implementation of these habitat conservation plans may help to reduce the extent of cumulative impact of non-Federal actions.

CONCLUSION

After reviewing the current status of the species and their critical habitat, the environmental baseline for the action area, the effects of the proposed CNF LRMP, and the cumulative effects, it is the Service's biological opinion that implementation of the CNF Revised Land and Resource Management Plan located in Cochise, Graham, Pima, Pinal, and Santa Cruz Counties, Arizona and Hidalgo County, New Mexico, as proposed, is not likely to jeopardize the continued existence of the jaguar, ocelot, Mount Graham red squirrel, lesser long-nosed bat, Mexican spotted owl, western yellow billed cuckoo, Sonoran tiger salamander, Chiricahua leopard frog, northern Mexican gartersnake, New Mexico ridge-nosed rattlesnake, Gila chub, Yaqui chub, Gila topminnow, Gila trout, Apache trout, spikedace, loach minnow, Sonora chub, desert pupfish, Yaqui catfish, Huachuca water umbel, and Pima pineapple cactus, and, in conference, the proposed roundtail chub. The proposed action is also not likely to destroy or adversely modify designated critical habitat for jaguar, Mount Graham red squirrel, Mexican spotted owl, Chiricahua leopard frog, New Mexico ridge-nosed rattlesnake, Gila chub, Yaqui chub, spikedace, loach minnow, Sonora chub, Yaqui catfish, or Huachuca water umbel, and, in conference, proposed critical habitat for the western yellow billed cuckoo and northern Mexican gartersnake. No critical habitat has been designated for the ocelot, lesser long-nosed bat, Sonoran tiger salamander, Gila topminnow, Gila trout, Apache trout, desert pufish, or Pima pineapple cactus. Projects that will have "no effect" on species or critical habitat do not require additional Service review. We base this conclusion on the following:

- The CNF LRMP does not make site-specific decisions about exactly how, when, and where these activities will be carried out;
- The proposed action is a "framework programmatic action" which establishes a framework for the development of specific future action(s) but does not authorize any future action(s); and
- Any future-project specific activities under the CNF LRMP that may affect species or critical habitats will receive additional Service review and/or section 7 consultation as appropriate and are described in the proposed action above.

The FWS and the National Marine Fisheries Service (NMFS) published a Final Rule on February 11, 2016 (81 FR 7214), revising the definition for destruction or adverse modification of critical habitat in the Act's implementing regulations at 50 CFR 402.02. Specifically, we finalized the following regulatory definition: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features." This revised definition has been applied to the applicable critical habitat analyses in this consultation.

The conclusions of this PBO/PCO are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR § 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally listed endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

Programmatic Consultations

The proposed action described above is a "framework programmatic action" as defined in 50 CFR 402.02. In accordance with 50 CFR 402.14(i)(6), an incidental take statement is not required at the programmatic level for a framework that does not authorize future actions; incidental take resulting from any action subsequently authorized, funded, or carried out under the program will be addressed in subsequent section 7 consultation, as appropriate. This biological opinion provides a broad-scale examination of the proposed action's potential impacts on jaguar, ocelot, Mount Graham red squirrel, lesser long-nosed bat, Mexican spotted owl, western DPS of the yellow-billed cuckoo, Sonoran tiger salamander, Chiricahua leopard frog, northern Mexican gartersnake, New Mexico ridge-nosed rattlesnake, Gila chub, Yaqui chub, Gila topminnow, Gila trout, Apache trout, spikedace, loach minnow, Sonora chub, desert pupfish, Yaqui catfish, roundtail chub, Huachuca water umbel, and Pima pineapple cactus but we lack reasonable certainty of where, when, and how much incidental take may occur. Therefore we have not quantified the amount and extent of incidental take that may result from the proposed action and have not exempted such take in this biological opinion.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Jaguar and Ocelot

1. We recommend that FS support jaguar and ocelot recovery through implementing and/or funding priority recovery actions for the jaguar and ocelot as determined by the Jaguar Recovery Team and the Ocelot Recovery Team.
2. We recommend that FS contribute to the protection and management of corridors to provide for habitat connectivity and movement of jaguars and ocelots (for example, important linkages for these cats likely include areas connecting the Patagonia and Santa Rita Mountains and Whetstone and Santa Rita Mountains).
3. We recommend that FS provide funding to contribute to researchers' efforts to evaluate and enhance existing and/or construct new wildlife crossings (e.g., wildlife overpasses or underpasses and associated fencing) along and across Highways 82 and 83. These crossings would improve connectivity between the Santa Rita and Patagonia Mountains and the Santa Rita and Whetstone Mountains, respectively. To be effective, at least four wildlife crossings should be located along Highways 82 and 83 based on studies of carnivore movement in the area.
4. We recommend that FS protect jaguar habitat and corridors in the northwestern recovery unit on the CNF, to the extent possible, to allow for expansion of jaguars from the nearest core area into the U.S.

Mount Graham Red Squirrel

We recommend that the Forest continues to assist the Recovery Team in the implementation of the Mount Graham red squirrel Recovery Plan and its revisions, including providing funding for carrying out key recovery actions under your authorities.

Lesser Long-Nosed Bat

1. We recommend that the CNF participate in the development of a revised long-term monitoring protocol for the lesser long-nosed bat as outlined in the most recent Lesser Long-Nosed Bat 5-year review and the recently completed evaluation by the University of Arizona (Cerro 2012).
2. We recommend that the CNF participate in the development of a range-wide agave monitoring program with a standardized monitoring protocol.
3. We encourage the CNF to initiate or participate in additional lesser long-nosed bat research related to the foraging patterns, roost occupancy patterns, and seasonal behavior of lesser long-nosed bats in southern Arizona.
4. We encourage the CNF to work with Border Patrol and the Department of Homeland Security to assess and minimize the impacts of border fences and other facilities on FS lands on the lesser long-nosed bat.

5. We recommend that the CNF investigate and monitor the invasion of Lehmann lovegrass and assist other agencies in developing methods for controlling this non-native grass.
6. We recommend that the CNF work with FWS, AGFD and New Mexico Department of Game and Fish (NMDGF) to implement recovery actions for lesser long-nosed bat.

Mexican Spotted Owl

1. We recommend CNF implement actions to protect protected activity centers from high-severity fire and improve the resiliency of fire-adapted forested habitats. Annual reports will provide information to assist the FWS in determining whether these long-term activities are occurring in such a way as to reduce fire risk to existing protected activity centers and replacement nest/roost habitat (nest/roost replacement recovery habitat).
2. We recommend that the CNF work with the Service to conduct spotted owl surveys over the next several years to attempt to determine how owls modify their territories in response to fuels treatments, forest restoration, and wildland fire. This information will aid us in understanding the short- and long-term impacts of these actions on the owl, and their subsequent effect on the status of the species.
3. We recommend that the CNF work with the Service to design forest restoration treatments across the forest that protect existing nest/roost replacement habitat from high severity, stand-replacing fire and enhance existing or potential habitat to aid in sustaining spotted owl habitat across the landscape. Protected activity centers can be afforded substantial protection from wildland fire by emphasizing fuels reduction and forest restoration in surrounding areas outside of protected activity centers and nest/roost replacement recovery habitat.

Western Yellow-Billed Cuckoo

1. We recommend that the USFS implement specific actions to assist in recovery of the yellow-billed cuckoo throughout the CNF.
2. We recommend the USFS continue conducting yellow-billed cuckoo surveys (per Halterman *et al.* 2016 or subsequent protocols) yellow-billed cuckoo surveys forest-wide to assess cuckoo habitat in the Sky Islands of Arizona.
3. We recommend the USFS retain ground cover, understory, midstory, and overstory vegetation (vertical habitat diversity) in suitable riparian habitat and Madrean evergreen woodland drainages.
4. We recommend the USFS retain upland vegetation to maintain healthy watersheds and allow for natural water infiltration and transport across the landscape.
5. We recommend that vegetation-altering activities (such as thinning, limbing, and herbicide or pesticide treatment) will not occur in riparian and Madrean evergreen woodland drainage breeding habitat. Breeding habitat may consist of a mix of native trees, tamarisk, and shrubs.
6. We recommend that foraging habitat adjacent to currently or potentially suitable YBCU breeding habitat will be retained, and may contain a mix of trees (including tamarisk), shrubs, and ground cover.
7. We recommend the USFS avoid grazing activities in the action area that reduce the suitability or regeneration of woody riparian or upland species (especially in Madrean evergreen woodland drainages) necessary to maintain YBCU breeding habitat.

8. We recommend the USFS avoid grazing activities that reduce the suitability of YBCU foraging habitat (e.g. prey species and some large woody shrubs or trees will be maintained).
9. We recommend the USFS avoid grazing activities that do not comply with the descriptions provided in Table 2, Appendix G of the 2002 U.S. Fish and Wildlife Service Southwestern Willow Flycatcher Final Recovery Plan (Appendix A). The guidelines for the Southwestern Willow Flycatcher are used as a surrogate for the Yellow-billed Cuckoo until such guidelines are developed for this species.
10. We recommend the USFS develop and implement a survey and monitoring plan to better determine the distribution, abundance, and trends of yellow-billed cuckoo populations on the CNF.
11. We recommend FS not conduct activities impacting yellow-billed cuckoo during their breeding season.

Sonoran Tiger Salamander, Chiricahua Leopard Frog, and Northern Mexican Gartersnake

1. We recommend the USFS to participate in, implement, and/or help fund studies of topics identified in the species recovery plan that may improve our understanding of the conservation and recovery needs of the Sonoran tiger salamander and Chiricahua leopard frog.
2. Many Standards and Guidelinescall for watershed, range, and/or habitat improvements. These improvements are not given a timeframe, thus populations may be impacted and individuals may be taken over time. We recommend that the CNF prioritize the projects that will allow for the greatest benefit to the species using a combination of factors which recognize extreme environmental degradation and T&E occupied sites.
3. We recommend that the USFS implement recovery actions as described within Chiricahua leopard frog and Sonoran tiger salamander recovery plans, and northern Mexican gartersnake when it is completed.
4. We recommend the USFS implement area or route closures in breeding populations to reduce impacts on breeding success and dispersing these species.
5. We recommend that the USFS prevent the introduction or movement of non-native aquatic species on CNF, as well as implement a removal program for non-native aquatic species on CNF.
6. Once monitoring plans are developed by FWS for Chiricahua leopard frog , Sonoran tiger salamander, and northern Mexican gartersnake, we recommend the Forest implement these monitoring plans to better determine the distribution, abundance, and trends of species populations on the CNF.
7. We recommend the Forest maintain active participation in the Gartersnake Conservation Working Group, Chiricahua leopard frog Steering Committees and Local Recovery Groups, and Sonoran tiger salamander Steering Committee, by ensuring forest biologists and other appropriate staff attend meetings and coordinate in monitoring and recovery planning.
8. We recommend the USFS work with the Arizona Department of Environmental Quality, or other suitable partners to install water-quality monitoring equipment.

New Mexico Ridge-Nosed Rattlesnake

1. We recommend the Forest actively participate in the recovery of the New Mexico ridge-nosed rattlesnake through the implementation of the recovery plan.
2. We recommend the Forest work in coordination with the BLM, Natural Resource Conservation Service, FWS, the Malpai Borderlands Group, and others to develop an Ecosystem Management Plan for the Peloncillo Mountains and surrounding areas.
3. We recommend the Forest work in coordination with AGFD, NMDGF, BLM, FWS, and the Malpai Borderlands Group to obtain funds for research designed to clarify the life history and ecology of the New Mexico ridge-nosed rattlesnake in order to quantify the effects of livestock grazing on the subspecies.
4. We recommend the Forest adopt conservative utilization rates to maintain or improve range conditions and vegetation communities within occupied habitats on the Peloncillo Mountains.
5. We recommend the Forest use traffic counters to monitor and manage levels of vehicular use on USFS roads to minimize threats to New Mexico ridge-nosed rattlesnakes.
6. We recommend the Forest follow the FWS's regional guidance criteria for the use of pesticides.
7. We recommend the Forest post signs to educate visitors of the laws restricting the collection of New Mexico ridge-nosed rattlesnakes in general information kiosks and brochures. Signs and other information should not identify location of suitable habitat.
8. We recommend the Forest monitor areas where core habitat has been altered or destroyed to determine regeneration times after various disturbances.
9. We recommend the Forest provide the FWS's Arizona Ecological Services Office with an annual report of all survey and monitoring activities.

Gila Chub, Yaqui Chub, Gila Topminnow, Gila Trout, Apache Trout, Spikedace, Loach Minnow, Sonora Chub, Yaqui Catfish, Desert Pupfish, Roundtail Chub

1. We recommend that the USFS continue to assist FWS and the AGFD in conserving and recovering the listed fish.
2. We recommend that the USFS continue to assist FWS with the completion and implementation of the recovery plans for the listed fish.
3. We recommend that the USFS implement recovery actions identified in the recovery plans.
4. We recommend that the USFS acquire instream flow water rights to ensure perennial flow in streams with listed fish.
5. We recommend that the USFS continue to work with the FWS and AGFD to remove non-native species and reestablish the listed fish throughout their historical range in Arizona.
6. We recommend that the USFS conduct fish surveys on National Forest lands to determine the extent that other species, such as the headwater chub (*G. nigra*), may occupy those streams.
7. We recommend that the USFS continue to work cooperatively with FWS, BLM, NMDGF, and AGFD to establish populations of these species wherever possible.

8. We recommends FS continue to identify factors that limit the recovery of these and other listed species on CNF lands and work to correct them.
9. We recommend the Forest minimize or eliminate adverse effects from site-specific projects to Yaqui chub and other species near the Coronado NF. This can be accomplished by managing riparian areas adjacent to and upstream of fish populations for conditions that will eliminate direct effects and minimize indirect effects to these species and their habitat. Also, the Coronado NF should design fire use, chemical use, range management, and recreational projects to minimize or eliminate adverse effects to the species.
10. We recommend the Forest leave a buffer in place adjacent to riparian and stream zones to off-set any impacts from forest product, invasive species and other activities.
11. We recommend the Forest design projects in potential Yaqui chub habitat to incorporate important characteristics of pool habitats with the goal of implementing projects that will have beneficial, insignificant, and discountable effects to the Yaqui chub and its habitat.
12. We recommend the Forest retain pool habitat in its current frequency and retain physical characteristics of the pools themselves. Important characteristics include: length, width, depth, residual depth, bank shape, bed material, instream cover type, presence of submergent or emergent vegetation, and absence of non-native fish or amphibians.
13. We recommend FS assist with the development of monitoring plans that addresses all actions occurring within pertinent watersheds on the Coronado NF.
14. We recommend FS work, in cooperation with FWS and state conservation agencies, to plan and conduct investigations on captive holdings, propagation, and rearing.
15. We recommend FS work to secure funding for studies and habitat improvement projects.
16. In cooperation with the Border Patrol and other appropriate parties, continue efforts to construct a stronger border fence strategically located to reduce trespass cattle from Mexico into the occupied or designated critical habitat for the Sonora chub.

Huachuca Water Umbel

1. We recommend continued monitoring Huachuca water umbel on Coronado NF lands.
2. We recommend that the FS participate in recovery efforts such as attaining water rights and augmenting or introducing occurrences of the Huachuca water umbel. The FWS will be finalizing a recovery plan in the near future.
3. We recommend that the FS participate in genetic studies, such as those underway by Fort Huachuca, in order to determine population and meta-population dynamics of Huachuca water umbel throughout its range.
4. The FWS recommends that the USFS continue to collect and analyze monitoring data regarding Huachuca water umbel occurrences on the CNF to assess trends.
5. We recommend that the FS use locally sourced native plant species for restoration efforts.
6. The FWS recommends that the FS conduct annual monitoring of grazing activities to assess needed changes.
7. The FWS recommends that the USFS continue with its ongoing efforts to arrest erosion and restore ecosystems on streams on the CNF within which Huachuca water umbel occurs. We recommend specific attention to areas invaded by Johnsongrass (*Sorghum halepense*).

8. The FWS recommends that the USFS explore remedies to resolve cattle congregation in Huachuca water umbel habitat during critical, dry periods.
9. We recommend that the FS address the timing of grazing and the removal of cattle early in dry springs, check and maintain pasture and enclosures fences, and remove trespass cattle from enclosures.
10. The FWS recommends that the USFS non-native invasive plant management program include control for those species particularly impacting habitat quality for Huachuca water umbel noted to be problematic in the 5 year status assessment.

Pima Pineapple Cactus

1. We recommend that the FS reinitiate Pima pineapple cactus monitoring on Coronado NF lands and analyze data collected sporadically since 1995 to assess trends. Long term data on this taxon is uncommon and data from the Coronado NF locations represents the only long-term data in the Santa Cruz Valley portion of the range.
2. We recommend that the FS used locally sourced native plant species for restoration efforts.
3. We recommend that the FS participate in efforts to identify and conserve Pima pineapple cactus throughout its range, including participation in forums that address the control of invasive, exotic plants (e.g. buffelgrass and Lehmann lovegrass).
4. The FWS recommends that FS conduct complete surveys for Pima pineapple cactus prior to prescribed burns and remove litter from around each individual to prevent plants from burning.
5. We recommend that FS use 5 gallon buckets covering individual Pima pineapple cactus prior to herbicide application.
6. We recommend that FS support research and monitoring proposals that will contribute to an increased understanding of important conservation efforts related to Pima pineapple cactus such as the effectiveness of translocating Pima pineapple cactus, appropriate management of conservation lands and conservation banks to promote recovery of Pima pineapple cactus, growing Pima pineapple cactus from seed within occupied sites, and effects of climate change and fire on Pima pineapple cactus.
7. The FWS recommends the USFS work with our agency to seedbank and experimentally transplant to appropriate locations (i.e., with no future development potential, including areas with non-severed mineral rights) any individual Pima pineapple cactus present that will be otherwise directly affected by activities. We recommend the USFS work to secure seed of the plants in the project area and vicinity on FS lands in a secure seed-bank (preferably the USDA National Center for Genetic Resources Preservation) for long-term storage and future use. At a minimum, seed for the plants expected to be removed or lost due to the project should be collected prior to their removal. We further recommend that monitoring be performed to test/determine if survivorship is better in an approach using immediate transplant to a new location, or by first transferring the removed plants to an off-site cultivation facility (botanical garden partner, etc.) until they have recovered and formed new root tissue, and then transplanting them to the wild later.
8. We recommend that the FS participate in recovery planning efforts for the Pima pineapple cactus. We will be preparing a recovery plan in the near future and would like to incorporate agency expertise. The FWS recommends that the USFS provide

comments when the draft recovery plan for the Pima pineapple cactus is released, and that such comments include a synthesis of the monitoring data discussed above.

In order that we are kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes the conference for Revised CNF Land and Resource Management Plan. You may ask us to confirm the conference opinion as a biological opinion issued through formal consultation if the proposed species is listed or critical habitat is designated. The request must be in writing. If we review the proposed action and find there have been no significant changes in the action as planned or in the information used during the conference, we will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary.

After listing as threatened or endangered and any subsequent adoption of this conference opinion, the US FS shall request reinitiation of consultation if: 1) new information reveals effects of the agency action that may affect the species in a manner or to an extent not considered in the conference opinion; 2) the agency action is subsequently modified in a manner that causes an effect to the species that was not considered in this opinion; or 3) a new species is listed or critical habitat designated that may be affected by the action.

This concludes formal consultation on the action(s) outlined in your request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Kerwin Dewberry, Forest Supervisor

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TABLES

Table 1. Land use zones, wilderness areas, and other special management areas allocated by the proposed action.

Management Area	Acres Allocated by Proposed Action
Land Use Zones	
Roaded Backcountry	595,497
Wild Backcountry	596,127
Developed Recreation	37,264
Motorized Recreation	4,862
Wilderness, Recommended Wilderness, and Wilderness Study Areas	
Wilderness	338,318
Recommended Wilderness (includes Ku Chish and Mount Graham)	108,890
Bunk Robinson Wilderness Study Area	19,062
Whitmire Canyon Wilderness Study Area	12,163
Special Management Areas	
Elgin Research Natural Area (RNA)	245
Appleton-Whittell Research Ranch	1,746
Goudy Canyon RNA	558
Santa Catalina RNA (proposed reduction from 4,040 acres designated in the 1986 plan)	634
Wet Canyon Talus Snail Zoological Area	1,218
Mount Graham Astrophysical and Biological Research Area	2,937
Wild Chile Botanical Area	2,836
South Fork of Cave Creek Zoological-Botanical Area	786
Guadalupe Canyon	3,436
Cave Creek Canyon Birds of Prey Zoological Area	26,764
Goodding RNA	540
Butterfly Peak RNA	1,058
Pole Bridge RNA	460
Finger Rock Canyon RNA	1,103
Canelo RNA	386
Pole Bridge Extension RNA	123
Goodding Extension RNA	1,594
Elgin Research Natural Area (RNA)	315
Appleton-Whittell Research Ranch	2,346

Table 2. Mineral Projects on the Coronado National Forest.

Project Name	Status	EMA	District
Dragoon Quarry	Active	Dragoon	Douglas
Rosemont Copper Mine	Active	Santa Rita	Nogales
Imerys Quarry	Active	Santa Rita	Nogales
Blue Fire Gem Exploration	Active	Tumacacori	Nogales
Blue Fire Gem Quarry/Opal	Active	Tumacacori	Nogales
Big Nugget	Inactive	Santa Rita	Nogales
Greaterville AML	Complete - Inactive	Santa Rita	Nogales
Hermosa Exploration	Withdrawn	Huachuca	Sierra Vista
Sunnyside	Withdrawn	Huachuca	Sierra Vista
Dice 8	Withdrawn	Huachuca	Sierra Vista
CH Drill	Withdrawn	Huachuca	Sierra Vista
Patagonia Jewel	Reclamation Complete – Inactive	Huachuca	Sierra Vista
Moore & Moore	Active	Huachuca	Sierra Vista
Harshaw Borrow Pits	Withdrawn	Huachuca	Sierra Vista
Tierny	Active	Huachuca	Sierra Vista
Oracle Ridge Mine	Withdrawn	Santa Catalina	Santa Catalina
Korn Kob	Active	Santa Catalina	Santa Catalina
Burney occupancy/trespass	Active	Santa Catalina	Santa Catalina
Imerys Quarry Drilling	Active	Santa Rita	Nogales
Patagonia Jewel Phase 2	N/A	Huachuca	Sierra Vista
Kennecott Drilling	Active	Galiuro	Safford
Happy Valley Quarry	Withdrawn	Santa Catalina	Santa Catalina
Oro Grande Placer	Completed	Santa Rita	Nogales
Margarita 1	Completed	Tumacacori	Nogales
Margarita 2 Drilling	Withdrawn	Tumacacori	Nogales
Quartz Dream Placer	Withdrawn	Santa Rita	Nogales
Javelina	Withdrawn	Huachuca	Sierra Vista
White Cloud Providencia	Withdrawn	Huachuca	Sierra Vista
OZ Providencia	Withdrawn	Huachuca	Sierra Vista
Ladron Mine	Active	Tumacacori	Nogales
Parolini NOI/POO	Active	Santa Rita	Nogales
Humbolt	Active	Huachuca	Sierra Vista
AML State Violations	Active	Dragoon	Douglas
Cramer Mine	Active	Tumacacori	Nogales
Snyder Mine NOI	Active	Tumacacori	Nogales
Hardshell Bond	Active	Huachuca	Sierra Vista
Los Lobos Bond	Unknown	Tumacacori	Nogales

Table J-1. Modeled habitat and potential numbers of jaguars in Core and Secondary Areas of the Northwestern Recovery Unit of the jaguar.

Name of Area	Estimated size of Area mi^2	Estimated Jaguar habitat within Area mi^2	Estimated number of potential Jaguars within Area
Jalisco Core Area	21,216	17,166	1,318
Sinaloa Secondary Area	12,043	11,090	929
Sonora Core Area	30,004	26,228	1,124
Borderlands Secondary Area – Mexico portion	13,110	8,842	37
Borderlands Secondary Area – U.S. portion	11,205	2,641	6
northwestern recovery unit – Mexico	76,373	63,327	3,408
northwestern recovery unit – United States	11,205	2,641	6
northwestern recovery unit – Total	87,578	65,967	3,414

Table J-2. Area of each CNF ecosystem management unit within the Borderlands Secondary Area of the Northwestern Recovery Unit for the jaguar.

Ecosystem Management Area	Area in acres (mi^2)
Tumacacori	203,800 (318)
Huachuca	276,350 (432)
Whetstone	45,023 (70)
Santa Rita	148,421 (232)
Peloncillo	87,985 (138)
Chiricahua	291,496 (455)
Dragoon	54,211 (85)
Total	**1,107,276 (1,730)**

Table J-3. Area and percent of jaguar critical habitat within the action area and within CNF.

Unit Name	Area of critical habitat within action area in acres	Area of critical habitat within CNF in acres	Percent of critical habitat within CNF
Atascosa	144,865	134,399	93
Patagonia	351,501	258,819	74
Whetstone	94,269	37,806	40
Peloncillo	102,724	57,729	56
Area of Affected Units	693,359	488,753	71
Total Area of Critical Habitat	**764,207**	**488,753**	**64**

Table MGRS-1. Formal consultations involving Mount Graham red squirrel on the Coronado NF since 2005.

Consultation #	Date of Final BO	Project	Approximate # of MGRS Anticipated Taken	Form of Take
02-21-86-F-075	7/14/1988	Mt. Graham Astrophysical Area Plan*	1 squirrel per year	Harm
02-21-96-F-286	*6/9/1999*	*Clark Peak Fire Emergency Suppression and Rehabilitation*	*15 squirrels*	*Harm & Harass*
02-21-98-F-282	10/5/2000	Pinaleno Ecosystem Management Demonstration Project	3 squirrels	Harm & Harass
02-21-04-M-0299	*6/8/2007*	*Nuttall-Gibson Complex Wildfire Suppression actions*	*1 active midden; Unknown number of squirrels*	*Harm & Harass*
22410-2007-F-0163	8/18/2008	Mount Graham Summerhome Special Use Permit Residence Renewals	2 squirrels	Harm (1) & Harass (1)
22410-2005-F-0651	8/5/2011	Pinaleño Ecosystem Restoration Project	15 percent decline in abundance of MGRS within treated areas during project implementation (through year 15)	Harm & Harass
22410-2008-F-0149-R001	*12/6/2011*	*Effects to Listed Species from U.S. USFS Aerial Application of Fire Retardants on NFS Lands*	*Incidental take will be tracked as it occurs per the BO*	*Harm & Harass*
2012-F-0005	4/30/2012	Coronado LRMP Continued Implementation	2 squirrels per year	Harm
22410-2009-F-0305	7/19/2013	Captive Breeding Pilot Program and Issuance of Section 10(a)(1)(A) Enhancement of Survival Permit	11 squirrels, also 50 percent of all captive squirrels and up to 3 wild squirrels per each five year period starting from the date of the opinion	Harm

*The 1988 BO originally included both the Forest Plan and the Astrophysical Area Plan. The 2005 LRMP BO/CO superseded the Forest Plan portion of this formal consultation, but the consultation is included here because the Astrophysical Area Plan portion authorized ongoing incidental take.

**Projects in italics are fire suppression activities; these activities are not included in the proposed action for this consultation.

Table MSO-1. Formal consultations on the Coronado National Forest from 2012 to present.

Consultation #	Date of Final BO	Project	Approximate # of Mexican spotted owls Anticipated Taken	# of PACs Anticipated Taken	Form of Take
22410-2009-F-0389	10/30/2013	Rosemont Copper Mine, Pima County, Arizona	0	0	n/a
02EAAZ00-2013-F-0093	4/27/2014	Galiuro Firescape and Rockhouse Burn Projects	0	0	n/a
22410-2009-F-0389R1	4/22/2016	Rosemont Copper Mine Reinitiation, Pima County, Arizona	0	0	n/a

Table YBC-1. Proposed critical habitat units for western yellow-billed cuckoo by county in SE Arizona.

Unit	Unit Name	Size Acres	County	Length Miles
24	AZ-16 Bonita Creek	929	Graham	6
26	AZ-18 Upper San Pedro River*	21,786	Cochise	83
27	AZ-19 Hooker Hot Springs*	375	Cochise	3
28	AZ-20 Lower San Pedro and Gila Rivers*	23,399	Cochise, Pima and Pinal	59
30	AZ-22 Peritas Wash	894	Pima	4
31	AZ-23 Arivaca Wash and San Luis Wash*	5,765	Pima	17
32	AZ-24 Sonoita Creek*	1,610	Santa Cruz	12
33	AZ-25 Upper Cienega Creek*	5,204	Pima	14
34	AZ-26 Santa Cruz River*	3,689	Santa Cruz	5
35	AZ-27 Black Draw*	890	Cochise	4
36	AZ-28 Gila River 1	20,726	Graham and Pinal	66
38	AZ-30 Lower Cienega Creek*	2,360	Pima	11
41	AZ-33 Aravaipa Creek*	1,209	Graham	9
45	AZ-37 Florida Wash*	188	Pima	4
Total		**89,024**		**297**

*Denotes proposed critical habitat units within action area.

Table CLF-1. The eight RUs as identified in the Recovery Plan and the current status of the delisting criteria for the Chiricahua leopard frog in each RU.

Recovery Unit	RU#	Recovery Criteria 1	Recovery Criteria 2	Recovery Criteria 3	Recovery Criteria 4
Tumacacori-Atascosa-Pajarito Mountains, Arizona and Mexico	1	Met	Not met	Not met	Not met
Santa Rita-Huachuca-Ajos Bavispe, Arizona and Mexico	2	Not met	Not met	Not met	Not met
Chiricahua Mountains-Malpai Borderlands-Sierra Madre, Arizona, New Mexico, and Mexico	3	Not met	Not met	Not met	Not met
Pinaleno-Galiuro-Dragoon Mountains, Arizona	4	Not met	Not met	Not met	Not met
Mogollon Rim-Verde River, Arizona	5	Not met	Not met	Not met	Not met
White Mountains-Upper Gila, Arizona and New Mexico	6	Not met	Not met	Not met	Not met
Upper Gila-Blue River, Arizona and New Mexico	7	Not met	Not met	Not met	Not met
Black-Mimbres-Rio Grande, New Mexico	8	Not met	Not met	Not met	Not met

Table CLF-2. Formal consultations on the Coronado National Forest for Chiricahua leopard frog from 2012 to present.

Consultation #	Date of Final BO	Project	Anticipated Take	Locations	Form of Take
02EAAZ00-2012-F-0170	11/6/2012	Tactical Infrastructure Maintenance and Repair Program along US/Mexico International Border in Arizona	1 occupied tank, pond or pool ½ covered with fresh silt following precipitation event	TIMR location	Harm
22410-2009-F-0389	10/30/2013	Rosemont Copper Mine, Pima County, Arizona	6 sites	Rosemont Copper Mine	Harm and harass
02EAAZ00-2013-F-0093	8/27/2014	Galiuro Firescape and Rockhouse Burn Projects	0	0	n/a
22410-2009-F-0389R1	4/22/2016	Rosemont Copper Mine Reinitiation, Pima County, Arizona	200 frogs, 8 egg masses	Rosemont Copper Mine	Harm and harass

Table NMGS-1: Current population status of the northern Mexican gartersnake in the United States.

	Location	Last Record	Suitable Physical Habitat Present	Native Prey Species Present	Harmful Nonnative Species Present	Predicted Population Status
1	Gila River (NM, AZ)	2013	Yes	Yes	Yes	Likely low density
2	Spring Canyon (NM)	1937	Yes	Possible	Likely	Likely extirpated
3	Mule Creek (NM)	1983	Yes	Yes	Yes	Likely low density
4	Mimbres River (NM)	Likely early 1900s	Yes	Yes	Yes	Likely extirpated
5	Lower Colorado River (AZ)	2015	Yes	Yes	Yes	Likely low density
6	Bill Williams River (AZ)	2012	Yes	Yes	Yes	Likely viable
7	Big Sandy River (AZ)	2015	Yes	Yes	Likely	Likely low density
8	Santa Maria River (AZ)	2015	Yes	Yes	Likely	Likely low density
9	Agua Fria River (AZ)	1986	Yes	Yes	Yes	Likely low density
10	Little Ash Creek (AZ)	1992	Yes	Yes	Yes	Likely low density
11	Lower Salt River (AZ)	1964	Yes	Yes	Yes	Likely extirpated
12	Black River (AZ)	1982	Yes	Yes	Yes	Likely low density
13	Big Bonito Creek (AZ)	1986	Yes	Yes	Yes	Likely low density
14	Tonto Creek (AZ)	2005	Yes	Yes	Yes	Likely viable
15	Upper /Middle Verde River (AZ)	2012	Yes	Yes	Yes	Likely viable
16	Oak Creek (AZ) (Page Springs and Bubbling Ponds State Fish Hatcheries)	2015	Yes	Yes	Yes	Likely viable
17	Spring Creek (AZ)	2014	Yes	Yes	Yes	Likely low density
18	Sycamore Creek (Yavapai/Coconino Co., AZ)	1954	Yes	Possible	Yes	Likely extirpated
19	Upper Santa Cruz River/San Rafael Valley (AZ)	2015	Yes	Yes	Yes	Likely viable
20	Redrock Canyon/Cott Drainage	2008	Yes	Yes	Yes	Likely low

	(AZ)					density
21	Sonoita Creek (AZ)	2013	Yes	Possible	Yes	Likely low density
22	Scotia Canyon (AZ)	2009	Yes	Yes	No	Likely low density
23	Parker Canyon (AZ)	1986	Yes	Possible	Yes	Likely low density
24	Las Cienegas National Conservation Area and Cienega Creek Natural Preserve (AZ)	2015	Yes	Yes	No	Likely low density
25	Lower Santa Cruz River (AZ)	1956	Yes	Yes	Yes	Likely extirpated
26	Buenos Aires National Wildlife Refuge (AZ)	2000	Yes	Yes	Yes	Likely low density
27	Brown Canyon (AZ)	2014	Yes	Yes	No	Likely low density
28	Fort Huachuca (AZ)	1994	Yes	Yes	Yes	Likely low density
29	Bear Creek (AZ)	1987	Yes	Yes	Yes	Likely low density
30	San Pedro River (AZ)	1996	Yes	Yes	Yes	Likely low density
31	Babocomari River and Cienega (AZ)	1986	Yes	Possible	Yes	Likely low density
32	Canelo Hills-Sonoita Grasslands Area (AZ)	2015	Yes	Yes	Yes	Likely low density
33	San Bernardino National Wildlife Refuge (AZ)	1997	Yes	Yes	Yes	Likely low density

Notes: “Possible” means there were no conclusive data found. “Likely extirpated” means the last record for an area predated 1980, and existing threats suggest the species is likely extirpated. “Likely low density” means there is a post-1980 record for the species, it is not reliably found with minimal to moderate survey effort, and threats exist which suggest the population may be low density or could be extirpated, but there is insufficient evidence to support extirpation. “Likely viable” means that the species is reliably found with minimal to moderate survey effort, and that the population is generally considered to be somewhat resilient.

Table NMGS-2. Santa Cruz River Subbasin: Las Cienegas NCA and Cienega Creek Natural Preserve (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1986	At Cienega Ranch; 35 miles SE Tucson	Rosen and Schwalbe 1988, Appendix I	Two adults
1994	R17E, T19S	Holycross *et al.* 2006; Appendix A	
1996	Cienega Creek at main perennial headwater	Rosen *et al.* 2001; Appendix I	Juvenile; dead
1997	Cienega Creek County Preserve; Nad 83 535113/354197	Caldwell 2012	
1999	UTM 536600, 3541200, S 1/2 Sec 28, T16S, R17E	Holycross *et al.* 2006; Appendix A	
2000	Cienega Creek at main perennial headwater	Rosen *et al.* 2001; Appendix I	Adult
2001	Cienega Creek County Preserve; Nad 83 535825/354952	Caldwell 2012	
2011	Las Cienegas National Conservation Area	Hall 2012	Five adults; two subadults
2012		FWS Files	40 captive-bred juveniles from ASDM released; cautery-marked
2014			36 captive-bred animals from ASDM released; Empire Wildlife Pond (5 subadults/ 6 juveniles), the Maternity Wildlife Pond (2 subadults/ 6 juveniles), and upper Cienega Creek (2 subadults/ 15 juveniles)
2014	Cienega Creek County Preserve	Caldwell 2014, pp. 12	One adult; one juvenile
2015	Las Cienegas National Conservation Area	Crawford 2015	19 captive-bred individuals from ASDM released; 12 near Cold Spring at the confluence with Mattie Canyon and 7 in the Cienega Creek headwaters area

Predicted Population Status: Likely low density

Table NMGS-3. Santa Cruz River Subbasin: Upper Santa Cruz River/San Rafael Valley Subbasin (Arizona) northern Mexican gartersnake records.

Record Year	**Locality Descriptor**	**Reference**	**Notes**
1986	Bog Hole Wildlife Management Area	Rosen and Schwalbe 1988, Appendix I	Nine specimens
1958	Sharp Spring		
1975			
1986		Rosen and Schwalbe 1988, Appendix I; Holycross *et al.* 2006, Appendix A	
1985	Upper 13 Reservoir	Rosen and Schwalbe 1988, Appendix I	
1979	Parker Canyon; 13 miles SE of Parker Canyon Lake	Holycross *et al.* 2006, Appendix A	5 specimens
1975	Lochiel vicinity	Rosen *et al.* 2001, p. 17, Appendix I; Holycross *et al.* 2006, Appendix A	4 specimens
1977	Lochiel vicinity		
1958	Sharp Spring		
1975			
1986			
2000			
2012	Pasture 9 Tank	C. Akins 2012, pers. comm.	Neonate
2012	Forest Service 799 Tank	T. Jones 2012d, pers. comm.	Two specimens; adult male, adult female
2007		T. Jones 2012b, pers. comm.	Adult female
2006	Upper Santa Cruz River	Stingelin *et al.* 2006, Table 1.3	
2008		Stingelin *et al.* 2009, p. 33)	55 specimens; 51 specimens were adults, one was a juvenile, and three were neonates
2010		Rorabaugh 2010, pers. comm.	Adult
2012		Lashway 2012, p. 5	24 specimens; one recapture from Stingelin *et al.* (2009, p. 33) 2008 effort; 1 neonate of 24 specimens

2015		Lashway 2015	29 snakes captured; 3 recaptures from 2008 survey and 2 recaptures from 2012 survey; 11 males and 18 females captured
2014		Timmons 2014	Captured in fish trap (alive or dead unreported)
2013	Private pond in Corral Canyon	Jones 2013, pers. comm.	
Predicted Population Status: Likely viable			

Table NMGS-4. Santa Cruz River Subbasin (Section 4 of 5): Scotia Canyon (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1981	Peterson Ranch site	Rosen and Schwalbe 1988, Appendix I; Holm and Lowe 1995, Appendix B	Three specimens
1982		Holm and Lowe 1995, Appendix B	Six specimens
1987	Scotia Canyon	Holycross *et al*. 2006, Appendix A	
1993	Peterson Ranch site	Holm and Lowe 1995, Appendix B	39 specimens
2000		Rosen *et al*. 2001, Table 4	Three specimens
2008		Frederick 2008b	Adult
2009		J. Servoss 2009, pers. obs.	Adult
Predicted Population Status: Likely low density			

Table NMGS-5. Santa Cruz River Subbasin (Section 5 of 5): Parker Canyon (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1968	Parker Canyon	Holycross *et al.* 2006, Appendix A	
1979	13 miles SE of Parker Canyon Lake		Five specimens
1967	Parker Canyon Lake		
1986	NE end of Parker Canyon Lake	Rosen and Schwalbe 1988, Appendix I	100 feet from lake shore under rock
Predicted Population Status: Likely low density			

Table NMGS-6. Santa Cruz River Subbasin: Redrock Canyon (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1920	"4.5 miles N of Crittenden (= ca. Monkey/Cottonwood Springs)"	Rosen and Schwalbe 1988; Appendix I	
2008	None provided	L. Jones 2008a, pers. comm.	Juvenile
Predicted Population Status: Likely low density			

Table NMGS-7. San Pedro River Subbasin: Bear Creek (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1968	"Bear Canyon"	Holycross *et al.* 2006, Appendix A	
1973	Bear Creek near Miller Peak		
1987	Bear Creek at Montezuma Pass Road		
Predicted Population Status: Likely low density			

<table>
<tr><th colspan="4">Table NMGS-8. San Pedro River Subbasin: San Pedro River (Arizona) northern Mexican gartersnake records.</th></tr>
<tr><th>Record Year</th><th>Locality Descriptor</th><th>Reference</th><th>Notes</th></tr>
<tr><td>1919</td><td>Lewis Spring</td><td rowspan="6">Rosen and Schwalbe 1988, Appendix I; Rosen et al. 2001, p. 21, Appendix I; Holycross et al. 2006, Appendix A</td><td>Single record</td></tr>
<tr><td>1920</td><td>Hereford</td><td>Five records</td></tr>
<tr><td>1959</td><td>“2 East Palamonas”</td><td>Single individual</td></tr>
<tr><td>1965</td><td>Highway 90 crossing</td><td>Single individual</td></tr>
<tr><td>1986</td><td>Lewis Spring</td><td>Two individuals</td></tr>
<tr><td>1986</td><td>Highway 90 crossing</td><td>Two records</td></tr>
<tr><td>1987</td><td>Unspecified locations</td><td>Corman 1988, p. 88</td><td>12 individuals</td></tr>
<tr><td>1996</td><td>Lewis Spring</td><td>HDMS</td><td>Single individual; photo-vouchered</td></tr>
<tr><td colspan="4">Predicted Population Status: Likely low density</td></tr>
</table>

<table>
<tr><th colspan="4">Table NMGS-9. San Pedro River Subbasin: Babocomari River and Cienega (Arizona) northern Mexican gartersnake records.</th></tr>
<tr><th>Record Year</th><th>Locality Descriptor</th><th>Reference</th><th>Notes</th></tr>
<tr><td>1892</td><td>“Babocomari”</td><td rowspan="8">Rosen and Schwalbe 1988, Appendix I</td><td></td></tr>
<tr><td rowspan="2">1958</td><td>Babocomari Ranch S of Elgin</td><td></td></tr>
<tr><td>Elgin</td><td></td></tr>
<tr><td>1969</td><td>In wash in middle of Elgin</td><td></td></tr>
<tr><td rowspan="2">1985</td><td>Babocomari Cienega (n=2); House Pond (N=1)</td><td>3 adults</td></tr>
<tr><td>Lower end of (dry bed and semi-permanent) cienega (in Babocomari River in Elgin)</td><td></td></tr>
<tr><td>1985</td><td>Babocomari River</td><td>1 young of the year</td></tr>
<tr><td>1968</td><td>Babocomari Ranch E of Elgin</td><td>Holycross et al. 2006, Appendix A</td><td></td></tr>
<tr><td colspan="4">Predicted Population Status: Likely low density</td></tr>
</table>

Table NMGS-10. San Pedro River Subbasin: Canelo Hills-Sonoita Grasslands Area (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1974	“Canelo Hill Santuary, O’Donnell Creek”	Rosen and Schalbe 1988, Appendix I; Holycross *et al.* 2006, Appendix A	Four individuals
1985	“Canelo”	Holycross *et al.* 2006, Appendix A	
1985	Findley Tank	Rosen and Schwalbe 1988, Appendix I	<108 individuals
1986			<108 individuals
1985	Turkey Creek; S end of the Research Ranch to Canelo Ranger Station		Single individual
1986			3 adult females; 3 adult males, 6 yearlings
1986	O’Donnell Creek, from Canelo Hills Nature Conservancy to central part of Research Ranch (= confluence of O’Donnell and Turkey Creeks)		2 adults; one subadult
1992	0.7 Rd miles north of Canelo Pass (Canelo Pass Rd)		
1996	Findley Tank	Rosen *et al.* 2001, Appendix I	Single juvenile
2000			22 adults; 3 juveniles
2007		d’Orgeix 2011, pp. 20-21	2 neonates
2008			9 individuals
2009			14 individuals
2014		Roger Cogan, 2014a, pers. comm.	Single individual
2007	Southwest Spring, Appleton-Whittell Research Ranch	d’Orgeix 2011, pp. 20-21	2 neonates
2009	Post Canyon, Appleton-Whittell Research Ranch		2 individuals
2012	Ephemeral pond in lower O’Donnell Canyon; Appleton-Whittell Research Ranch	d’Orgeix *et al.* 2013, pp. 213-215	Five individuals found exploiting Mexican spadefoot toad breeding colony
2014		Roger Cogan, 2014b, pers. comm.	Single individual presumably foraging on Mexican spadefoot toads

Predicted Population Status: Likely low density

Table NMGS-11. Santa Cruz River Subbasin: Buenos Aires National Wildlife Refuge (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1970	Arivaca Cienega	Rosen and Schwalbe 1988, Appendix I	5 individuals
2000		Rosen *et al.* 2001, Appendix I	Single juvenile
2001	Stock tank in Los Encinos Wash, Pozo Verde Mtns	AGFD records; Tonn 2013, pers. comm.	1 individual (observed by former AGFD Ranid Frog Biologist, Sean Blomquist)
Predicted Population Status: Likely low density			

Table NMGS-12. Rio Yaqui Subbasin: San Bernardino National Wildlife Refuge (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1939	WP Taylor "3900"	Rosen and Schwalbe 1988, Appendix I; Holycross *et al.* 2006, Appendix A	2 individuals
1950	San Bernardino Ranch		2 individuals
1954			2 individuals
1956	About 15 miles. East Douglas, Slaughter Ranch		1 individual
1957	San Bernardino Ranch		2 individuals
1958	Aston Draw, San Bernardino Ranch		2 individuals
1959	Slaughter Ranch (= San Bernardino) 18 miles East Douglas, Second Pond		1 individual
1961	*ca.* 17.0 miles. East Douglas, San Bernardino Ranch		8 individuals
		Rosen and Schwalbe 1988, Appendix I	1 individual; Collector: R. Bezy
1985			2 individuals; large adults
1986			8 individuals; large adults
1993	San Bernardino NWR, Bunning Spring at North Pond	Holycross *et al.* 2006, Appendix A	1 individual
1994	San Bernardino NWR, Mesquite Pond near Cottonwood/Cienega Springs		1 individual
1995	San Bernardino NWR, North Pond		2 individuals
1997	San Bernardino NWR, Twin Pond		2 individuals

2005	San Bernardino NWR, Black Draw	USFWS 2012, p. 109	1 individual
Predicted Population Status: Likely low density			

Table NMGS-13. Santa Cruz River Subbasin: Sonoita Creek (Arizona) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1954	Patagonia vicinity	Rosen and Schwalbe 1988, Appendix I; Holycross *et al.* 2006, Appendix A	
1974	3 miles SW of Patagonia on AZ Route 82		
2013	On trail where it's closest to creek: the Nature Conservancy's PatagoniaSonoita Creek Preserve	Bookwalter 2014, pers. comm.	Sub-adult
Predicted Population Status: Likely low density			

Table NMGS-14. Santa Cruz River Subbasin: Lower Santa Cruz River (Arizona and northern Sonora, Mexico) northern Mexican gartersnake records.

Record Year	Locality Descriptor	Reference	Notes
1912	SW of Tucson	Holycross *et al.* 2006; Appendix A	
1909	Tucson, Sabino Canyon		
1939	Tucson		
1939	Sabino Canyon		
Unknown	Tucson		7 individuals; AMNH accession no's 62815, 64369, 64370, 64371, 64374; ANSP 11743, ANSP 16459
1942	Base Agua Caliente Mts, NE Tucson		
1912	Tucson, Santa Cruz River		3 individuals
1947	Fort Lowell (Rillito River)		
1941	5 miles E Tucson; near Fort Lowell (Rillito River)		2 individuals
1942	Near Fort Lowell (Rillito River)		2 individuals
1958	3 miles NE		

	Lochiel, Santa Cruz River		
1942	Sabino Canyon		
1942	Tucson		4 individuals
1891	Tucson	Rosen and Schwalbe 1988, Appendix I; Holycross *et al*. 2006; Appendix A	7 individuals
1893			2 individuals
1947	4 miles NE Tucson		
1960	Tucson Country Club (Rillito River)		5 individuals
1952	Sabino Cyn Rd, 0.5 miles S Cloud Rd. Jct., N.E. Tucson		
1942	Near Fort Lowell (Rillito River)		4 individuals
1949	Rincon Stock Farm, Tucson; Ft. Lowell area		
1956	Mouth of Potrero Canyon, 5 miles N Nogales at Country Club Rd	Rosen and Schwalbe 1988, Appendix I	
1942	Tubac		
2006-2011	Arroyo Los Fresnos	Rorabaugh *et al.*, *In Press*, pp. 10-11	4 individuals
1990			S. Stefferud field notes
2006-2011	Rio Cocospera at Rancho El Arribabi		
Predicted Population Status: Likely extirpated			

Table GC-1. Population status of Gila chub at known historically occupied localities, showing the last year of confirmed occupancy and source of occupancy information within and adjacent to Coronado NF.

Locality	Status	Last Confirmed Occupation	Sources
San Pedro River basin			
Babocomari River	NDR-1	1968	ASU 4845
Hot Springs/Bass canyons* (Double R Canyon) (Wildcat Canyon)	L	2013 2012 2010 2012	Robinson (2014)
O'Donnell Creek* (Post Canyon) (Turkey Creek)	S	2012 1989 1991	Crowder and Robinson (2012) ASU 12401 Crowder and Robinson (2012)
Redfield Canyon*	L	2013	Robinson (2014)
Santa Cruz River basin			
Cienega Creek (upper)* (Cienega Creek-lower*) (Mattie Canyon*)	L	2013 2012 2011 2008	Robinson (2014) Ehret and Dickens (2009) Ehret and Dickens (2009)
Romero Canyon (repatriated 2005)	S	2012	Timmons and Upton (2013)
Sabino Canyon*	M	2012	Timmons and Upton (2013)

Note – Localities in parentheses are considered subpopulations whose statuses are not considered separately from their major source metapopulation. Streams are located in Arizona unless marked otherwise. Asterisks (*) denote localities located within designated critical habitat. Museum acronyms are ASU=Arizona State University Collection of Fishes.

Status – EX-Extirpated, NDR-Not Detected Recently (in past 20-49 years), S-Small (fewer than 500 adults), M-Medium (500-5000 adults), L-Large (>5000 adults)

Kerwin Dewberry, Forest Supervisor

Table GT-1. Reestablished wild populations of Gila topminnow that are likely extant, 2013 to 2016. In Arizona unless noted otherwise (Voeltz and Bettaso 2007, Crowder and Robinson 2015, Robinson and Crowder 2015, FWS files).

Site Name	Year stocked (discovered)	Mixed/pure	Lineage(s)	Fish From:
Cottonwood Artesian	1982 - **Failed** 2001	Mixed Pure	Monkey/Bylas/Cocio Bylas Springs	BTA ASU ARC
Lime Creek	Dispersal from Lime Cabin Spring (1996)	Mixed	Monkey/Bylas/Cocio (Lime Cabin Spring stocked in 1982)	BTA
Bass Canyon	2014	Pure	Bylas	Dudleyville pond
Bonita Creek (upper)	2010/2014	Pure	Bylas Spring	Dudleyville pond
Buckhorn Spring	2011	Pure	Sharp Spring	
Burro Cienega, NM	2008	Pure	Bylas Spring	Dudleyville pond
Chalky Spring	2009	Pure	Sharp Spring	
Cherry Spring Canyon (Muleshoe)	2007-2008	Pure	Bylas Spring	Dudleyville pond
Cieneguita Wetland 1 & 3	2013	Pure	Cienega Creek	
Cold Spring (#85)	1985	Pure	Monkey Springs	BTA
Cottonwood Spring (Goldfield Mountains)	2008	Mixed	Monkey Springs	Boyce Thompson Arboretum
Cottonwood Tank	2013	Pure	Cienega	Cienega
Empire Tank	2013	Pure	Cienega Creek	
Fossil Creek (#280)	2007-2010	Pure	Sharp Spring	
Gaucho Tank	2013	Pure	Cienega	Cienega
Headquarters Spring (Muleshoe)	2008	Pure	Bylas Spring	Dudleyville pond
Hot Springs Canyon	2013	Pure	Bylas	Dudleyville
Howard Well	2008	Pure	Bylas Spring	Dudleyville pond
Larry Creek trib	2005	Pure	Coalmine Spring	Coalmine Spring
Lousy Canyon	1999, 2006	Pure	Coalmine Spring	Coalmine Spring
Morgan City Wash	2009	Pure	Sharp Spring	
Mud Springs	1982	Mixed	Monkey/Bylas/Cocio	BTA
Murray Spring	2011	Pure	Cottonwood Springs	Bubbling Ponds
O‘Donnell Creek	1974	Pure	Monkey	Monkey

Pasture 2 Tank	2013	Pure	Sharp Spring	Robbins Butte
Redfield Canyon	2012	Pure	Bylas	Dudleyville Ponds
Redrock Wildlife Area NM	2010	Pure	Bylas Spring	Dudleyville pond
Road Canyon Tank	2012	Pure	Cienega Creek	Robbins Butte
Rock Spring	2013	Pure	Santa Cruz (Peck)	Phoenix Zoo
San Rafael	2013	Pure	Sharp Spring	Robbins Butte
Sabino Creek (The Crack)	2015	Pure	Cienega Creek	Cienega Creek/Road Canyon Tank
Sabino Creek	2016	Pure	Cienega Creek	Road Canyon Tank
Secret Spring (#331, Muleshoe)	2007	Pure	Bylas Spring	Dudleyville pond
Sheepshead Canyon	2014	Pure	Santa Cruz	Phoenix Zoo
Springwater Wetland	2013	Pure	Cienega Creek	
Swamp Springs Canyon (Muleshoe)	2007-2008	Pure	Bylas Spring	Dudleyville pond
Tule Creek	1981	Mixed	Monkey/Bylas/Cocio	BTA
Unnamed Drainage 68b	Dispersal from Mesquite Tank #2 (1985)	Mixed	Monkey/Bylas/Cocio (Mesquite Tank @ stocked in 1982)	BTA

Table DP-1. Extant natural populations of desert pupfish in the United States and Mexico, by state, by subspecies.

Arizona	**Baja California**	**California**	**Sonora**
Cyprinodon m. macularius			
-	Cerro Prieto	San Felipe Creek	Cienega de Santa Clara
	Laguna Salada	Salt Creek	El Doctor
		Salton Sea	
		Hot Mineral Spa Wash	
		Salton Sea irrigation drains	
Cyprinodon m. eremus			
Quitobaquito pond and springs			Rio Sonoyta

Table DP-2. Reestablished wild populations of desert pupfish that are likely extant. In Arizona unless noted otherwise (AGFD, CDFW, Service files). The wild source for all releases is Cienega de Santa Clara/El Doctor.

Site Name	Years stocked	Last survey date pupfish found	Last survey date (if no pupfish found)
Antelope Hill – Las Cienegas National Conservation Area	2013	2016	
Bald Wildlife Pond – Las Cienegas National Conservation Area	2013	2016	
Bonita Creek	2008, 2010, 2011	2015	2011
Cherry Spring Canyon	2007, 2008	2010	2014
Cieneguita Wetland Ponds	2013 2005	2015	
Cinco Canyon Wildlife Pond	2013	2014	
Cold Springs	1983	2014	
Cottonwood Wildlife Pond – Las Cienegas National Conservation Area	2013	2015	
Empire Wildlife Pond - Las Cienegas National Conservation Area	2013	2015	
Gaucho Wildlife Pond – Las Cienegas National Conservation Area	2013	2015	
Headquarters Spring	2008-2010	2015	
Howard Well	2008, 2009	2015	
Kei Sundt Pond	2010	2015	
Little Joe Spring – San Pedro Riparian National Conservation Area	2013	2015	
Larry/Charlie Tank	1976	2013	

Morgan/KT Ranch Pond	2012	2015	
Morgan City Wash	2009, 2010	2015	
Mud Springs	2007-2009, 2011	2015	
Murray Spring	2011, 2013	2014	
Nabhan-Monti Pond	2012	2015	
Road Canyon Wildlife Pond	2012	2014	
Secret Springs	2007, 2008, 2010	2012	2013
Swamp Springs Canyon (Muleshoe)	2007-2009	2008	2014
Tule Creek	2007, 2009	2009	2011
Walnut Spring	2008		2015

Table DP-3. Known extant refuge or captive populations of desert pupfish (*Cyprinodon m. macularius*) and Rio Sonoyta pupfish (*C. m. eremus*) (the latter indicated in **bold text**) in the U.S. and Mexico.

Arizona	California	Mexico
Apache Elementary School	Anza Borrego State Park	CEDES, Hermosillo
Aquatic Research & Conservation Center	Borrego Springs High School – 2 ponds	**Reserva Pinacate, Schuk Toak**
Arizona Historical Society	Oasis Springs Ecological Reserve – 2 ponds/streams	**Reserva Pinacate, HQ**
Arizona-Sonora Desert Museum	Dos Palmas Reserve – 4 ponds	**COBACH, Sonoyta**
Arizona-Sonora Desert Museum	Living Desert Museum – 4 ponds	**CEDO, Puerto Penasco**
ASU Desert Arboretum	Salton Sea State Recreation Area	
Audubon Society Appleton- Whittell Research Ranch	Coachella Valley Preserve – McCallum Pond	
Bill Williams NWR	University-California Riverside, Palm Desert Campus	
Black Canyon City		
Boyce-Thompson Arboretum		
Cabeza Prieta NWR		
Cibola NWR		
Deer Valley High School		
Desert Botanical Garden		
Flowing Wells Jr. HS		
Hermosa Montessori		
Hernbrode Pond		
Imperial NWR		
International Wildlife Museum		
Keiser Pond[3]		
Libby Elementary School		
Lulu Walker Elementary School		
McDowell Mountain Regional Park – 2 ponds		
MCC Red Mountain Campus		
Onofryton Pond		
Organ Pipe Cactus National Monument – La Cienega		
Palo Verde HS		
Phoenix Zoo – 2 ponds		
Rio Salado Audubon		
Robbins Butte Wildlife Management Area – 2 ponds		

Scottsdale Community College		
Southwestern Native Aquatic Resources & Recovery Center		
Spur Cross Solar Oasis		
the Nature Conservancy Lower San Pedro Preserve		

Table RC-1. Estimated Historical and Current Ranges of the Roundtail chubs in the Lower Colorado River.

		Roundtail Chub
Estimated Historical Range[1]	km	4,422
	miles	3,041
Estimated Current Range[2]	km	2,098
	miles	1,298
Percent of Estimated Historical Range Currently Occupied		47%
Estimated Reduction in Range	km	2,816
	miles	1,750
Percent of Estimated Historical Range No Longer Occupied		53
Number of Streams Historically Occupied		48
Number of Streams Currently Occupied		35

[1]This includes perennial, intermittent, and dry reaches within a stream.
[2]This includes perennial and interrupted perennial reaches within a stream.

Table RC-2. Roundtail chub DPS Historical and Current Status by Stream Length.

Watershed	Stream	Known Status as of 2009	Historical estimate of total stream length[1]		Watered area available in 2015[2,3]	
			km	miles	km	miles
Bill Williams River	Bill Williams River	Extirpated	75	47	N/A	N/A
	Boulder Creek	Extant	60	37	14	9
	Burro Creek	Extant	95	59	76	47
	Conger Creek	Extant	26	16	7	4
	Cottonwood Creek	Extant	15	9		0
	Cow Creek	Extant	5	3	1	1
	Fort Rock Creek	Extant	4	2	7	4
	Francis Creek	Extant	36	22	12	7
	Kirkland Creek	Extant	64	40	37	23
	Santa Maria River	Extant	81	50	28	17
	Stone Corral Canyon	Extant	4	2	3	2
	Sycamore Creek	Extant	38	24	23	14
	Trout Creek	Extant	87	54	53	33
	Wilder Creek	Extant	24	15	12	7
Gila River	Aravaipa Creek	Extant	91	57	44	27
	Blue River	Extirpated	82	51	N/A	N/A
	Eagle Creek	Extant	94	58	32	20
	Lower Gila River	Extirpated	472	293	N/A	N/A
	Upper Gila River	Extant	505	314	403	250
	San Francisco River	Extirpated	256	159	N/A	N/A
	San Pedro River	Extirpated	230	143	N/A	N/A
Little Colorado River	Little Colorado River	Extirpated	580	360	N/A	N/A
	East Clear Creek/Clear Creek	Extant	170	106	36	22
	Chevelon Creek	Extant	135	84	45	28
	Zuni River	Extirpated	140	87	N/A	N/A
Salt River	Black River	Extant	183	114	183	114
	Canyon Creek	Extant	83	52	67	42
	Carrizo Creek	Extant	102	63	61	38
	Cedar Creek	Extant	23	14	Extirpated[4]	N/A
	Cherry Creek	Extant	98	61	25	16
	Cibecue Creek	Extant in lower reach, extirpated below barrier	75	47	2	1

	Corduroy Creek	Extant	58	36	43	27
	Salome Creek	Extant	32	20	22	14
	Salt River	Extant	322	200	322	200
	White River	Extant	28	17	56[5]	35
Verde River	Beaver Creek	Extant	15	9	9	6
	Dry Beaver Creek	Extirpated	29	18	N/A	N/A
	Wet Beaver Creek	Extant	39	24	33	21
	Fossil Creek	Extant	28	17	22	14
	Oak Creek	Extant	81	50	81	50
	West Clear Creek	Extant	59	37	59[6]	37
	Verde River	Extant	270	168	270	168
Total Stream Length	**44 streams**	**35 streams**	**4,422**	**3,041**	**2,098**	**1,298**

[1]This includes perennial, intermittent, and dry reaches within a stream.
[2]This includes perennial and interrupted perennial reaches within a stream.
[3]N/A means this information is not applicable to this AU because the species is extirpated from the area.
[4]Verbal information from the White Mountain Apache Tribe states that they consider Cedar Creek to be extirpated for Roundtail chub. Further, for Cibecue Creek, they state there are no records of chub above the waterfall barrier 2 km up from the Salt River confluence, so we have removed the rest of this creek from consideration.
[5] Now includes occupied portion of North Fork White River.
[6] This is the total watered length of West Clear Creek available, not the determination of which chub is present in which section.

Table RC-3. Newly Established Populations for the roundtail chub DPS.

Drainage Basin	Analysis Unit	Watered area available in 2015 (perennial and interrupted perennial reaches of stream)
Gila River	Blue River Unit	50 miles
Salt River	Ash Creek Unit	3 miles
Verde River	Gap Creek Unit	2 miles
Verde River	Roundtree Canyon Unit	2 miles
Total		57 miles

Table RC-4. Category Rankings for Nonnative Species.

Level of Impact to Chubs	Nonnative Species in Category
Very High	Green Sunfish, Flathead Catfish, Smallmouth Bass
High	Black Bullhead, Yellow Bullhead, Brown Trout, Largemouth Bass, Crayfish
Moderate	Channel Catfish, Rainbow Trout, Rock Bass, Red Shiner, Western Mosquitofish, River Otter
Low	Bullfrog, Common Carp, Fathead Minnow

Kerwin Dewberry, Forest Supervisor

FIGURES

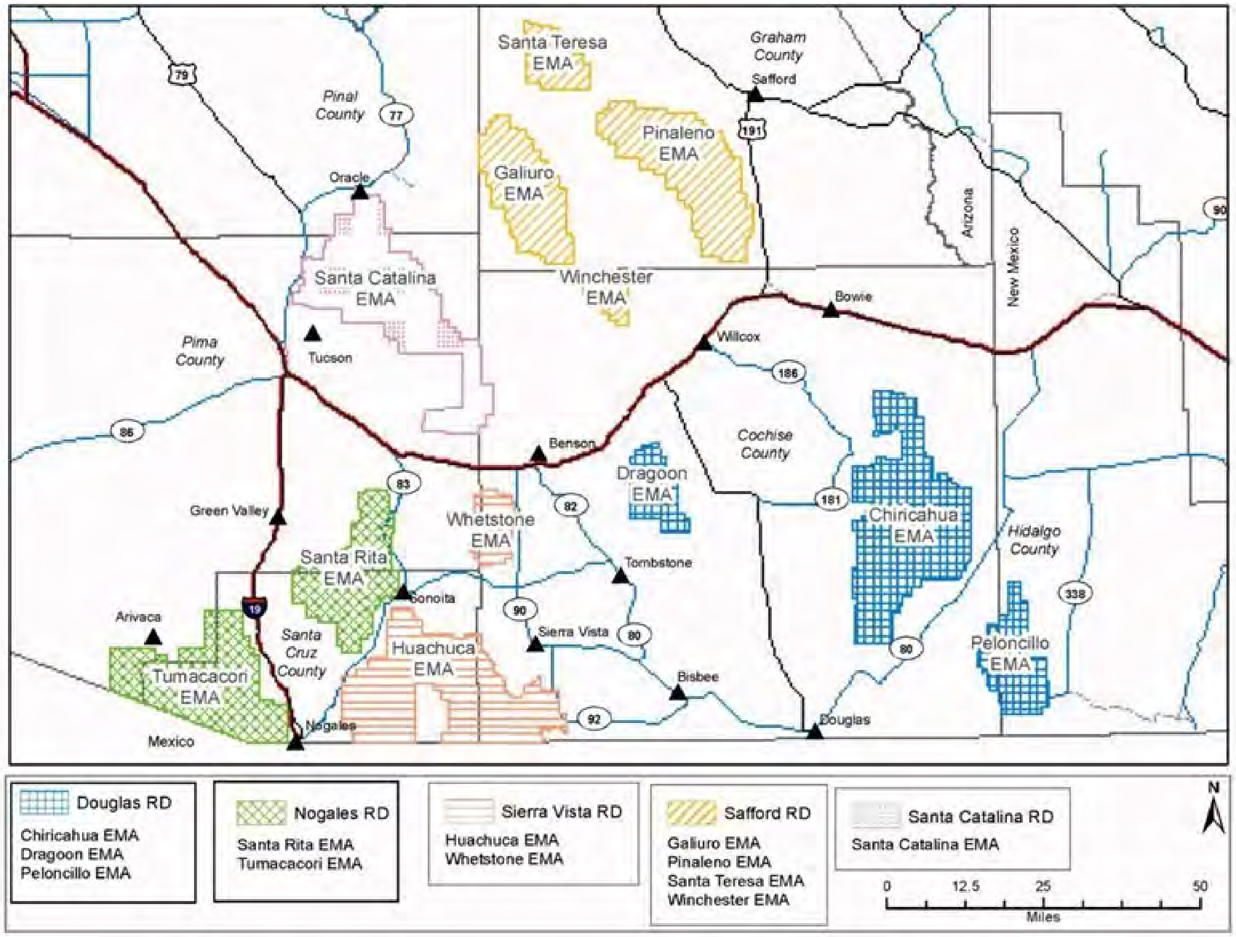

Figure 1. Coronado National Forest vicinity map with ranger districts locations and ecosystem management areas (EMAs).

Figure J-1. Map of the extent of the Northwestern Jaguar Recovery Unit.

Kerwin Dewberry, Forest Supervisor

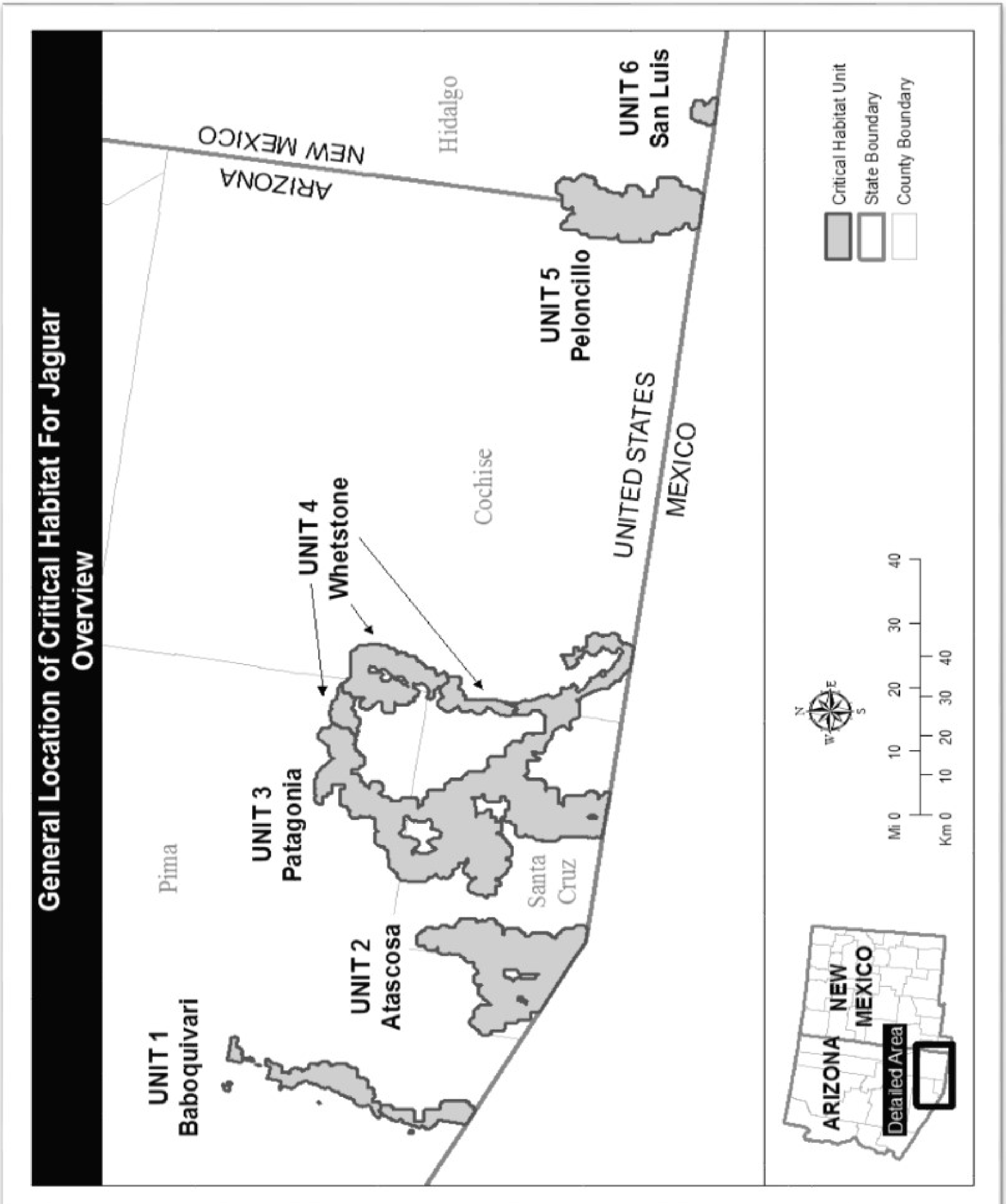

Figure J-2. Map of the extent of designated critical habitat for the jaguar (79 FR 12571).

Kerwin Dewberry, Forest Supervisor

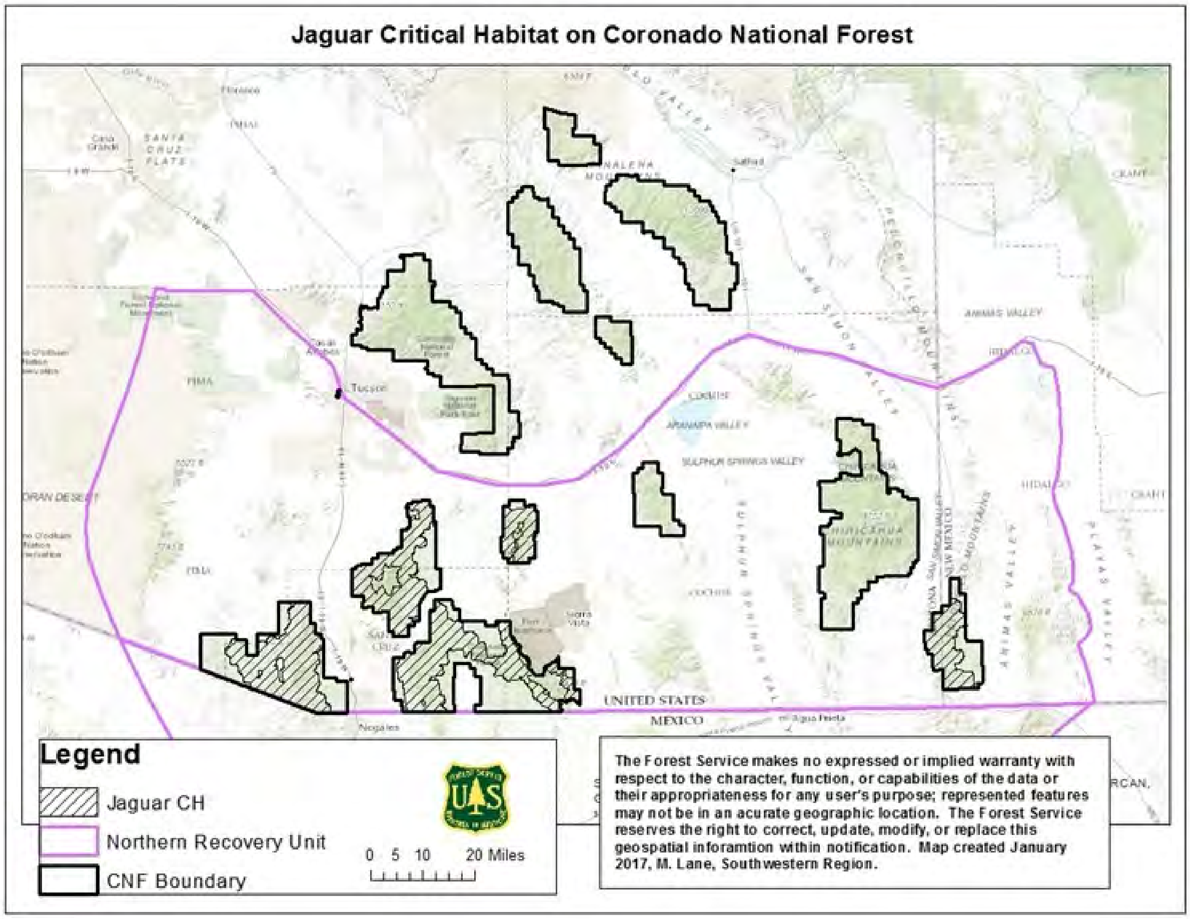

Figure J-3. Map of Jaguar critical habitat on the CNF.

Kerwin Dewberry, Forest Supervisor

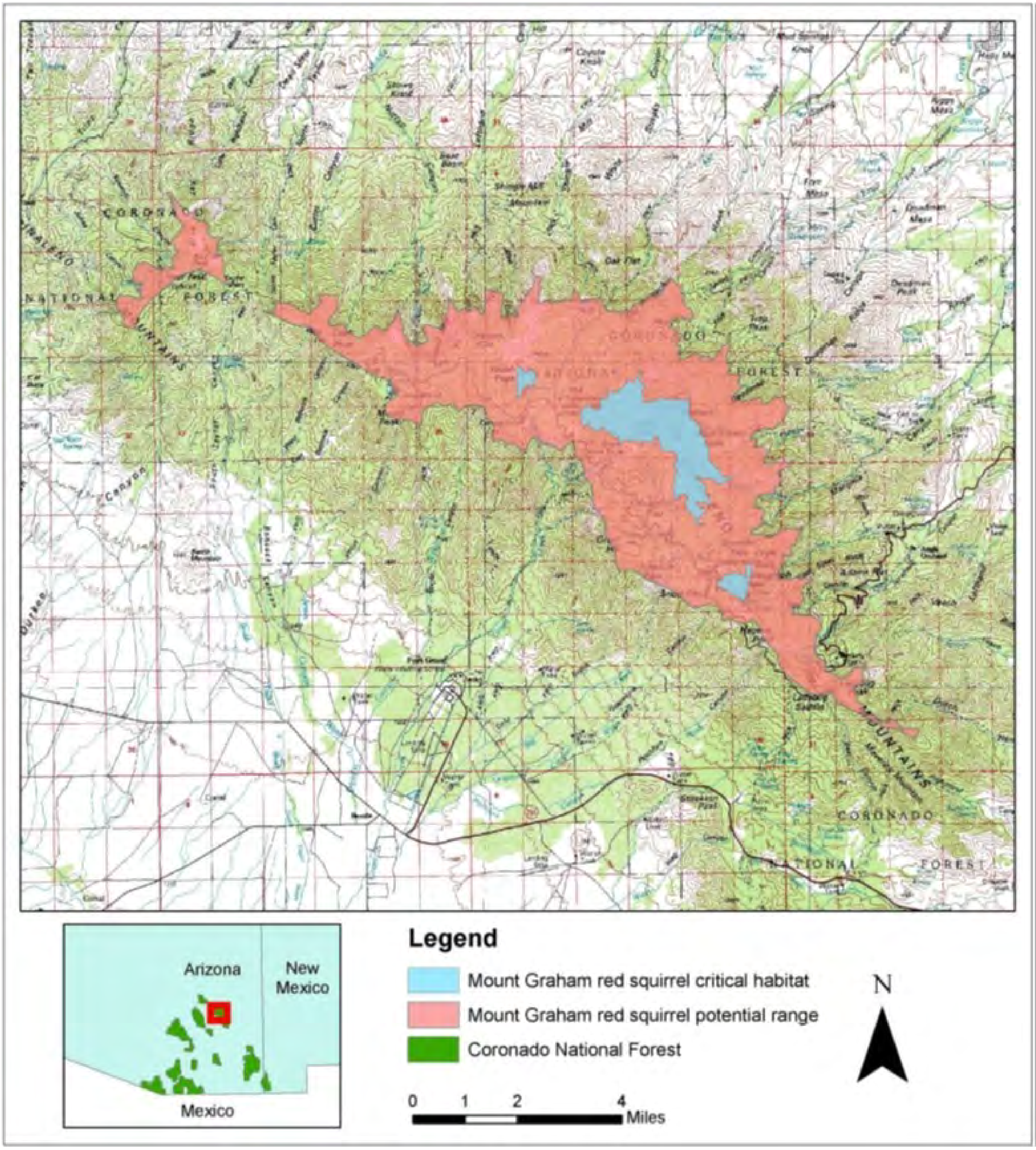

Figure MGRS-1. Mount Graham red squirrel potential range and critical habitat boundary, Pinaleño Mountains, Arizona (potential range boundary determined by Hatten 2009).

Kerwin Dewberry, Forest Supervisor

Figure MSO-1. Ecological Management Units for the Mexican spotted owl in the southwestern United States.

Kerwin Dewberry, Forest Supervisor

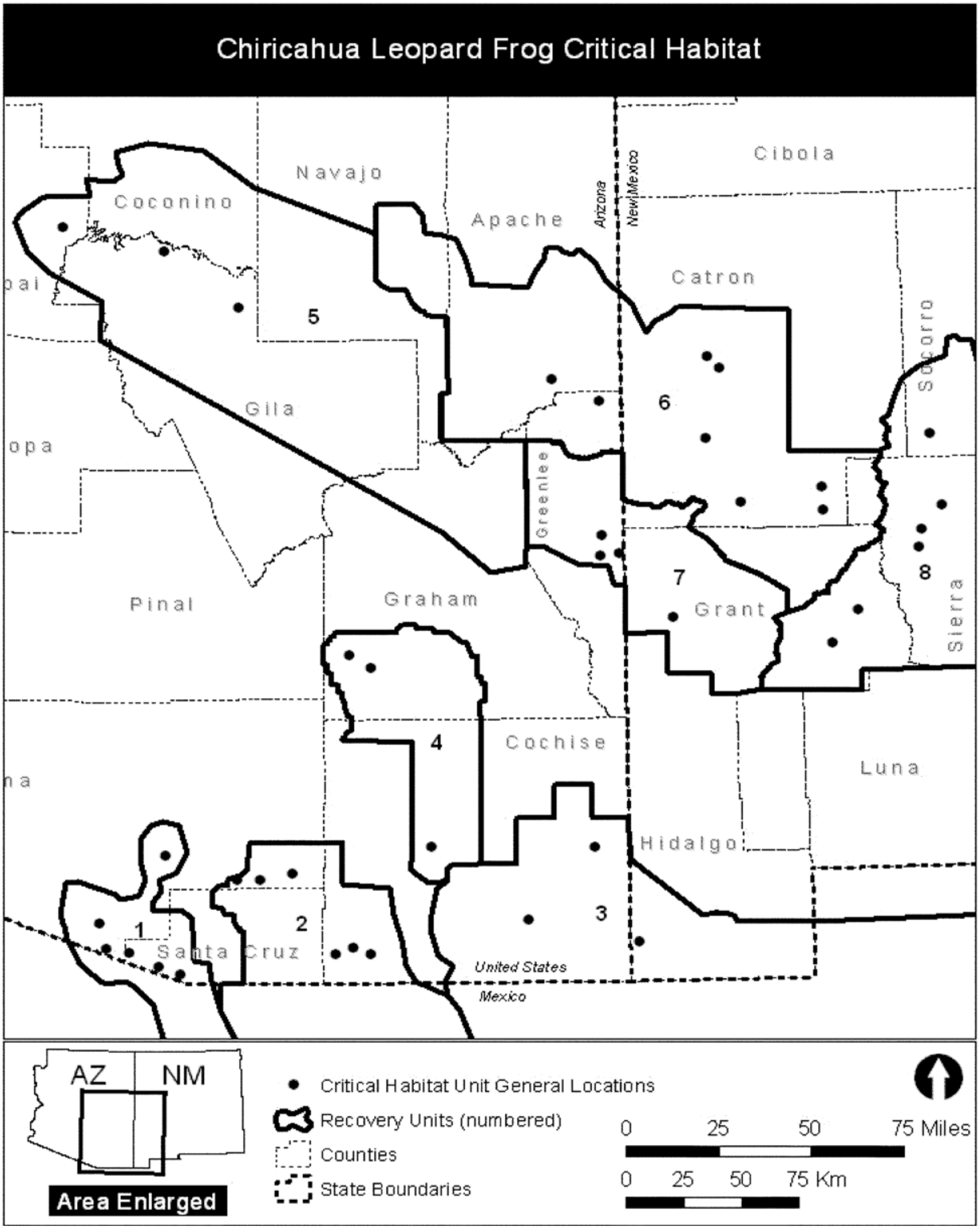

Figure CLF-1. Map of the known range of the Chiricahua leopard frog including critical habitat. The map covers areas in Arizona and New Mexico. All eight recovery units (RUs) are delineated by number.

Kerwin Dewberry, Forest Supervisor

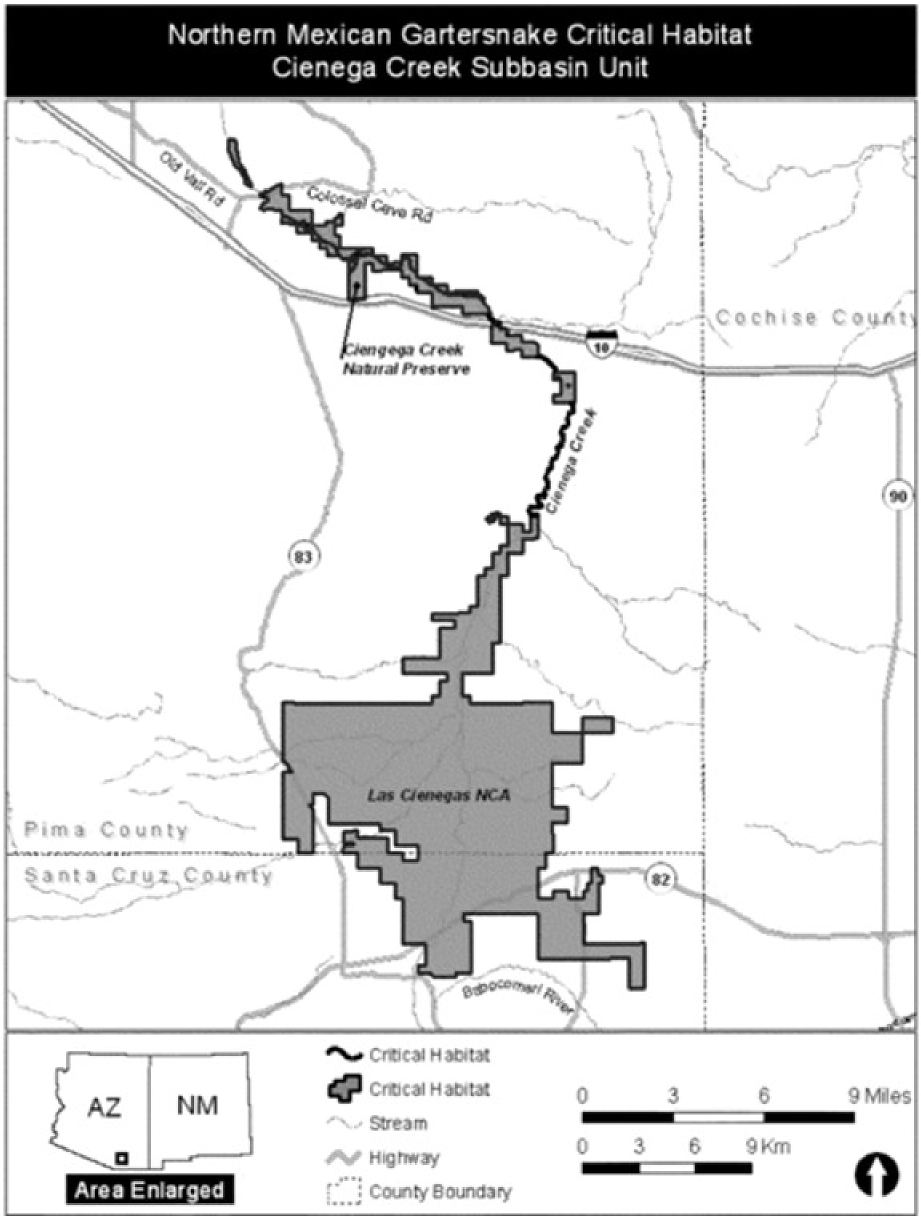

Figure NMGS-1. Map of Cienega Creek Subbasin Unit proposed for designation as critical habitat: Pima and Santa Cruz Counties, AZ.

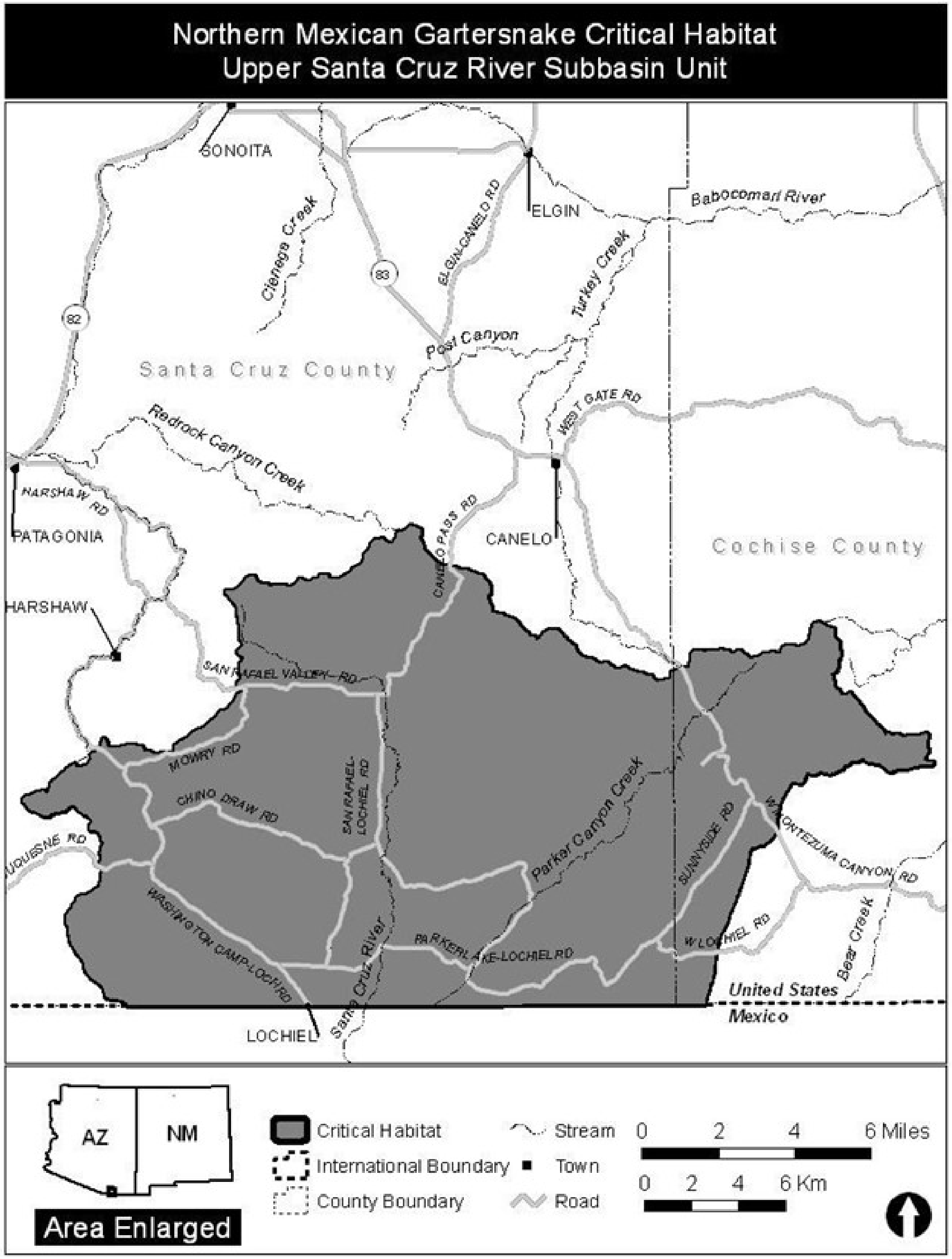

Figure NMGS-2. Map of Upper Santa Cruz River Subbasin Unit proposed for designation as critical habitat: Santa Cruz and Cochise Counties, AZ**.**

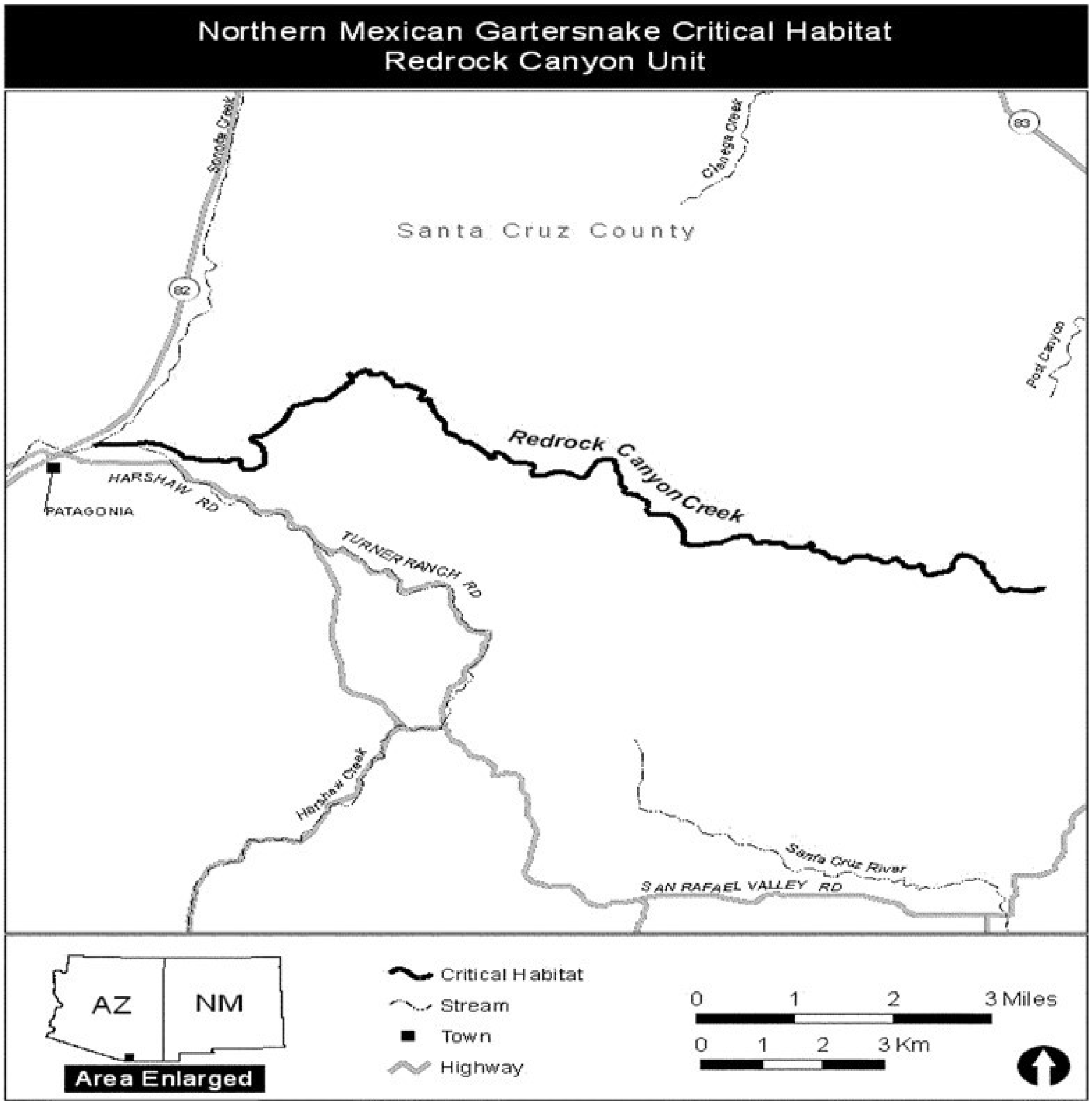

Figure NMGS-3. Map of Redrock Canyon Unit proposed for designation as critical habitat: Santa Cruz and Cochise Counties, AZ.

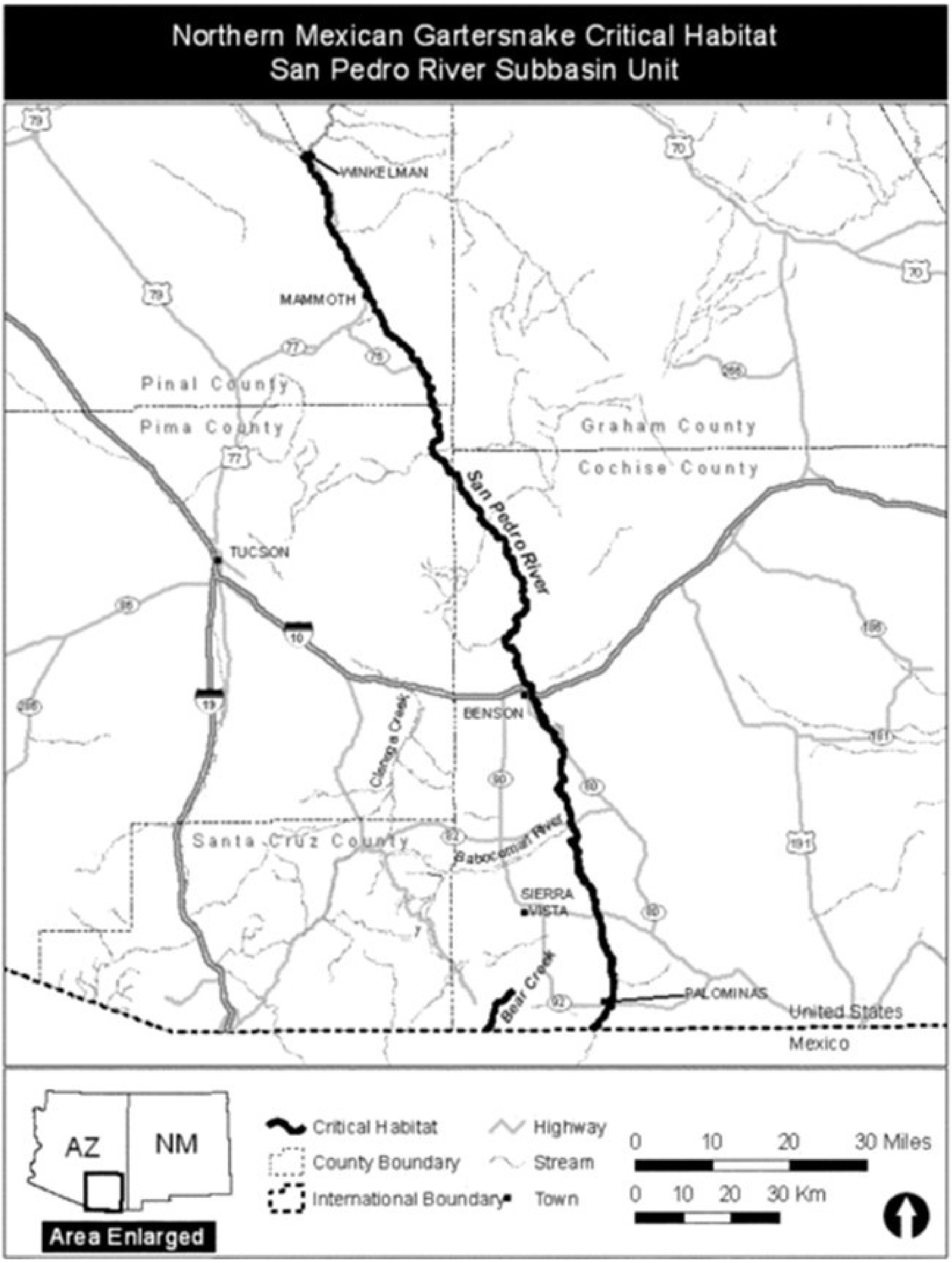

Figure NMGS-4. Map of San Pedro River Subbasin Unit proposed for designation as critical habitat: Cochise, Pima, and Pinal Counties, AZ.

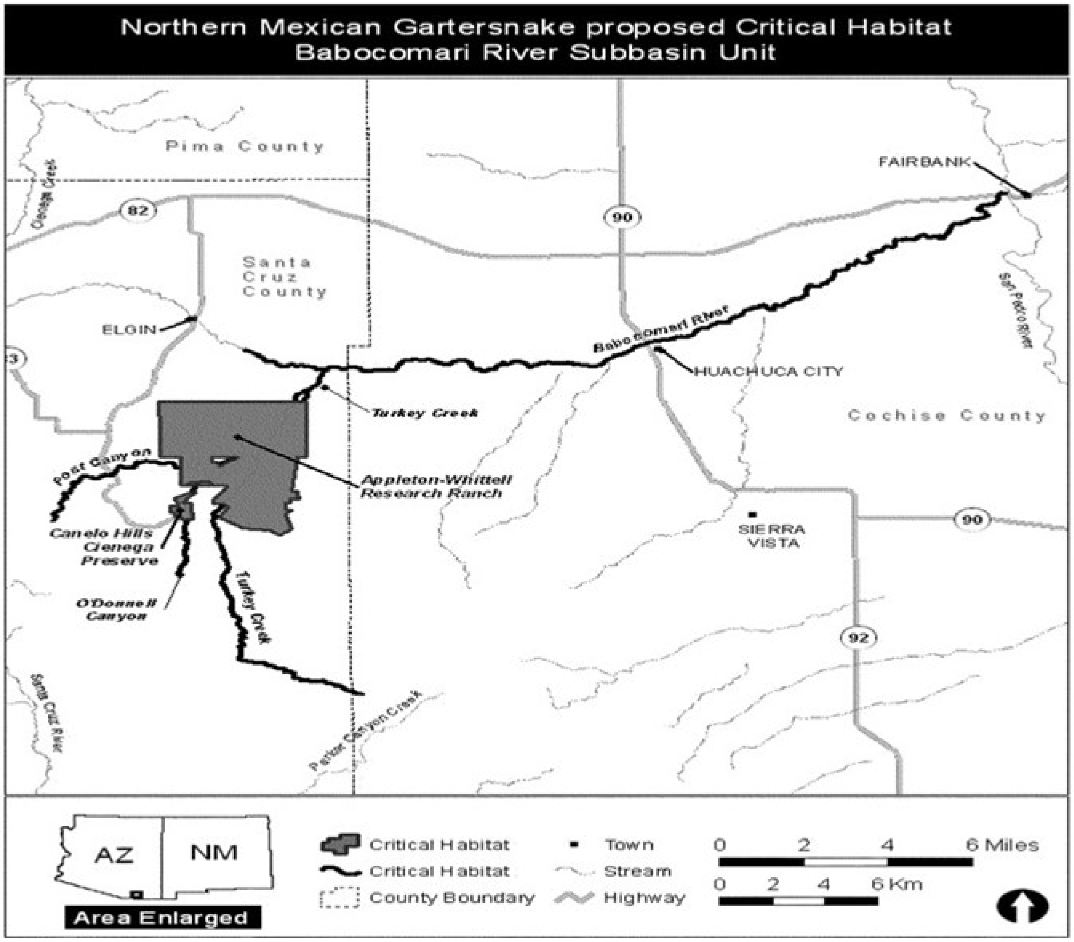

Figure NMGS-5. Map of Babocomari River Subbasin Unit proposed for designation as critical habitat: Santa Cruz and Cochise Counties, AZ.

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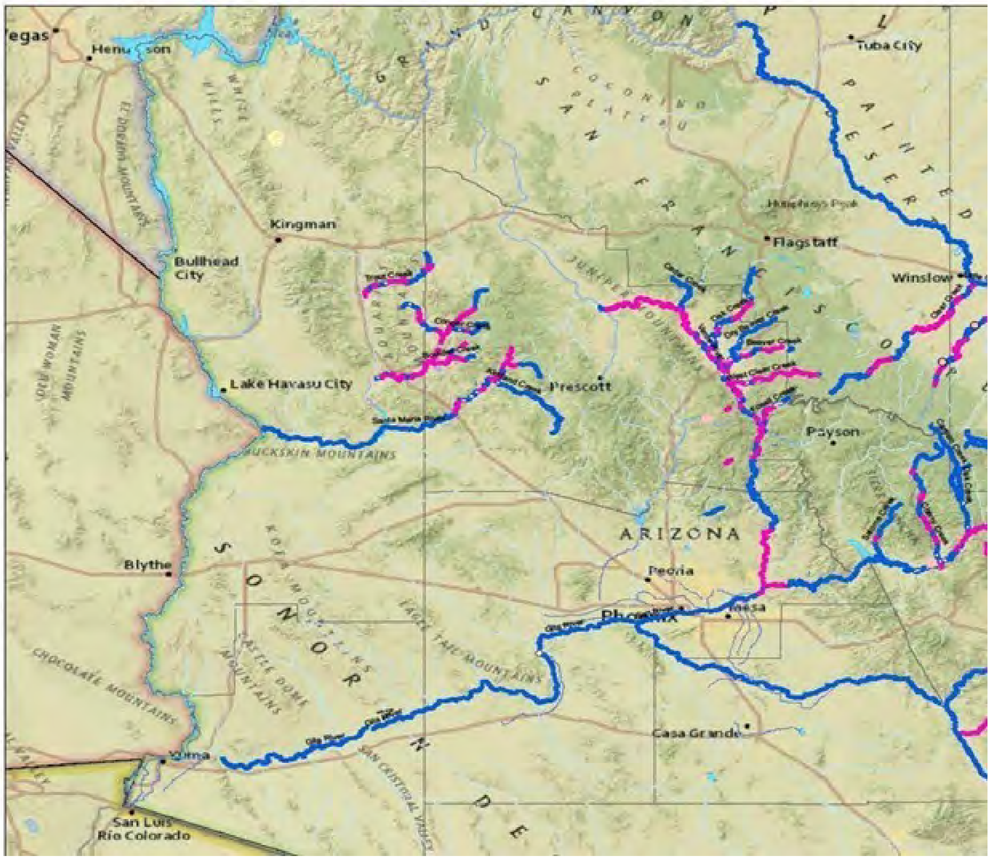

Figure RC-1. Historical Range and Current Survey Records of Roundtail chub in the LCR DPS. (Blue is the historical range and pink is current survey records plus 0.9 miles above and below the survey record site).

APPENDIX A

CONCURRENCE and CONFERENCE REPORTS

In your correspondence requesting consultation on the effects of the programmatic LRMP you concluded that the proposed action may affect, *not likely to adversely affect* the endangered Mexican long-nosed bat (*Leptonycteris nivalis*) and the endangered Canelo Hills ladies'-tresses (*Spiranthes delitescens*). You also concluded that the proposed action *is not likely to jeopardize* the continued existence of the non-essential experimental population (10j) of Mexican gray wolf (*Canis lupus baileyi*) and Northern Aplomado falcon (*Falco femoralis septentrionalis).* For the purposes of section 7(a)(2) of the ESA, we treat a non-essential experimental population as a species proposed to be listed, except when it occurs in an area within the National Wildlife Refuge System or National Park System. You also requested our concurrence with your determination that the proposed action is *not likely to result in destruction or adverse modification* for the proposed critical habitat for the western yellow billed cuckoo and the northern Mexican gartersnake. We agree with your determinations and provide our rationales below.

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is described above in the Biological Opinion/Conference Opinion (BO/CO) and is included herein by reference. In summary, the proposed action is the implementation of the LRMP on the CNF. The LRMP directs how future activities will be implemented for the programs operated by the CNF, including Wildland Fire and Fuels Management, Biophysical Features, Water Resources – Natural, Water Resources – Constructed, Soil, Air, Animals and Rare Plants, Invasive Species, Forest Products, Minerals, Public Access, Motorized Transportation System, Recreation, Scenery, Special Uses, Cultural Resources, Tribal Relations, Range Management, and Land Ownership Adjustments and Boundary Management. A summary of these programs, the ongoing and planned future activities for each program, and standards and guidelines, which minimize the effects of program activities on species and their habitats, are included above in the BO/CO.

Mexican Long-Nosed Bat

The Mexican long-nosed bat was listed as endangered in 1988 (53 FR 38456) (USFWS 1988). No critical habitat has been designated for the species. A recovery plan was completed in 1994 (USFWS 1994). Loss of roost and foraging habitat, as well as direct taking of individual bats during animal control programs, particularly in Mexico, have contributed to the current endangered status of the species. Recovery actions include roost monitoring, protection of roosts and foraging resources, and reducing existing and new threats.

The Mexican long-nosed bat is primarily a Mexican species, but occurs in the U.S. during the summer months in the mountains of the Trans-Pecos area of Texas along the Rio Grande, and in southern Hidalgo County, New Mexico. It is speculated that the Mexican long-nosed bat forages on the Douglas Ranger District in the Peloncillo Mountains; however, there are currently only one known roost location on the CNF within the Peloncillo Mountains (AGFD 2013). No new information is available that would indicate that the Mexican long-nosed bat roost or breed on NFS lands (USFS 2016). The Mexican long-nosed bat is found in desert scrub vegetation containing agaves, mesquite and a variety of cacti.

The Mexican long-nosed bat recovery plan (USFWS 1994) and listing document (USFWS 1988), discuss the status of the species, and threats, and are incorporated by reference.

The FWS concurs with your determination that the proposed action of the Coronado NF LRMP *may affect, but is not likely to adversely affect* the Mexican long-nosed bat. Our concurrence is based on the following reasons:

1. The Mexican long-nosed bat is not believed to occur in Arizona, and the only confirmed occurrences of the species on the CNF were from 1963 and 1967 in Hidalgo County, New Mexico (USFWS 2005) and a later study with Mexican long-nosed bats in 2005 (AGFD 2013). The Mexican long-nosed bat forages within the Peloncillo Mountains, and only one known roost occurs on the CNF.
2. There has been no incidental take of Mexican long-nosed bat on the CNF since the 2005 BO/CO.
3. The CNF implements conservation measures that provide for the protection of roost sites and potential roost sites. Measures such as pre-project surveys, installation of gates, and temporal and spatial restrictions, are likely to minimize most risks to the Mexican long-nosed bat if roosts are discovered on the CNF.
4. The CNF will monitor and apply adaptive management to evaluate the effects of the proposed action, as well as the effectiveness of proposed conservation measures. This process will allow the CNF and FWS to evaluate and adapt the approach of the proposed conservation measures to be as effective as possible.

Canelo Hills Ladies'-Tresses

The Canelo Hills ladies' tresses was listed as an endangered species in 1997 (USFWS 1997). Neither a Five-Year Review nor a Recovery Plan has been written for this species.

All populations of Canelo Hills ladies' tresses occur in ciénega habitats where scouring floods are uncommon. Springs are the primary water source, but a creek near one locality contributes near-surface groundwater (McClaran and Sundt 1992). The dominant vegetation associated with *Spiranthes* includes grasses, sedges, rushes (*Juncus* spp.), spike rush, cattails *(Typha* spp.), and horsetails (*Equisetum* spp.). Associated grass species include the non-native Kentucky bluegrass and Johnson grass (*Sorghum halepense*), as well as, native muhlys (*Muhlenbergia aspeifolia* and *M. utilis*; Fishbein and Gori 1994). The surrounding vegetation is semi-desert grassland or oak savannah.

Populations of this species are known to exist in only four ciénegas in southern Arizona. One population is found in Cochise County and four are found in Santa Cruz County. Plants are found at the Arizona Nature Conservancy's Canelo Hills Ciénega and on adjacent CNF lands. Three populations are found on private lands: one in the San Rafael Valley, one in the Babocomari Ciénega, and one near Turkey Creek.

Estimating Canelo Hills ladies' tresses population size and stability is difficult because non-flowering plants are very hard to find in the dense herbaceous vegetation in which they typically occur. Population size is likely to be underestimated because dormant plants may not be counted. McClaran and Sundt (1992, pp. 300-301) monitored and marked individuals in a Canelo Hills ladies' tresses population during a three-year period. They concluded that the subpopulations at both monitored sites were stable between 1987 and 1989, although Newman (1991) reported that one monitored site was reduced to one non-flowering plant in 1991. Despite searches for this species in several of the locations in recent years, no plants have been located in any population since 2006.

Threats to the Canelo Hills ladies'-tresses include groundwater pumping, water diversions, sand and gravel mining, recreation impacts, illegal collection, and invasion of cienega habitats by non-indigenous plant species, such as Johnson grass and Bermuda grass, *Cynodon dactylon* (USFWS 1997). The effect of livestock grazing on the Canelo Hills ladies'-tresses is unclear. A *Spiranthes* population growing at a site grazed for more than 100 years was found to be larger and more vigorous than a population growing at a site ungrazed since 1969 (McClaran and Sundt 1992, Newman 1991). Limited numbers of populations and individuals threaten this taxon with demographic and environmental extinction as a result of stochastic events that are often exacerbated by habitat disturbance. For instance, the restriction of the species to a relatively small area in southeastern Arizona increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought could eliminate populations or cause extinction.

The Canelo Hills ladies' tresses listing document (USFWS 1997) discusses the status of the species, and threats, and is incorporated by reference. There is no critical habitat designated for this species.

The FWS concurs with your determination that the continued implementation of the Standards and Guidelines within the CNF LRMP may affect, but is not likely to adversely affect the Canelo Hills ladies' tresses for the following reasons:

1. There is only one location of this species on the CNF, and that area is protected by a fence and excluded from livestock grazing.
2. Suitable habitat that may be present on the CNF is protected by the Standards and Guidelines that give priority to managing habitat (cienegas) to protect the productivity and diversity of riparian-dependent resources.
3. The CNF has protective Standards and Guidelinesin place to mitigate the effects of Forest activities on occupied habitat of listed species

Mexican Gray Wolf

The Mexican gray wolf was listed as an endangered species in April, 1976 (41 FR 24062) (USFWS 1976). Mexican gray wolves were extirpated from the wild in the U.S. by private and government control campaigns. A detailed account of the taxonomy, biology, and reproductive characteristics of the Mexican gray wolf is found in the Mexican Wolf Conservation Assessment (USFWS 2010), as well as the Mexican Wolf Recovery Plan (USFWS 1982). This information is incorporated herein via reference.

Historically, Mexican gray wolves were found in the eastern and central portions of Arizona. Wolves were known to occur on the CNF and on portions of the Apache National Forest as well. FWS reintroduced the endangered Mexican gray wolf into the Blue Range Wolf Recovery Area, a designated area within the subspecies' probable historic range in 1998. The Blue Range Wolf Recovery Area consists of the entire Apache and Gila National Forests in east-central Arizona and west-central New Mexico (USFWS 1998). Although historically the wolf occurred on CNF, there are no current records of the species on CNF.

The wolf's native diet consists primarily of elk (*Cervus elaphus*), Coues white tail deer (*Odocoileus virginianus couesi*), and mule deer (*Odocoileus hemionus*) (Brown 1983). Their preferred habitat is the same of their prey, pine and mixed conifer forests, pinyon juniper woodlands and adjacent grasslands above 4,500 feet in elevation (Brown 1983).

There are no known wolves occurring within the action area. If individual wolves disperse from the experimental population south into the action area, humans working near individuals could disturb the wolves, but they would only move to other areas. Livestock grazing would be managed to improve or maintain the productivity of the area, and would not affect the native prey base of the wolf.

We concur with your determination that the proposed action of the CNF LRMP is *not likely to jeopardize* the Mexican gray wolf. No critical habitat will be affected because none has been designated. Our concurrence is based on the following:

1. Any wolves likely to be found in the action area are considered part of the experimental, non-essential population, so no action could lead to jeopardy for the species.
2. The survival and reproduction of any wolves that may disperse from the experimental population into the action area would not be affected because the wolves would move to another area if disturbed, and the prey base is unlikely to be adversely affected by livestock management.
3. By definition, a nonessential experimental population is not essential to the continued existence of the species; therefore, no proposed action impacting the experimental, nonessential population so designated under the ESA §10(j) could lead to a jeopardy determination for the entire species.

Northern Aplomado Falcon

We listed the northern aplomado falcon as endangered in a Federal Register notice (51 FR 6686), dated January 25, 1986, without critical habitat (USFWS 1986). We completed a recovery plan in June 1990 (USFWS 1990). On July 26, 2006 the falcon was reclassified as a non-essential experimental population (71 FR 42298, USFWS 2006). The aplomado falcon was listed as endangered as a result of habitat degradation due to brush encroachment fostered by overgrazing and fire suppression, over-collecting; and reproductive failure caused by organochlorine pesticide use, namely DDT (USFWS 1986).

Their habitat consists of open grassland terrain with scattered trees, relatively low ground cover, an abundance of small to medium-sized birds, and a supply of suitable nesting platforms, particularly yuccas and mesquite. Typical habitat ranges in elevation between 3,500 to 9,000 feet. Woody vegetation, fence posts, and telephone poles serve as perches. Its historical range in the U.S. was limited to southeastern Arizona (Cochise and Santa Cruz counties, Arizona), southern New Mexico, and southern Texas. It was also found throughout most of Mexico south to Tierra del Fuego.

It has more limited distribution today. In 1992, breeding populations in Chihuahua, Mexico, approximately 80 miles south and 50 miles west of the U.S. border (Big Bend, Texas) were confirmed. Since then, several reliable sightings have been reported in areas west of the initial breeding population. The discovery of breeding aplomados in northern Chihuahua may be the source of aplomados recently observed in southern New Mexico and west Texas. Numerous sightings of aplomados have occurred over the years.

A broad area of northern aplomado falcon habitat occurs within the action area. For the purposes of this analysis, all grassland vegetation within the action area were considered habitat for the northern aplomado falcon. No northern aplomado falcons have been seen in Arizona since an observation in Cochise County in 1977 (AGFD 2001). In southern New Mexico, there have been numerous sightings in various location, and breeding pairs were observed in 2013 and 2014 (USFWS 2014). Future recovery of the species may all for dispersal into habitat within CNF.

The FWS concurs with your determination that the proposed action of the CNF LRMP *is not likely to jeopardize* the continued existence of the §10(j) nonessential, experimental population of the northern aplomado falcon for the following reasons:

1. No nesting or foraging northern aplomado falcons are known to occur on NFS lands in the Region, including the CNF. This is based on a lack of observations during breeding bird surveys and nest surveys;
2. Currently, moderately suitable foraging and nesting habitat occurs on the CNF; however, this area is located approximately 60 miles from the recently successful nest site near Deming, New Mexico;
3. Due to the presence of moderately suitable habitat on the CNF, there is the potential that habitat on the Forest could be colonized over the next five to 10 years. Provisions for dealing with northern aplomado falcons, including conducting surveys and protecting nesting and foraging habitats would be implemented if the species is found on USFS lands. If aplomado falcons are found on the CNF during the life of the plan, this consultation would be re-evaluated and reinitiation would occur if needed; and
4. By definition, a nonessential experimental population is not essential to the continued existence of the species; therefore, no proposed action impacting the experimental, nonessential population so designated under the ESA §10(j) could lead to a jeopardy determination for the entire species.

Kerwin Dewberry, Forest Supervisor

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APPENDIX B

Forest Land Management Plan Decisions specifically-referred to in this Biological Opinion (Objective = O; Standard = S; and Guideline = G) [1].

Kerwin Dewberry, Forest Supervisor

Forestwide/ Mgt Area/ Geo Area	Resource area	Type of decision	Number	Management Action
FW	**WUI**	**O**	**1**	Treat 5,000 to 10,000 acres in the Wildland-Urban Interface and Landscape-scale Fire using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication every year to reduce fire hazard and risk to communities and the forest
FW	**VDC**	**O**	**1**	Suppress or eradicate buffelgrass on 1,000 to 1,500 acres of Sonoran Desert every year using herbicides and manual methods.
FW	**VGC**	**O**	**1**	Treat at least 72,500 acres of grasslands using wildland fire (planned and unplanned ignitions), thinning, and mastication.
GA	**VIC**	**O**	**1**	Treat at least 5,000 acres of interior chaparral every 10 years using wildland fire (planned and unplanned ignitions) and mechanical treatments
FW	**VME**	**O**	**1**	Treat at least 367,000 acres of Madrean encinal woodlands using wildland fire (planned and unplanned ignitions) and mechanical treatments (thinning and mastication) every 10 years.
FW	**VPO**	**O**	**1**	Treat at least 25,000 acres of Madrean pine-oak woodlands using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication every10 years.
FW	**VPP**	**O**	**1**	Treat at least 12,500 acres of ponderosa pine-evergreen shrub using wildland fire (planned and unplanned ignitions) and mechanical treatments (prescribed cutting and mastication).
FW	**VDM**	**O**	**1**	Treat at least 13,800 acres of dry mixed conifer using wildland fire (planned and unplanned ignitions) and prescribed cutting every 10 years.
MA	**VWM**	**O**	**1**	Treat at least 2,400 acres of wet mixed conifer using wildland fire (planned and unplanned ignitions) and prescribed cutting every 10 years.
FW	**WET**	**O**	**1**	Restore native vegetation and natural waterflow patterns on at least 10 wetland sites
FW	**RIA**	**O**	**1**	Treat 2,500 to 10,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to maintain watershed stability and, thereby, the structure and function of streams, flood plains, and riparian vegetation.
FW	**BIP**	**O**	**1**	Install an average of two wildlife-friendly closures at mines, caves, or adits each year
FW	**NWS**	**O**	**1**	Apply for at least 10 instream flow water rights on streams for recreation and wildlife purposes, prioritizing locations necessary for sustaining native fish populations and species of conservation concern.

FW	**NWS**	**O**	**2**	Reconstruct at least 3 developed springs every 10 years to provide aquatic habitat for the recovery of plant and/or animal species.
FW	**NWS**	**O**	**3**	Complete 3 stream restoration and/or development projects to benefit aquatic species of conservation concern
FW	**COW**	**O**	**1**	Install wildlife escape ramps in all aboveground constructed waters
FW	**SOI**	**O**	**1**	Enhance or restore 2,500 to 15,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to attain necessary ground cover by litter and ground cover by plant basal area.
FW	**PUA**	**O**	**1**	Increase the number of permanent legal access routes to and within the Coronado National Forest by resolving the legal status deficiencies of 40 to 50 existing and proposed National Forest System roads and trails, using a variety of methods
FW	**MTS**	**O**	**1**	Complete maintenance on at least 150 miles of high-clearance (maintenance level 2) roads annually.
FW	**MTS**	**O**	**2**	Complete maintenance on at least 200 miles of passenger car (maintenance levels 3, 4, and 5) roads annually throughout the plan period, based on a safety prioritization.
FW	**MTS**	**O**	**3**	Decommission, close, and restore 3 to 10 miles of unneeded nonsystem roads annually throughout the plan period, except for roads identified for potential public access routes.
FW	**MTS**	**O**	**4**	Install at least one hardened road surface each year at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat in order to prevent downstream effects.
FW	**MTS**	**O**	**5**	Realign or remove 2 miles of roads in wetlands or meadows.
FW	**REC**	**O**	**1**	Reduce the backlog of recreation deferred maintenance in developed sites by 20 percent within five years of plan approval.
FW	**REC**	**O**	**2**	Retrofit or install wildlife-resistant trash cans at all developed recreation areas and wildlife-resistant food storage boxes at all developed campgrounds within 10 years of plan approval
MA	**PSR**	**O**	**1**	Annually treat 200 to 1,000 acres of exotic invasive grass populations (primarily buffelgrass and fountain grass) on the southwest slopes of the Pusch Ridge Wilderness.
GA	**CHI**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 20 percent of the Chiricahua Ecosystem Management Area to create resiliency to disturbances.
GA	**DRA**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on

				at least 15 percent of the Dragoon Ecosystem Management Area to create resiliency to disturbances.
GA	**PEL**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 35 percent of the Peloncillo Ecosystem Management Area to create resiliency to disturbance.
GA	**RIT**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 20 percent of the Santa Rita Ecosystem Management Area to create resiliency to disturbances.
GA	**TUM**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Tumacacori Ecosystem Management Area to create resiliency to disturbances. One-third of this treatment should target the area east of the Goodding Research Natural Area to Nogales, from the international border to the vicinity of Ruby Road.
GA	**HUA**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Huachuca Ecosystem Management Area to create resiliency to disturbance.
GA	**WHE**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 15 percent of the Whetstone Ecosystem Management Area to create resiliency to disturbances.
GA	**GAL**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 40 percent of the Galiuro Ecosystem Management Area to create resiliency to disturbances.
GA	**PIN**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Pinaleño Ecosystem Management Area to create resiliency to disturbances.
GA	**TER**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 40 percent of the Santa Teresa Ecosystem Management Area to create resiliency to disturbances.
GA	**WIN**	**O**	**1**	Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 10 percent of the Winchester Ecosystem Management Area to create resiliency to disturbances.
GA	**CAT**	**O**	**1**	Treat vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Santa Catalina Ecosystem Management Area to create resiliency to disturbances.

FW	**VLS**	**S**	**2**	The maximum size opening that may be created in one harvest operation to create an even-aged stand shall not exceed 40 acres except when it is following a large-scale disturbance event such as a stand-replacing fire, wind storm, or insect or disease outbreak.
FW	**VLS**	**G**	**1**	Project design should provide for wildlife movement between treated and untreated areas to increase available habitat.
FW	**VLS**	**G**	**2**	Only native plant species or short lived, non-persistent, non-native species should be used for mine reclamation purposes or wildfire treatments.
FW	**VLS**	**G**	**3**	Management activities should favor the development of native grasses in areas where they have the potential to establish and grow.
FW	**VLS**	**G**	**4**	Even-aged silvicultural practices may be used as a strategy for achieving the desired conditions over the long term, such as bringing mistletoe infection levels to within a sustainable range.
FW	**VDC**	**G**	**1**	Ground-disturbing activities that occur in an area occupied by buffelgrass should include measures to eradicate or limit the spread of buffelgrass during or following the activity and implement measures to limit the potential for its spread into unoccupied areas.
FW	**VDC**	**G**	**2**	Wildland fire (planned or unplanned ignitions) should not be used as a management activity in desert communities, except as a strategy to control invasive vegetation.
FW	**VDC**	**G**	**3**	Vegetation treatments in desert communities should provide for maintaining a sustainable population of paniculate agaves.
FW	**VDC - Grasslands**	**G**	**1**	Some patches of shrubby species, such as mesquites and yuccas, should be retained during fuel reduction projects on sites where they are appropriate under the desired conditions.
FW	**VDC-Grasslands**	**G**	**2**	Vegetation treatments in semidesert grasslands should provide for maintaining a sustainable population of paniculate agaves.
FW	**VIC**	**G**	**1**	Vegetation treatments in interior chaparral should provide for maintaining a sustainable population of paniculate agaves.
FW	**VME**	**G**	**1**	Fuel reduction and habitat restoration projects should leave clusters of live trees and shrubs to benefit species that require these structures for breeding, feeding, shelter, and other habitat needs.
FW	**VME**	**G**	**2**	Vegetation treatments in Madrean encinal woodland should provide for maintaining a sustainable population of paniculate agaves.

FW	**VPO**	**G**	**1**	Vegetation treatments in Madrean pine-oak woodlands should provide for maintaining a sustainable population of paniculate agaves.
FW	**VPO**	**G**	**2**	Clusters of trees and shrubs should be maintained in treatment areas to benefit species that require these structures for breeding, feeding, shelter, and other needs.
FW	**VPO**	**G**	**4**	An uneven-aged forest management approach should be emphasized; however, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity.
FW	**VPO**	**G**	**6**	Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area and/or lack nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.
FW	**VPP**	**G**	**1**	Vegetation treatments should be designed such that replacement structural stages are proportionally present to assure continuous representation of old growth over time.
FW	**VPP**	**G**	**2**	Slash piles from harvest activities should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
FW	**VPP**	**G**	**3**	Fuel reduction or firewood gathering projects should retain some large-diameter trees and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
FW	**VPP**	**G**	**5**	Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.
FW	**VDM**	**G**	**1**	Vegetation treatments should be designed such that replacement structural stages are proportionally present to assure continuous representation of old-growth characteristics across the landscape over time.
FW	**VDM**	**G**	**2**	Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
FW	**VDM**	**G**	**3**	Fuel reduction or firewood gathering projects should retain some large diameter trees and shrubs, and these should be protected well enough from scorching to survive

				subsequent burn treatments.
FW	**VDM**	**G**	**4**	Surveys for reforestation needs should be completed within 2 years following a wildfire or other natural disturbance greater than 2,000 acres.
FW	**VDM**	**G**	**5**	Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.
FW	**VWM**	**G**	**1**	Forest landscapes should be managed such that replacement structural stages are proportionally present to assure continuous representation of old growth over time.
FW	**VWM**	**G**	**2**	Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
FW	**VWM**	**G**	**3**	Vegetation treatments should be designed to create stand conditions that enhance cone production of white fir, corkbark fir, Engelmann spruce, and Douglas-fir in order to provide a reliable Mount Graham red squirrel food source.
FW	**VWM**	**G**	**4**	Fuel reduction or firewood gathering projects should retain some large diameter trees and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
FW	**VWM**	**G**	**6**	Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.
FW	**VSF**	**G**	**1**	Vegetation treatments should be designed such that replacement structural stages are proportionally present to assure continuous representation of old growth over time.
FW	**VSF**	**G**	**2**	Slash from firewood harvest should be managed to a level compatible with the Forest Service’s ability to protect the remaining resources.
FW	**VSF**	**G**	**4**	Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.
FW	**MOM**	**G**	**1**	There should be no new water diversions in meadows unless it can be demonstrated that there would be no significant changes to the native plant assemblage, such as species diversity and biomass.

FW	**MOM**	**G**	**2**	Meadows should not be used as staging areas for off-highway vehicles or livestock, or for storage of equipment or forest products.
FW	**MOM**	**G**	**3**	When thinning edges of meadows and clearings, all large standing trees and snags greater than 12 inches d.b.h. should be retained for bat roosting habitat.
FW	**WET**	**S**	**1**	The total acreage of existing wetlands will not be diminished due to management activities.
FW	**WET**	**G**	**1**	Livestock grazing in wetlands should only be allowed where there would be no significant deleterious effects to wetland form or function.
FW	**RIA**	**G**	**1**	New road construction in riparian areas should be avoided, except to cross drainages, unless alternate routes have greater overall resource impacts. If road construction in riparian areas is unavoidable, it should be designed and implemented to minimize effects to natural waterflow and native vegetation communities.
FW	**RIA**	**G**	**2**	Livestock grazing in riparian areas should only be allowed when there are no significant deleterious effects to riparian area structure or function.
FW	**RIA**	**G**	**3**	Vegetation treatments should favor the retention of large diameter woody debris in and near stream channels.
FW	**RIA**	**G**	**4**	Vegetation treatments should favor the retention of snags and growth of large riparian trees.
FW	**BIP**	**S**	**1**	When closing mine features and caves to public entry, pre-closure inspections shall be conducted to determine if cave dependent or other species are present. Closures will be designed and implemented to address the needs of resident or historically occurring wildlife within the constraints of meeting public safety needs.
FW	**BIP**	**S**	**2**	For caves that have been designated or nominated as “significant,” manage to perpetuate those features, characteristics, values, or opportunities for which they were designated.
FW	**BIP**	**G**	**1**	Talus slopes should not be altered and materials should not be removed from them. In areas that harbor talussnails, vegetation treatments should be designed to retain microhabitat characteristics for endemic snails and other talus-dependent species.
FW	**BIP**	**G**	**2**	Management activities should be designed to avoid or minimize the alteration of naturally occurring rocky outcroppings or cliff faces.
FW	**BIP**	**G**	**3**	Environments in caves and abandoned mines should not be altered except where necessary to protect associated natural resources or to protect health and safety. Where mine closure is necessary to protect human health and safety, closures should preserve habitats for roosting bats and

				avoid direct impacts to bats.
FW	**BIP**	**G**	**4**	Surface management activities, including drilling, in the vicinity of cave and karst features should avoid actions that would significantly impact underground ecosystems by modifying drainage patterns, subsurface airflow, or other natural processes.
FW	**BIP**	**G**	**5**	Identified bat roosts should be managed to provide for the enhancement and protection of bat populations. Protection measures may include seasonal closures, public education, and wildlife-friendly gates.
FW	**NWS**	**G**	**1**	Projects in upland habitats adjacent to streams should be designed to minimize input of sediment to streams.
FW	**NWS**	**G**	**2**	Water quality, quantity, and aquatic habitat at natural springs and seeps should be protected or enhanced.
FW	**NWS**	**G**	**3**	Fuel buildup should be reduced around natural water sources to protect them from uncharacteristic fire effects.
FW	**NWS**	**G**	**4**	Management activities should not impair soil moisture recharge at outflows of natural water sources.
FW	**NWS**	**G**	**5**	Projects affecting perennial streams should be designed and constructed to allow for the natural instream movement of native fish, except where barriers are necessary to preclude the movement of non-native species.
FW	**COW**	**G**	**1**	Wildlife escape ramps should extend to the bottom and near edge of aboveground constructed waters, and at an angle to avoid entrapment of wildlife underneath the ramp.
FW	**COW**	**G**	**2**	Artificial waters constructed for livestock should be designed and/or retrofitted to provide a year-round drinking and habitat resource for native wildlife.
FW	**COW**	**G**	**3**	Overflow should be diverted to allow for soil moisture recharge and creation or maintenance of wetland habitat features.
FW	**ARP**	**G**	**1**	Activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from approved recovery plans and signed conservation agreements.
FW	**ARP**	**G**	**3**	Active raptor nests on cliff faces should be protected from disturbance during the nesting season.
FW	**ARP**	**G**	**4**	Trash cans and food storage boxes at developed recreation areas should be wildlife resistant.
FW	**ARP**	**G**	**5**	Identified bat roosts should be protected from disturbance during periods of bat occupancy. During nonoccupancy periods, activities should not modify biophysical features that contribute to roost habitat quality or contribute to the spread of diseases harmful to bats.

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FW	**ISM**	**G**	**1**	Habitat improvement and aquatic restoration projects within or adjacent to water sources occupied by ranid frogs (see glossary), Mexican Gartersnake, Sonoran tiger salamanders, or native fish should include provisions to remove non-native invasive animals.
FW	**FOP**	**S**	**1**	Harvesting systems should be selected based on their ability to meet desired conditions and not on their ability to provide the greatest dollar return.
FW	**FOP**	**S**	**2**	On lands classified as not suited for timber production, timber harvesting should only be used for making progress toward desired conditions or for salvage, sanitation, public health, or safety.
FW	**FOP**	**G**	**1**	Timber harvest activities should be carried out in a manner consistent with maintaining or making progress toward the desired conditions in this plan.
FW	**MIN**	**S**	**1**	Permanent structures and/or occupancy for mining purposes are limited to only those that are necessary and incidental to approved mining operations.
FW	**MIN**	**S**	**2**	Only native or nonpersistent seed and plant materials will be used when revegetating disturbed sites.
FW	**MIN**	**G**	**1**	Talus slopes should not be used as a common variety mineral materials source where disturbance would destabilize the talus slopes and alter any endemic or rare species habitat or presence.
FW	**MIN**	**G**	**2**	Mine reclamation should use a geomorphic approach that results in landforms similar to adjacent natural terrain and hydrologic functions similar to natural systems to minimize long-term monitoring and maintenance requirements.
FW	**MIN**	**G**	**3**	Mining activities should incorporate reclamation measures that reduce contrasts with the surrounding landscapes.
FW	**PUA**	**S**	**1a**	Where an existing road through non-Federal lands (State, county, private, and other ownerships) to and within the Coronado National Forest, which has traditionally provided public access to National Forest System roads and trails, is closed to public use by a non-Federal landowner or agency (State, county, private, and other ownerships) and a right of public access (written or unwritten title) does not exist: a. Limit the use of the road(s) across National Forest System lands to administrative purposes or only where specifically authorized under the terms of a permit.
FW	**PUA**	**S**	**1b**	Do not allow ancillary uses of roads that are not open to the public outside the terms of a permit.
FW	**PUA**	**G**	**1**	Where no legal right of public or administrative access exists (written or unwritten title) or can't be determined, needed right-of-way easements for existing and proposed roads and trails through non-Federal lands (State, county, private, and others) adjacent to, adjoining, within, or a

				combination thereof, should be acquired using a variety of methods.
FW	**PUA**	**G**	**2**	If a non-Federal landowner or agency (State, county, private, and other ownerships) is unwilling to grant needed right-of-way easements for an existing or proposed road or trail alignment, the road or trail should be realigned and/or reconstructed. Construction around the non-Federal land onto National Forest System, other Federal, and non-Federal lands (State, county, private, and other ownerships), or a combination thereof, where a permanent legal right of public access exists should be secured unless it is not needed.
FW	**PUA**	**G**	**3**	Exclusive motorized and nonmotorized access routes across National Forest System lands to the National Forest System roads and trails from adjacent private developments, and subdivisions, and other non-Federal ownerships (State, county, and others) should not be authorized.
FW	**PUA**	**G**	**4**	Access routes across National Forest System land to National Forest System roads and trails from adjacent private developments, subdivisions, and other non-Federal ownerships or agencies (State, county, and others) should be available for use by the public. If access is not available to the public, access to the national forest from adjacent private developments, subdivisions, and other non-Federal ownerships should not be authorized.
FW	**PUA**	**G**	**5**	Legal public access to National Forest System lands should not be decreased, unless restricted for Forest Service administrative purposes
FW	**MTS**	**S**	**1**	Motor vehicle use is allowed on the designated system of roads and motorized trails shown on the motor vehicle use map that is available at each ranger district office. Motor vehicle use is prohibited in all other locations, unless it is specifically authorized by law, permit, and/or orders issued by the Forest Service in conjunction with resource management and public safety actions.
FW	**MTS**	**S**	**2**	Within inventoried roadless areas, roadless character shall be maintained.
FW	**MTS**	**G**	**1**	Where impacts to archaeological sites from road maintenance are unavoidable, they should be mitigated by adding fill to protect sites, ensuring leadout ditches and other features are not excavated within sites, or by conducting archaeological data recovery
FW	**MTS**	**G**	**2**	New road construction in meadows and wetlands should be avoided where physically or financially feasible. If these activities are unavoidable, they should be designed and implemented to minimize effects to waterflow, wetland recharge, and ecosystem function.

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FW	**MTS**	**G**	**3**	New road construction in riparian areas should be avoided, except to cross the riparian area, unless alternate routes are physically or financially infeasible or have greater overall resource impacts. If these activities are unavoidable, they should be designed and implemented to minimize effects to natural waterflow and native vegetation communities.
FW	**MTS**	**G**	**4**	Construction of roads across highly erodible soils and areas of high and very high scenic integrity should be avoided.
FW	**REC**	**G**	**1**	The recreation opportunity spectrum framework for guiding recreation planning and management and the Coronado National Forest recreation opportunity spectrum maps should be incorporated into project designs as they are planned and implemented.
FW	**REC**	**G**	**2**	Recreation sites should be managed for capacities that do not cause unacceptable resource damage or impact the landscape character.
FW	**REC**	**G**	**3**	When possible, activities that affect visitors should be scheduled outside of the major recreation season.
FW	**REC**	**G**	**4**	The Coronado National Forest paint color guidelines, the Forest Service's "Built Environment Image Guide" and the "Coronado National Forest Architectural Guidelines for Recreation Residences" should be used for public and private facilities across the Coronado.
FW	**REC**	**G**	**5**	In recreation areas popular with Spanish-speaking visitors, information should be provided in both English and Spanish.
FW	**REC**	**G**	**6**	Rock climbing should be managed to balance demand for the activity and the need to protect plants, animals, and other natural resources.
FW	**SCQ**	**G**	**1**	Projects should use the Coronado National Forest Scenery Management System maps (including scenic integrity, scenic class, and concern levels) and meet scenic integrity objectives. Additionally, projects should use the scenery management system implementation guide during project design and planning.
FW	**SCQ**	**G**	**2**	Facilities should be designed to complement the landscape by siting them to reduce scenic impacts, using dark, neutral colors, and repeating the line, form, texture, pattern, and scale of the landscape to blend structures into their surroundings. This applies to public recreation sites, administrative sites, facilities owned by other government agencies (except for Department of Homeland Security), and permitted structures. Facilities associated with locatable mining activities should blend with the natural background.
FW	**SCQ**	**G**	**3**	Department of Homeland Security should attempt to use mitigation measures at their facilities to minimize impacts to scenic quality.

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FW	**SCQ**	**G**	**4a**	Scenic integrity objectives may be temporarily lowered in the short term if necessary to meet project objectives, but should meet scenic integrity objectives over the long term
FW	**SCQ**	**G**	**4b**	Vegetation management projects should avoid even spacing of retained trees, leave a diversity of tree species and sizes, avoid damage to vegetation that will remain, and naturalize disturbed areas.
FW	**SCQ**	**G**	**4c**	Prescribed slash treatment in the immediate foreground (up to 300 feet) of concern level 1 and 2 travelways should be completed as soon as conditions permit.
FW	**SCQ**	**G**	**4d**	Healthy large trees should be favored as a larger proportion of the immediate foreground along concern level 1 and 2 travelways, unless doing so would not achieve project goals.
FW	**SCQ**	**G**	**4e**	In the immediate foreground along concern level 1 and 2 travelways, stumps should be treated to reduce their visibility by methods such as cutting as low as possible (no more than 6 inches above ground on uphill side) and angling large stump faces away from viewing locations.
FW	**SCQ**	**G**	**4f**	Log decks should be removed, and actions should be taken to naturalize skid trails as soon as conditions permit.
FW	**SCQ**	**G**	**5**	Effects from prescribed fire should be considered during project planning and implementation. Blackened and scorched vegetation may be visible in project areas in the short term following treatments, but scenic integrity objectives should be met in the long term, though blackened trunks may remain visible.
FW	**SCQ**	**G**	**6**	Range facilities are allowed in all scenic integrity objectives, but should use mitigation measures to minimize impacts to scenic quality.
FW	**SCQ**	**G**	**7**	New facilities added to communication sites, astrophysical complexes, and administrative sites should be clustered within existing areas. Facility colors and materials should blend with the landscape, structures should generally be below the height of vegetation, and vegetation that screens views to facilities should be protected and encouraged unless doing so would not achieve project goals.
FW	**SCQ**	**G**	**8**	Activities that affect scenic quality should be scheduled outside of the major recreation season, unless doing so would not achieve project goals or would conflict with wildlife restrictions.
FW	**SCQ**	**G**	**9**	New utility lines should be buried in areas with sensitive scenic resources, such as areas along scenic byways, nationally designated trails, and within recreation areas. Existing utility lines that do not meet scenic integrity objectives should be buried or relocated to reduce scenic impacts whenever opportunities become available (such as when poles are replaced).

FW	**SCQ**	**G**	**10**	Active exploratory mining may not meet the scenic integrity objectives in the short term. Exploratory mining drill pads and temporary access roads should be reclaimed by recontouring topography and revegetating sites so they mimic adjacent landscapes after project completion to meet scenic integrity objectives.
FW	**SCQ**	**G**	**11**	Mines and quarries should be reclaimed by shaping topography and vegetating sites so that they blend with adjacent landscapes unless doing so would cause greater resource impacts.
FW	**SUM**	**S**	**1**	A special use permit is required for collection of plants or animals in all zoological and botanical areas.
FW	**SUM**	**S**	**2**	Major utility corridor development is confined to the area identified and mapped in the 2008 "West-wide Energy Corridor Programmatic EIS."
FW	**SUM**	**S**	**3a**	Communications sites will be managed to the following standards: a. Maximize the colocation of new and existing buildings and structures
FW	**SUM**	**S**	**3b**	Site use shall be allocated to users on a facility-need basis.
FW	**SUM**	**S**	**3c**	Maintenance of National Forest System roads and trails to access communication sites, above and beyond normal Forest Service maintenance, or use and maintenance of private roads, will be carried out by the facility owner or association only after obtaining the proper authorizing document (e.g., road use permit).
FW	**SUM**	**S**	**3d**	Clearing of vegetation will be limited to that which poses a hazard to facilities and operational efficiency (see the communication site plan for further direction).
FW	**SUM**	**S**	**3e**	High- and low-power communication uses will be authorized only where designated as such in the communications site plans. Any potential electromagnetic interference must be resolved by the site users before construction can proceed. Senior uses on a site have priority over new or proposed uses. Microwave corridors will be protected from electromagnetic interference.
FW	**SUM**	**S**	**3f**	All new and replacement towers must be self-supporting
FW	**SUM**	**S**	**3g**	New and replacement antennas and towers will be below the height for which the Federal Aviation Administration requires lights because of the interference with the fire lookout tower and aesthetics.
FW	**SUM**	**S**	**3h**	All utility lines connecting to communications sites will be buried underground.
FW	**SUM**	**S**	**3i**	All buildings and towers will meet color requirements set forth in the Coronado National Forest's "Architectural

				Guidelines for Recreation Residences." Microwave dishes will use dark grey/brown covers. Other antennas will be dark grey/brown, when available through the manufacturer.
FW	**SUM**	**S**	**4**	Limit nonpedestrian activities (e.g., bicycle and equestrian) authorized under special use permits to existing National Forest System trails and roads
FW	**SUM**	**S**	**5**	Limit motorized special use activities to existing National Forest System roads and motorized trails.
FW	**SUM**	**S**	**6**	Require obliteration of non-National Forest System trails created by activities authorized under special use permits when the permit expires.
FW	**SUM**	**G**	**1**	Facilities should be sited and designed to blend into the landscape as much as possible. Whenever possible, heights of structures should be kept below the height of surrounding vegetation, and vegetation that screens views to utilitarian facilities should be protected and encouraged.
FW	**SUM**	**G**	**2**	Phone and power distribution lines that cross National Forest System lands to access private inholdings or Forest Service facilities should be located and designed so as to be screened by topography or vegetation as much as possible.
FW	**SUM**	**G**	**3**	Phone or power distribution line requests to cross National Forest System lands to access private lands outside the national forest boundary should not be permitted outside of existing utility corridors.
FW	**SUM**	**G**	**4**	New or reconstructed utility lines should be placed underground when possible to protect scenic resources, unless this is not feasible because of overriding environmental concerns or technical considerations.
FW	**SUM**	**G**	**5**	New electric transmission lines and natural gas pipelines should be located in existing corridors that meet the scenic integrity objective. Existing corridors that do not meet the scenic integrity objective should be relocated when construction becomes necessary.
FW	**SUM**	**G**	**6**	Public road or trail access to special use areas such as communication sites should not be restricted unless there are security, safety, or other concerns.
FW	**SUM**	**G**	**7**	Requests for permits or easements for private gates, driveways, trails, or roads to cross National Forest System lands to access private lands located outside the national forest boundary should be denied unless a public benefit can be shown, such as a reciprocal easement.
FW	**HER**	**G**	**1**	Contracts, permits, and leases that have the potential to affect cultural resources should include appropriate clauses on protection responsibilities and liability for damage.
FW	**HER**	**G**	**2**	Historic values should be considered in the development and modification of facilities.

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FW	**RAM**	**S**	**1**	Grazing permits will not be issued for domestic goats or sheep in the Galiuro or Santa Catalina Mountain ranges.
FW	**RAM**	**S**	**2**	New issuance, renewal, modification, and management of grazing permits shall comply with the Coronado National Forest's "Stockpond and Aquatic Habitat Management and Maintenance Guidelines for the Chiricahua Leopard Frog." Additionally, for the San Rafael Valley and surrounding areas, permits shall comply with the Coronado National Forest's "Stockpond Management and Maintenance Plan for the Sonora Tiger Salamander."
FW	**RAM**	**S**	**3**	In areas occupied by lowland leopard frogs, stock ponds will be managed according to the general guidance, as applicable, of the Coronado National Forest's "Stock Pond and Aquatic Habitat Management Guidelines for Chiricahua Leopard Frog" (if lowlands are included in the revised guidelines, then this no longer applies).
FW	**RAM**	**G**	**1**	Forage utilization should be based on site-specific resource conditions and management objectives, but in general should be managed at a level corresponding to light to moderate intensity (15 to 45 percent of current year's growth). Exceptions may be allowed in order to meet objectives related to scientific studies, fuels reduction, invasive plant control, or other targeted grazing or site-specific objectives.
FW	**RAM**	**G**	**2**	Burned areas should be given sufficient deferment from grazing, especially during the growing season, to ensure plant recovery and vigor.
FW	**RAM**	**G**	**3**	Construction or reconstruction of livestock fencing and replacement of nonpermeable fencing where wildlife movement is restricted should be consistent with the appropriate state wildlife agency standards for safe passage of wildlife and/or species-specific fencing guidelines developed at the local or regional level.
FW	**RAM**	**G**	**4**	Grazing management practices should be designed to maintain or promote ground cover that will provide for infiltration, permeability, soil moisture storage, and soil stability appropriate for the ecological zone. Additionally, grazing management should retain ground cover sufficient for the forage and cover needs of native wildlife species.
FW	**RAM**	**G**	**5**	Within riparian areas, structures used to manage livestock should be located and used in a way that does not conflict with riparian functions and processes.
FW	**RAM**	**G**	**6**	Treatments for restoring rangelands should emphasize the use and perpetuation of native plant species.
FW	**RAM**	**G**	**7**	Grazing intensity, frequency, occurrence, and period should provide for growth and reproduction of desired plant species while maintaining or enhancing habitat for wildlife.

FW	**RAM**	**G**	**8**	Management practices to achieve desired plant communities should consider protection and conservation of known cultural resources, including historical sites, prehistoric sites, and plants of significance to Native American peoples.
FW	**LOA**	**G**	**1**	Land exchanges should result in an improved land ownership pattern, more effective management of National Forest System lands, and foster sound community development.
FW	**LOA**	**G**	**2**	Land exchanges should not result in the creation of isolated National Forest System parcels surrounded by non-Federal lands or isolated non-Federal parcels surrounded by National Forest System lands, unless it is found to be a public benefit.
FW	**LOA**	**G**	**3a**	The non-Federal lands considered for exchange into Federal ownership should meet one or more of the following criteria: a. Lands that provide needed public and administrative access, protect public lands from fire or trespass, or prevent damage to Coronado resources.
FW	**LOA**	**G**	**3b**	Lands that contain vital threatened and endangered species habitat or vital wildlife habitat.
FW	**LOA**	**G**	**3c**	Lands providing services to the public (e.g., developed and dispersed recreation, open space).
FW	**LOA**	**G**	**3d**	Wetlands, riparian areas, and other water-oriented lands.
FW	**LOA**	**G**	**3e**	Lands that contain unique, natural, or cultural values.
FW	**LOA**	**G**	**3f**	Lands within designated wilderness.
FW	**LOA**	**G**	**3g**	Lands that will improve public land management, meet specific administrative needs, or benefit other national forest programs.
FW	**LOA**	**G**	**3h**	Lands that meet programs prescribed or endorsed by acts or reports of Congress or the Department of Agriculture.
FW	**LOA**	**G**	**4a**	Federal lands offered by the United States in a proposed land exchange should meet one or more of the following criteria: a. Lands needed to meet the needs of communities and the public.
FW	**LOA**	**G**	**4b**	Lands that provide improved public land management.
FW	**LOA**	**G**	**4c**	Lands that will improve management, benefit specific resources, or increase management efficiency.

FW	**LOA**	**G**	**4d**	Lands that have lost their wildland characteristics.
FW	**LOA**	**G**	**4e**	Lands with long-term land occupancy commitments, high management and operating costs, do not contribute significantly to achieving management objectives, have minimal benefit to the public, and would not create an isolated non-Federal parcel surrounded by National Forest System lands such as, but not limited to, recreation residence areas and administrative sites.
FW	**LOA**	**G**	**5a**	Landline location surveys should be prioritized by the following criteria: a. Where known litigation is pending, a title claim has been asserted, encroachments are suspected, or the probability of encroachment can be reduced
FW	**LOA**	**G**	**5b**	Where significant resource values exist and use or manipulation of resources is planned (this includes the location, by survey, of right-of-way easements necessary for resource management).
FW	**LOA**	**G**	**5c**	All remaining property lines.
FW	**LOA**	**G**	**6**	A BLM resurvey should be requested where there has been an extensive loss or obliteration of original corner monuments and/or where the potential for future litigation regarding the property boundaries between the national forest and private lands are high.
FW	**LOA**	**G**	**7**	Painting and excessive clearing of property lines should be avoided.
MA	**WBC**	**G**	**1**	Recreation opportunity spectrum classes in this land use zone should be primitive, semiprimitive nonmotorized, and semiprimitive motorized except in areas where the recreation setting is influenced by motorized access in adjacent land use zones or by private inholdings.
MA	**WBC**	**G**	**2**	Temporary roads should be allowed only for administrative access, national security, tribal needs, forest health projects, or fires, except in inventoried roadless areas (IRAs).
MA	**WBC**	**G**	**3**	New roads should be allowed only as needed to restore motorized public access to National Forest System land.
MA	**WBC**	**G**	**4**	Scenic resources should be managed so that human activities are minimally visually evident, as per the Coronado National Forest scenic integrity objective map.
MA	**WBC**	**G**	**5**	New utility structures and power lines should not be allowed.
MA	**RBC**	**G**	**1**	Recreation opportunity spectrum classes in this land use zone should be semiprimitive nonmotorized, semiprimitive motorized, roaded modified, and roaded natural except where there are small, remote administrative sites, developed recreation sites, and permitted facilities.

MA	**RBC**	**G**	**2**	The level and type of development should be limited in order to protect the natural character inherent in this zone.
MA	**RBC**	**G**	**3**	Managers should consider expanding the uses of existing facilities before proposing new facilities.
MA	**RBC**	**G**	**4**	New roads may be constructed, reconstructed, or relocated for a variety of public and administrative uses and needs.
MA	**RBC**	**G**	**5**	Scenic resources should be managed so that human activities are visually subordinate or blend into the landscape, as per the Coronado National Forest scenic integrity objective map.
MA	**RBC**	**G**	**6**	New utility structures and power lines should be located within existing communications sites and utility corridors.
MA	**DEV**	**G**	**1**	Recreation opportunity spectrum classes in this land use zone should be roaded natural, roaded modified, rural, and urban unless conflicting with wilderness management or needed to support the larger forest setting.
MA	**DEV**		**2**	As public facilities are constructed or renovated, they should be made more accessible to meet or exceed accessibility guidelines.
MA	**DEV**		**3**	Scenic resources should be managed so that human activities are visually subordinate and blend into the landscape as much as possible, as per the Coronado National Forest scenic integrity objective map and recreation opportunity spectrum classes. Utilitarian facilities that would not meet this guideline because of their functional requirements should be mitigated to minimize their contrast with line, form, color, texture, and scale of the surrounding landscape and built environment.
MA	**DEV**	**G**	**4**	New utility structures and power lines should not be allowed, and upgrades to existing overhead lines should be buried when replaced.
MA	**DEV**	**G**	**5**	Livestock grazing should not be permitted within developed recreation zone sites, except where designated allotments overlap with recreation area boundaries or for the purposes of targeted grazing for vegetation management.
MA	**MOT**	**G**	**1**	Recreation opportunity spectrum classes in this land use zone should be semiprimitive motorized, roaded natural, and rural.
MA	**MOT**	**G**	**2**	In off-road vehicle corridors, development of new facilities should protect natural resources and mitigate off-road vehicle impacts.
MA	**MOT**	**G**	**3**	Scenic resources should be managed so that human activities are visually subordinate and blend into the landscape, as per the Coronado National Forest scenic integrity objective map.

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MA	**MOT**	**G**	**4**	Facilities determined to be obsolete or no longer needed should be removed, except for facilities with historical significance.
MA	**CHR**	**G**	**1**	Wilderness character should be maintained or improved. This includes untrammeled, natural, and undeveloped qualities, as well as opportunities for solitude or primitive and unconfined recreation.
MA	**CHR**	**G**	**2**	Restrictions on visitor freedom (e.g., closures, permit systems, area quotas) should only be used when less invasive measures have proven insufficient to meet management objectives.
MA	**SQL**	**S**	**1**	Wilderness areas shall be managed for a scenic integrity objective of very high, except when specified otherwise in an individual wilderness management plan.
MA	**SQL**	**G**	**1**	When trees or other materials are used for building trails, fences, signage, or other structures, materials should be harvested out of view from trails and campsites. Cutting or removing materials should not be evident.
MA	**SQL**	**G**	**2**	Construction of additional structures should be limited in wilderness areas and should use a limited amount of non-native materials when native materials are available.
MA	**VEG**	**G**	**1**	Vegetation treatments should only be used to restore or maintain communities to functioning systems that are sustainable and resilient under changing climate conditions and disturbance regimes
MA	**VEG**	**G**	**2**	Gathering of dead and downed fuelwood should be limited to recreational campfire use.
MA	**FIR**	**G**	**1**	Natural unplanned ignitions should be used to obtain resource benefits.
MA	**FIR**	**G**	**2**	Prescribed fire should be used to create conditions that enable naturally occurring fires to return to their historic role or to achieve wilderness area desired conditions.
MA	**FIR**	**G**	**3**	Minimum impact suppression tactics should be used in wilderness.
MA	**ISM**	**G**	**1**	Human controls should not be applied to insect and disease life cycles, except to protect resources on adjacent lands, to protect threatened and endangered species, or when human health and safety are a concern.
MA	**WLF**	**S**	**1**	Nonnative species shall not be introduced into any wilderness area.
MA	**WLF**	**S**	**2**	Reintroductions shall only occur when a species is determined to be indigenous to the area and when it was extirpated by human-induced events.
MA	**WLF**	**G**	**1**	Nonnative species should not be introduced into areas adjacent to wilderness areas when it is likely that individuals of that species will spread to wilderness areas

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				during ordinary life processes.
MA	**SLW**	**S**	**1**	Water quality measurements shall be made with temporary use of portable equipment.
MA	**SLW**	**G**	**1**	Designated camping areas should be located on durable surfaces, and should be contained by using natural materials to create perimeter boundaries to prevent from increasing in size or compaction.
MA	**REE**	**S**	**1**	The existing recreation opportunity spectrum classification composition shall be maintained at primitive, unless specified otherwise for an individual wilderness area.
MA	**REE**	**S**	**2**	Outfitter-guide operating plans shall include appropriate wilderness practices, such as “leave no trace” principles, and incorporate awareness for wilderness values in their interaction with clients and others.
MA	**TAS**	**G**	**1**	Trail maintenance should be coordinated to avoid anticipated high use visitor periods to minimize encounters.
MA	**TAS**	**G**	**2**	New trail construction should only be considered if the objective is to enhance wilderness character (e.g., control overuse, limit resource degradation).
MA	**TAS**	**G**	**3**	Bridges should not be constructed or installed.
MA	**TAS**	**G**	**4**	Signs within wilderness areas should provide directional information only, unless a specific need exists for an individual wilderness area.
MA	**TAS**	**G**	**5**	Natural and preferably locally available materials should be used in the construction and signing of trails within wilderness areas, except when specified otherwise for an individual wilderness area.
MA	**RES**	**G**	**1**	Research proposals should not be approved in wilderness areas if locations outside of wilderness areas provide similar research opportunities.
MA	**RES**	**G**	**2**	Field marking of temporary plots, points, or other research design components should not be noticeable to visitors or impair wilderness character.
MA	**RES**	**G**	**3**	Installations, such as cameras and remote sensing equipment, should be avoided.
MA	**CHI**	**S**	**1**	The existing recreation opportunity spectrum classification shall be maintained at primitive.
MA	**CHI**	**G**	**1**	Trailhead parking areas, adjacent to the wilderness area, should be designed to passively limit visitor use to levels that maintain the wilderness character.
MA	**MIP**	**G**	**1**	Signs should be constructed from durable materials to sustain the impacts associated with the international border. In some cases, manmade materials for signs or signposts may be the most appropriate for this purpose, although

				natural-appearing materials suitable for a primitive recreation opportunity spectrum setting should be favored.
MA	**MTW**	**S**	**1**	Wilderness areas within Madera Canyon shall be managed at the highest possible scenic integrity level, with a level of very high.
MA	**MTW**	**G**	**1**	Trailhead parking areas should be designed to passively limit visitor use at levels that maintain the wilderness character.
MA	**MTW**	**G**	**2**	The existing recreation opportunity spectrum classification composition should be maintained at semiprimitive nonmotorized, or increased to primitive.
MA	**PAJ**	**G**	**1**	Signs should be constructed from durable materials to sustain the impacts associated with the international border. In some cases, manmade materials may be the most appropriate for this purpose, although natural appearing materials should be favored.
MA	**PSR**	**S**	**1**	Wilderness areas near Sabino Canyon Recreation Area, Mount Lemmon communication sites, and along the General Hitchcock Highway shall be managed at the highest possible level, with a scenic integrity level of very high.
MA	**PSR**	**S**	**2**	The existing recreation opportunity spectrum classification shall be maintained at semiprimitive nonmotorized in areas near heavily used trailheads and primitive elsewhere.
MA	**PSR**	**S**	**3**	All areas treated for exotic invasive grass populations shall be monitored and re-treated as often as necessary to prevent reestablishment of the target invasive species.
MA	**PSR**	**G**	**1**	Recreation facilities should not be developed in the Pusch Peak area.
MA	**PSR**	**G**	**2**	Trailhead parking areas should be designed to passively limit visitor use at levels that maintain wilderness character.
MA	**PSR**	**G**	**3**	Natural appearing materials suitable for a primitive recreation opportunity spectrum setting should be favored. Manmade materials should only be used in the construction and signing of trails when natural materials cannot be obtained at, or transported to, the site.
MA	**PSR**	**G**	**4**	Cross-country travel should be discouraged to limit impacts to vegetation, soils, water, and wildlife.
MA	**RNC**	**G**	**1**	Trailhead parking areas should be designed to prevent motorized trespass beyond the wilderness boundary.
MA	**WSA**	**S**	**1**	Salable minerals extraction will not be allowed.
MA	**WSA**	**G**	**1**	Wilderness study areas and recommended wilderness areas should be managed to maintain their wilderness character.
MA	**WSA**	**G**	**2**	Wilderness study areas and recommended wilderness should be managed to preserve or enhance scenic resources.

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MA	**WSA**	**G**	**3**	Wilderness study areas and recommended wilderness should be managed for primitive recreation settings.
MA	**WSA**	**G**	**4**	New recreation facilities other than trails should not be constructed.
MA	**WSA**	**G**	**5**	Timber harvest should not be permitted.
MA	**WSA**	**G**	**6**	Gathering of forest products for sale should not be permitted.
MA	**WSA**	**G**	**7**	Mechanized or motorized trails should not be designated.
MA	**WSA**	**G**	**8**	New roads should not be constructed.
MA	**EWA**	**S**	**1**	The conditions that support the classification and outstandingly remarkable values will be maintained when implementing projects.
MA	**RNA**	**S**	**1**	Salable minerals extraction will not be allowed.
MA	**AZT**	**G**	**1**	Management actions within ½ mile of the Arizona National Scenic Trail should not result in recreation setting changes from less to more developed.
MA	**AZT**	**G**	**2**	Permitted recreation special use authorizations should be managed to protect the desired recreation setting for a nonmotorized trail.
MA	**AZT**	**G**	**3**	New road or motorized trail construction across or adjacent to the Arizona National Scenic Trail should be avoided.
MA	**AZT**	**G**	**4**	Placement of new utility corridors and communication facilities should be avoided by choosing alternate locations or colocated with existing utility corridors and facilities.
MA	**AZT**	**G**	**5**	Utility lines should be buried when feasible to mitigate visual impacts.
MA	**AZT**	**G**	**6**	Forest health projects should be managed to minimize long-term visual impacts within and adjacent to the Arizona National Scenic Trail corridor.
MA	**AZT**	**G**	**7**	Fire on or in the foreground of the Arizona National Scenic Trail should be managed using minimum impact suppression tactics, or other tactics appropriate for the protection of values and resources for which the trail was designated.
GA	**CHI-Pole Bridge RNA**	**S**	**1a**	Within the Pole Bridge Research Natural Area and Proposed Pole Bridge Research Natural Area Extension: a. Vegetation cutting is prohibited, including harvest of forest products and firewood.

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GA	**CHI-Pole Bridge RNA**	**S**	**1b**	New roads or other improvements are prohibited; the use of existing roads and trails is allowed for fire management purposes.
GA	**CHI-Pole Bridge RNA**	**S**	**1c**	Camping is prohibited.
GA	**CHI-South Fork of Crave Creek ZBA**	**S**	**2a**	Within South Fork of Cave Creek Zoological-Botanical Area and the proposed Cave Creek Canyon Birds of Prey Zoological-Botanical Area: a. A special use permit is required for any plant or animal collection.
GA	**CHI-South Fork of Crave Creek ZBA**	**S**	**2b**	A special use permit is required for scientific research that would involve placing anything on National Forest System lands within the proposed zoological-botanical area.
GA	**CHI**	**G**	**1**	Cattle should be excluded from Camp Rucker to foster protection of the historic buildings and ruins.
GA	**CHI**	**G**	**2**	During vegetation treatments, considerations of mesic microenvironments for woodland and talussnails endemic to the Chiricahua Ecosystem Management Area (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides) should be incorporated.
GA	**CHI**	**G**	**3**	Incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Chiricahua Ecosystem Management Area, these species include, but are not limited to: Chiricahua fleabane, Chiricahua gentian, copper mine milk-vetch, Hinkley's Jacob's ladder, Porsild's starwort, purple-spike coralroot, Rusby's hawkweed, & smooth baby-bonnets
GA	**DRA**	**G**	**1**	Existing motorized dispersed camping areas on the west side of the ecosystem management area should be limited to defined motorized dispersed camping areas identified on the motor vehicle use map.
GA	**DRA**	**G**	**2**	During vegetation treatments, considerations of mesic microenvironments for woodland and talussnails endemic to the Dragoon Ecosystem Management Area (e.g., trees

				near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be incorporated.
GA	**DRA**	**G**	**3**	Areas disturbed by unauthorized motorized camping (outside of the defined dispersed camping areas) on the west side of the ecosystem management area should be revegetated and protected from new disturbance.
GA	**DRA**	**G**	**4**	Management activities involving ground disturbance and/or vegetation management should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Dragoon Ecosystem Management Area, these species include, but are not limited to: Coleman's coral-root, Purple-spike coral-root
GA	**PEL**	**G**	**1**	During vegetation treatments within Skull Canyon, considerations of mesic microenvironments for talussnails endemic to the Peloncillo Ecosystem Management Area (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides) should be incorporated.
GA	**PEL**	**G**	**2**	Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Peloncillo Ecosystem Management Area, these species include, but are not limited to: Chiricahua mudwort, Copper mine milk-vetch, & New Mexico bitterweed
GA	**PEL-Guadalupe Canyon ZBA**	**G**	**3a**	Within the Guadalupe Canyon Zoological Area: a. A special use permit should be issued for any plant or animal collection.
GA	**PEL-Guadalupe Canyon ZBA**	**G**	**3b**	A special use permit should be issued for scientific research that would involve placing anything on National Forest System lands within the proposed zoological area.
GA	**RIT**	**G**	**1**	During vegetation treatments, considerations of mesic microenvironments for woodland and talussnails endemic to the Santa Rita Ecosystem Management Area (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be incorporated.
GA	**RIT**	**G**	**2**	Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Santa Rita

				Ecosystem Management Area, these species include, but are not limited to: Arizona eryngo, Arizona Manihot, Ayenia, beardless chinch weed, Chisos Coralroot, Cochise woolwort, Huachuca cinquefoil, Pima pineapple cactus, purple-spike coral-root, Santa Rita yellowshow, & Southwest monkeyflower
GA	**TUM-Wild Chile BA**	**S**	**1**	Within the Wild Chile Botanical Area: a. A special use permit is required for any plant or animal collection (excluding traditional uses) and for research activities that involve placing anything on National Forest System lands.
GA	**TUM-Goodding RNA**	**S**	**2a**	Within Goodding Research Natural Area and the proposed Goodding Research Natural Area Extension: a. Do not permit livestock grazing.
GA	**TUM-Goodding RNA**	**S**	**2b**	b. Do not permit harvest of forest products, including fuelwood.
GA	**TUM**	**G**	**1**	Fuel reduction and vegetation treatments should leave islands of mesic microenvironments around riparian areas, colluvium, and woody debris on side slopes and stream channels (ephemeral and perennial).
GA	**TUM**	**G**	**2**	In rocky stream areas where large granitic boulders occur, projects should be designed to minimize or avoid impact to Mannia californica and Plagiochasma wrightii habitat.
GA	**TUM-Wild Chile BA**	**G**	**3a**	Within the Wild Chile Botanical Area: a. Planned and unplanned ignitions should be used seasonally prior to wild chile flowering and fruiting.
GA	**TUM-Wild Chile BA**	**G**	**3b**	Livestock grazing should be deferred during the growing season of wild chiles, approximately August to November.
GA	**TUM-Wild Chile BA**	**G**	**3c**	Wild chile plants should be protected when high-severity fire threatens the population.
GA	**TUM**	**G**	**4**	Management activities involving ground disturbance and/or vegetation management should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Tumacacori Ecosystem Management Area, these species include, but are not limited to, the following: Cochise woolwort, recurved corycactus, soft Mexican-orange, & Whisk fern.

GA	**HUA-Elgin RNA & Proposed Canelo RNA**	**S**	**1a**	Within Elgin Research Natural Area and the proposed Canelo Research Natural Area: a. Livestock grazing will not be permitted
GA	**HUA-Elgin RNA & Proposed Canelo RNA**	**S**	**1b**	Harvest of forest products, including fuelwood, will not be permitted
GA	**HUA**	**G**	**1**	In aquatic habitats occupied by Arizona treefrog, water levels should be maintained or enhanced during breeding season to a level adequate to support reproduction.
GA	**HUA**	**G**	**2**	Impacts from management actions such as grazing, vegetation treatments, and recreation should be mitigated within Arizona treefrog habitat.
GA	**HUA**	**G**	**3**	During vegetation treatments, mesic microenvironments for woodland and talussnails endemic to the Huachuca Ecosystem Management Area (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be protected.
GA	**HUA**	**G**	**4**	Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Huachuca Ecosystem Management Area, these species include, but are not limited to: beardless chinch weed, Cochise woolwort, elusive browallia, Huachuca cinquefoil, Huachuca milkvetch, Huachuca water umbel, Pima pineapple, purple-spike coralrootcactus, Rusby's hawkweed, & smooth baby-bonnets.
GA	**WHE**	**G**	**1**	During vegetation treatments, mesic microenvironments for woodland and talussnails endemic to the Whetstone Ecosystem Management Area (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be protected.
GA	**PIN-Goudy Canyon RNA**	**S**	**1a**	Within the Goudy Canyon Research Natural Area: a. Wildlife habitat improvement, water yield improvement, and related improvement projects are prohibited.
GA	**PIN-**	**S**	**1b**	Vegetation manipulation, including timber sale and harvest of forest products, will not be allowed except for approved research purposes.

	Goudy Canyon RNA			
GA	**PIN**	**S**	**2**	Within habitat for the Mount Graham red squirrel, no new recreational residence or developed recreation areas will be established.
GA	**PIN**	**G**	**1**	Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Pinaleño Ecosystem Management Area, these species include, but are not limited to: broad-leaf ground-cherry, leafy Jacob's ladder, Rusby's hawkweed, & white-flowered cinquefoil.
GA	**PIN**	**G**	**2**	Planned and unplanned ignitions should be used to reduce the risk of uncharacteristic wildfires that can cause sedimentation, diminished water quality, and soil erosion in talussnail habitat.
GA	**PIN-Mount Graham red squirrel habitat**	**G**	**3a**	Within habitat for Mount Graham red squirrel: a. Red squirrel habitat needs should supersede the needs of all other species of plants and animals.
GA	**PIN-Mount Graham red squirrel habitat**	**G**	**3b**	Hiking use levels should not negatively impact Mount Graham red squirrel habitat or individuals.
GA	**PIN-Mount Graham red squirrel habitat**	**G**	**3c**	Vegetation treatments should be designed and implemented to avoid disturbance of Mount Graham red squirrel middens.
GA	**CAT-Santa Catalina & Butterfly Peak RNA**	**S**	**1a**	Within the Santa Catalina and Butterfly Peak Research Natural Areas, and the proposed Finger Rock Canyon Research Natural Area: a. Livestock grazing will not be permitted.

GA	**CAT-Santa Catalina & Butterfly Peak RNA**	**S**	**1b**	Timber cutting is prohibited.
GA	**CAT**	**G**	**1**	During vegetation treatments, mesic microenvironments for woodland and talussnails endemic to the Santa Catalina Ecosystem Management Area (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be protected.
GA	**CAT**	**G**	**2**	Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Santa Catalina Ecosystem Management Area, these species include, but are not limited to: Aravaipa woodfern, Arizona eryngo, Arizona manihot, & Rusby's hawkweed

[1] Not all plan decisions in the LRMP are relevant to this biological opinion.