Nationwide Aerial Application of Fire Retardant on National Forest System Land

Biological Assessment for Fish and Wildlife Service Species



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BIOLOGICAL ASSESSMENT FOR NATIONAL FORESTS WITH SPECIES UNDER THE JURISDICTION OF FISH AND WILDLIFE SERVICE ON NATIONAL FOREST LANDS

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1 Summary

In August 2011 the Forest Service submitted a biological assessment to the United States Department of Interior Fish and Wildlife Service (Fish and Wildlife Service) for the Nationwide Aerial Application of Fire Retardant on National Forest System Land. The biological assessment analyzed the programmatic continued use of aerially applied fire retardant on National Forest System lands throughout the United States. A biological opinion was issued by the Fish and Wildlife Service in November of 2011. Supplemental and addendum consultations were conducted to address changes in avoidance area maps; additions of species, species range, or critical habitat; and instances where the Incidental Take Statement was met or exceeded. The project timeline in the consultation was January 1, 2012 through January 1, 2022, when all consultation documents expire.

In preparation for reinitiating consultation prior to the expiration, the Forest Service reviewed the Final Environmental Impact Statement (USDA Forest Service 2011a) for new information or changed conditions. The results are documented in a supplemental information report (USDA Forest Service May 2020). Based on recommendations in the supplemental information report, the Forest Service is completing a Supplemental Environmental Impact Statement and analyzing a new proposed action. This document is the biological assessment for the modified proposed action.

The modified proposed action includes updated language and clarification, adds procedures for use of new aerial retardant products, and changes monitoring requirements. This proposal would allow aerially applied fire retardants, included now or in the future on the Forest Service Qualified Products List, to be used on National Forest System lands. The proposal would protect resources and continue to improve the documentation of retardant effects through reporting, monitoring, and application coordination. Aerial retardant drops are not allowed in mapped avoidance areas for Endangered Species Act threatened, endangered, proposed, or candidate species; mapped avoidance areas for certain regional forester sensitive species; in waterways or their buffers, mapped or not, where water is present; or avoidance areas mapped by the local unit. This national direction is mandatory and would be implemented in all cases except where human life or public safety are threatened and retardant use in the avoidance area could be reasonably expected to alleviate that threat. When an application occurs inside avoidance areas for any reason, hereafter referred to as an intrusion, it would be reported, assessed for impacts, monitored, and remediated as necessary. This alternative includes the following components: aircraft operational guidance; Avoidance Area Mapping Requirements; Annual Coordination and Reporting and Monitoring Requirements; and Procedures for environmental clearance when there are additions to the Qualified Products List. The modified proposed action is described in detail within the document.

This biological assessment analyzes 438 species and 131 critical habitats that occur across National Forest System lands. Appendix D includes a complete list of species and critical habitats considered for the project. For information purposes appendix F lists those species for which the use of aerially applied retardant would have no effect on the species or its designated critical habitat. With this biological assessment the Forest Service is requesting informal consultation and concurrence that aerially applied retardant may affect but is not likely to adversely affect 162 species and 73 critical habitats. The Forest Service is requesting formal consultation on 111 species and 17 critical habitats for which aerially applied retardant may affect and is likely to adversely affect the species or designated critical habitat. In addition, the Forest Service is requesting conference opinions for 4 proposed species and 6 proposed critical habitats. The proposed action is not likely to jeopardize the continued existence of these species or adversely modify the proposed critical habitat. In order to expedite consultation at the time of final listing, this Biological Assessment provides analysis as if the proposed entities are fully listed.

2 Introduction

The purpose of this biological assessment is to analyze the extent to which implementation of the proposed action (implementation of the nationwide aerial retardant program, as updated and described in the 'Project Description' section of this document) may affect any of the threatened, endangered, or proposed species or their designated or proposed critical habitat found on National Forest System lands. This Biological Assessment is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)).

Under provisions of the Endangered Species Act, federal agencies shall use their authorities to carry out programs for the conservation of species listed as endangered, threatened, and proposed, and shall ensure that any action authorized, funded, or implemented by a federal agency is not likely to (1) adversely affect listed species or designated critical habitat, (2) jeopardize the continued existence of a proposed species, or (3) adversely modify proposed critical habitat (16 U.S.C. 1563).

This document includes a description of the proposed federal action, and the biological assessments for aquatic, wildlife, and plant species and their proposed and designated critical habitat. It follows the general format and incorporates information from previous consultations as described in the following section.

Supplements to consultation may occur:

- if there are changes in information that would alter the effects discussed in the nationwide consultation, or if there are changes to the federal action or to the status of species or critical habitats (as required by the provisions of 50 CFR 402.16),
- if authorized take is exceeded for a species,
- to approve a new retardant product, or
- if site-specific conditions warrant a request for changes to the requirements of the nationwide Biological Opinion; this includes such things as changes to the size of avoidance areas, adding provisions from local conservation agreements, or others.

Appendix E describes the process that would be used to supplement this consultation should any of the above circumstances arise.

3 Consultation History

In August 2011 the Forest Service submitted a biological assessment to the United States Department of Interior Fish and Wildlife Service (Fish and Wildlife Service) for the Nationwide Aerial Application of Fire Retardant on National Forest System Land. In September 2011 a biological assessment addressing aquatic species was submitted to the United States Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). These biological assessments analyzed the programmatic continued use of aerially applied fire retardant on National Forest System lands throughout the United States. Biological opinions were issued by the Fish and Wildlife Service and NOAA Fisheries in November and December of 2011, respectively.

Supplemental and addendum consultations were conducted to maintain currency of the consultations described above. These subsequent consultations addressed changes in avoidance area maps; additions of species, species range, or critical habitat; and instances where the Incidental Take Statement was met or exceeded. A full description of subsequent consultations is found in appendix A of the Nationwide Aerial Application of Fire Retardant on National Forest System Lands Supplemental Information Report (USDA Forest Service 2020a); a summary of those consultations is as follows:

- 2012: Fish and Wildlife Service concurrences with removal of dry intermittent streams from avoidance areas in Forest Service Regions 3, 5, and 6.
- 2015: Re-initiation or informal consultations for Taylor's checkerspot butterfly and critical habitat, northern spotted owl revised critical habitat, and woodland caribou critical habitat
- 2016: Supplemental consultation for Snake River spring and summer Chinook salmon, Snake River fall-run Chinook salmon, Snake River sockeye salmon, Snake River basin steelhead, and critical habitats.
- 2018: Supplemental consultation for wolverine, Canada lynx, gray wolf, California condor, northern long-eared bat, Gunnison sage grouse; re-initiation for Sierra Nevada yellow-legged frog and critical habitat, mountain yellow-legged frog and critical habitat, Yosemite toad and critical habitat, western yellow-billed cuckoo, and Oregon spotted frog and critical habitat.
- 2019: Supplemental consultation for bull trout and critical habitat; several population segments of Chinook salmon, steelhead, chum, Coho salmon, and sockeye salmon

The project description in the original biological assessments stated the "timeframe for this project is January 1, 2012, to January 1, 2022, and includes a 5-year programmatic compliance review." The compliance review was completed in March 2018.

The existing biological opinions expire on January 1, 2022. In preparation for reinitiating consultation prior to the expiration, the Forest Service reviewed the Nationwide Aerial Application of Fire Retardant on National Forest System Land, Final Environmental Impact Statement (USDA Forest Service 2011a) for new information or changed conditions. The results are documented in a supplemental information report (USDA Forest Service 2020a). Based on recommendations in the supplemental information report, the Forest Service is completing a Supplemental Environmental Impact Statement and analyzing a new proposed action (refer to the 'Project Description' section below). This document is the biological assessment for that action.

The Forest Service contacted the Fish and Wildlife Service Washington Office in June 2011 to initiate discussion about this consultation. Both agencies engaged in ongoing communication among various offices regarding current species lists, analysis methods, and timeframes. A draft Biological Assessment was provided to the Fish and Wildlife Service in February 2021 and comments were received by the Forest Service and discussed on March 25 or 26, 2021.

4 Project Description

The U.S. Department of Agriculture, Forest Service, proposes to continue the nationwide use of aerial application of fire retardant. Effects described within this biological assessment refer to aerial delivery of retardant only. This analysis does not address use of foams, water enhancers, ground-based application of retardants, or the environmental effects of wildland fire.

Aerial use of fire retardant is a programmatic activity with no end date. Re-initiation of consultation according to the provisions of 50 CFR 402.16 will occur if there are changes in information that would alter the effects discussed in this consultation, or if there are changes to the federal action or to the status of species or critical habitats addressed here. Any changes to the agency action, effects to the species based on new information, or species to be considered in the future will be addressed following the provisions of 50 CFR 402.16. New retardant products can be added to the Qualified Products List under the framework of this program without requiring re-initiation of the biological opinion as long as the maximum extent and duration of effects of the new products to species under the jurisdiction of Fish and Wildlife Service do not exceed the effects of other products already considered.

4.1 Proposed Action (Modified Alternative 3)

This proposal would allow aerially applied fire retardants, included now or in the future on the Forest Service Qualified Products list (Wildland Fire Chemicals), to be used on National Forest System lands as follows:

- Aerial retardant drops would be prohibited in aerial retardant avoidance areas (see definition below), which include:
    - ♦ Waterways or their buffers, whether mapped or not, when water is present (also referred to as aquatic avoidance areas)
    - ♦ All or part of the habitat of Endangered Species Act threatened, endangered, proposed, or candidate species or Regional Forester sensitive species, as mapped per the requirements described in the "Aerial Retardant Avoidance Areas Mapping Requirements" section of this proposal
    - ♦ Areas mapped by the local unit
- The above direction would be mandatory nationwide except when human life or public safety are threatened and retardant use in the aerial retardant avoidance area could be reasonably expected to alleviate the fire threat.
- When an intrusion (formerly termed 'misapplication', see definition below) occurs for any reason it would be reported, assessed for impacts, monitored, and remediated as necessary.

The definition of 'aerial retardant avoidance area' has been updated to clarify its purpose and ensure consistency in use. An aerial retardant avoidance area (also referred to simply as 'avoidance area') is defined as *an area in which application of aerial fire retardant is prohibited in order to avoid, limit, or mitigate potential impacts to specified resources*.

- The term 'aquatic avoidance area' refers to any avoidance area, whether mapped or not, that is based on the presence of waterways, or as mapped to protect Endangered Species Act threatened, endangered, proposed, or candidate species or critical habitat or Regional

Forester sensitive species or habitat associated with waterways, waterbodies, or riparian areas.

- The term ‘terrestrial avoidance area’ refers to any avoidance area that is mapped to protect Endangered Species Act threatened, endangered, proposed, or candidate species or critical habitat or Regional Forester sensitive species or habitat or other resources that are not associated with waterways or riparian areas.

The term ‘misapplication’ has been replaced by the term ‘intrusion’ for clarity of meaning. An intrusion is defined as *the intentional or unintentional application of aerial fire retardant into an aerial retardant avoidance area.*

In addition to the above direction, this proposal includes five components that provide specific direction for aircraft operations, aerial retardant avoidance area mapping, coordination, reporting and monitoring, and procedures for additions to the Qualified Products List, as described below. Additional information on implementation of these components, as well as guidance on operations planning and on the role and function of resource specialists are found in the Implementation Guide for Aerial Application of Fire Retardant (USDA Forest Service 2019 or subsequent versions).

This proposal would allow aerially applied fire retardants, included now or in the future on the Forest Service Qualified Products List, to be used on National Forest System lands. The current Qualified Products List can be found at the Wildland Fire Chemicals website. The proposal would protect resources and continue to improve the documentation of retardant effects through reporting, monitoring, and application coordination. Aerial retardant drops are not allowed in mapped avoidance areas for Endangered Species Act threatened, endangered, proposed, or candidate species; mapped avoidance areas for certain regional forester sensitive species; in waterways or their buffers, mapped or not, where water is present; or avoidance areas mapped by the local unit. This national direction is mandatory and would be implemented in all cases except where human life or public safety are threatened and retardant use in the avoidance area could be reasonably expected to alleviate that threat. When an application occurs inside avoidance areas for any reason, hereafter referred to as an intrusion, it would be reported, assessed for impacts, monitored, and remediated as necessary. Also included is direction to better protect important heritage, cultural, and tribal resources and sacred sites based on site specific recommendations.

This alternative includes the following components: Aircraft Operational Guidance; Avoidance Area Mapping Requirements; Annual Coordination and Reporting and Monitoring Requirements; and Procedures for environmental clearance when there are additions to the Qualified Products List.

Aircraft Operational Guidance

This guidance shall not require pilots to fly in a manner that endangers their aircraft or other aircraft or structures, or that compromises the safety of ground personnel or the public.

- Operational guidance to ensure retardant drops are not made within avoidance areas:

Incident commanders and pilots should follow guidance in the current version of the Implementation Guide for Aerial Application of Fire Retardant (USDA Forest Service 2019 or subsequent versions), which will be updated as needed. This guidance includes:

- ♦ Requirements for providing pilots with maps or other information about the location of all avoidance areas on the unit
  - ♦ Information on performing dry runs or other methods for ensuring retardant is not applied in avoidance areas
  - ♦ Information on when and how to terminate and resume application of fire retardant when approaching and departing avoidance areas
  - ♦ Guidance on flight conditions that allow for safe and effective use of retardant, including keeping retardant out of avoidance areas.

- Operational guidance to limit potential impacts outside of avoidance areas to species listed under the Endangered Species Act or to Regional Forester sensitive species:

Whenever practical, agency administrators and incident commanders shall use water or other less toxic suppressants in habitats of species listed under the Endangered Species Act or certain Regional Forester sensitive species, where those habitats are not mapped as avoidance areas.

- Operational guidance to provide protection of cultural resources, including historic properties, traditional cultural resources, and sacred sites:

These resources cannot be mapped using a national protocol or addressed with a standard prescription that would apply to all instances. Cultural resources specialists, archaeologists, and tribal liaisons would assist on a case-by-case basis in the consideration of effects and alternatives for protection when aerial application of fire retardant is ordered. Incident commanders would consider the effects of aerial applications on known or suspected historic properties, any identified traditional cultural resources, and sacred sites.

Avoidance Area Mapping Requirements

All forests and grasslands would review and update maps annually, following current national mapping protocols described in the Implementation Guide for Aerial Application of Fire Retardant (USDA Forest Service 2019 or subsequent versions).

Requirements for mapping or identifying aerial retardant avoidance areas are as follows:

- Any waterway (including but not limited to perennial streams, intermittent streams, lakes, ponds, identified springs, reservoirs, vernal pools, and riparian vegetation) in which water is present at the time of retardant application, and buffers extending no less than 300 feet on either side of a waterway, is considered an avoidance area (also called aquatic avoidance area), whether mapped or not.
- Mapping of waterways that are dry at the time of retardant application is not required, but these may be included in avoidance areas where there is a potential for downstream effects to occur.
- Map avoidance areas where aerial application of fire retardant may impact one or more aquatic or terrestrial Endangered Species Act threatened, endangered, proposed, or candidate plant or animal species or designated critical habitat.
- Map avoidance areas where aerial application of fire retardant may impact certain aquatic or terrestrial Regional Forester sensitive species or their habitat.
- Avoidance Areas may be adjusted for local conditions. Avoidance area buffers around waterways with water present may not be less than 300 feet on either side of a waterway in which water is present but may be increased where needed. Adjustments related to Endangered Species Act threatened, endangered, proposed, and candidate species would be coordinated with the local offices of the United States Department of Interior Fish

and Wildlife Service and National Oceanic and Atmospheric Administration National Marine Fisheries Service (hereafter referred to as the 'Services').

Annual Coordination

The Forest Service would coordinate annually with:

- local Fish and Wildlife Service and NOAA Fisheries offices,
- aviation managers and pilots, and
- cooperators/other agencies.

Coordination would ensure requirements of the provisions of the proposal are met and would maintain relationships and allow problem resolution to occur at the lowest management level. Guidance on coordination meetings would be provided in the Implementation Guide for Aerial Application of Fire Retardant (USDA Forest Service 2019 or subsequent versions).

Reporting and Monitoring

The Forest Service would maintain a database for reporting intrusions of aerially applied fire retardant into avoidance areas. Intrusion reporting requirements are described in the Implementation Guide for Aerial Application of Fire Retardant (USDA Forest Service 2019 or subsequent versions), and include requirements for upward reporting to the Services for any intrusions into avoidance areas for any threatened, endangered, proposed, or candidate species or critical habitat. The Forest Service would provide to the Services annual reports summarizing retardant use and intrusions, as well as a list of intrusions and a summary of observations and actions for each intrusion.

If a retardant drop occurs on a cultural resource, a traditional cultural property, or a sacred site, then the site condition would be assessed by a qualified archaeologist and reported to the State Historic Preservation Officer and, if appropriate, tribal representatives including the Tribal Historic Preservation Officer. If the affected resource is a sacred site, or a traditional cultural property, then tribal notification and consultation would be required as part of the determination of effects. If the effect is found to be adverse, then the agency would consult with the tribe to determine an appropriate course of action to mitigate or resolve the adverse effect.

Procedures for Additions to the Qualified Products List

Private companies submit retardants to the Forest Service for qualification. New products or new formulations of existing products must meet current Forest Service specification for long-term retardant (United States Department of Agriculture, Forest Service, Specification 5100-304 Long-term Retardant, Wildland Firefighting) to be included on the Qualified Products List. In addition to meeting those specifications, any retardant added to the Qualified Products List would meet the requirements of the Endangered Species Act as follows:

- Products or new formulations do not require additional consultation as long as the maximum extent and duration of effects of the new products do not exceed the effects of other products already considered in the biological assessments and biological opinions for this action. Products will generally meet these criteria when the percentages of retardant salts, thickeners, coloring agents, and performance ingredients in the total mixed product are similar to those in products for which consultation has been completed. Retardant salts may include diammonium phosphate, monoammonium

phosphate, ammonium polyphosphate and magnesium chloride. The toxicity levels must not exceed those of currently approved products, and there must be no new identified risk factors. The Fish and Wildlife Service and NOAA Fisheries will be notified of additions to the Qualified Products list.
- Products or new formulations that do not meet the above criteria will result in reinitiation of consultation with the Fish and Wildlife Service and NOAA Fisheries. The product is not eligible for the Qualified Products List until all required tests and consultation are completed.

In the future, any retardant that is added to the Qualified Products List could be used under the direction provided in this proposal.

Appendix A contains a consultation reinitiation framework for new chemicals. It is an updated version of a document the Forest Service provided to NOAA Fisheries in 2013 to serve as a set of standard operating procedures to clarify when reinitiation is required after new long-term retardants are developed and approved for use by the Forest Service. This framework provides additional information to help determine if new products meet the intent of the first bullet above.

4.2 Action Area

The action area for the proposed Federal action includes all National Forest System lands encompassing 193 million acres, in 9 regions (Figure 1), in 42 states, and 1 territory. This includes 154 national forests, 20 national grasslands, 13 national monuments, 24 national recreational areas, 8 national scenic areas, and 21 national game refuge or wildlife preserves (Figure 2). It also includes areas upstream and downstream of Forest Service lands where use of retardant may affect listed species or their habitat. These areas consist of numerous types of environments including terrestrial or aquatic ecosystems containing threatened, endangered, or proposed species, and any associated critical habitats. Areas where species occurrences or critical habitats occur adjacent to or in close proximity to National Forest System lands, and aerially applied fire retardant has the potential to affect species or habitats, will be addressed on a case-by-case basis in this assessment.

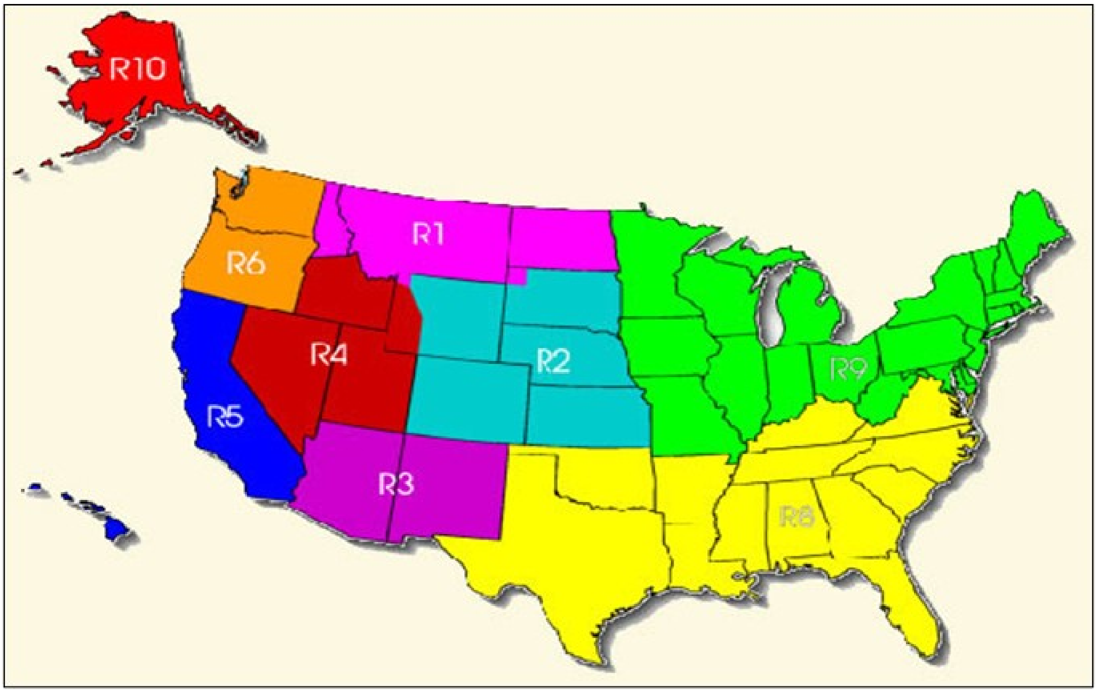

Figure 1. Map of Forest Service Regions

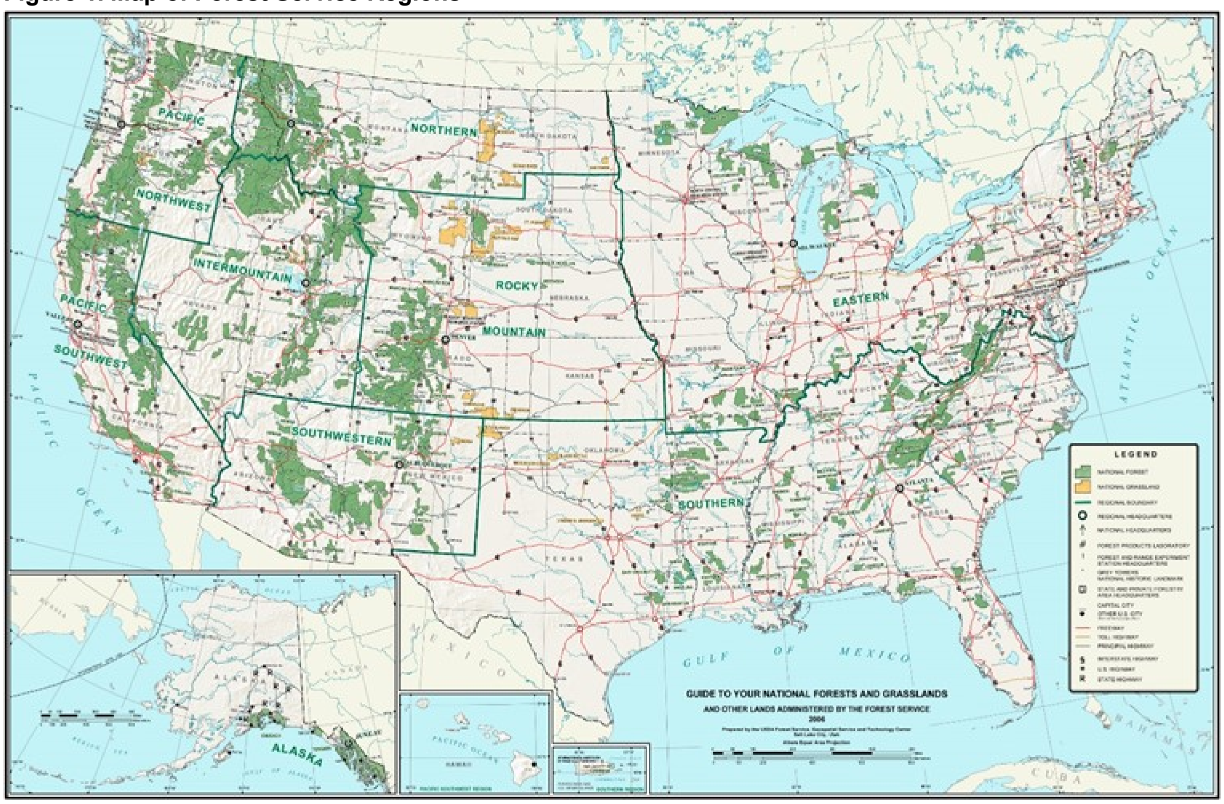

Figure 2. Map of National Forest System lands

4.3 Aerial Fire Retardant Information

This section provides information on retardant components and testing requirements, retardant use, and monitoring and reporting data. The information helps to understand the use of retardant and analyze the effects to species and habitats.

Fire retardant, which is approximately 85 percent water, slows the rate of fire spread by cooling and coating the fuels, robbing the fire of oxygen, and slowing the rate of fuel combustion with inorganic salts that change how the fire burns. Retardant is used in conjunction with other firefighting resources, most often in the building and holding of firelines. Retardant is most effective with support from ground resources but can be used to hold a fire for long duration or even stop the fire if the overall conditions favor this. In addition, retardants are used in situations where the operational tactic is too slow to influence the forward rate of spread or where effective fireline building may be impossible by other types of resources.

Retardant coverage level is a unit of measure used to describe the thickness of the chemical on the ground and is expressed in gallons per 100 square feet, abbreviated as GPC. The coverage levels range from 0.5 GPC to greater than 8 GPC. There are general guidelines for coverage levels according to fuel type, and suggested coverage levels are intended to be used as starting points only. Feedback from crews on the ground is essential in determining the effectiveness of those drops and whether the coverage should be lighter or heavier.

4.3.1 Retardant Components and Testing Requirements

Retardant formulations in use today are comprised primarily of inorganic salts and water. Forest Service specifications for long-term retardant (United States Department of Agriculture, Forest Service, Specification 5100-304 Long-term Retardant, Wildland Firefighting) includes requirements for effectiveness, safety and environmental protection, materials protection, stability, and physical properties. The Forest Service has developed unique test methods or identified standard test methods for each requirement in the evaluation process.

Although retardant is approximately 85 percent water, the inorganic salts constitute about 60 to 90 percent of the remainder of the product. The other ingredients include thickeners, such as xanthan gum; suspending agents, such as clay; dyes; and corrosion inhibitors (Johnson and Sanders 1977, Pattle Delamore Partners 1996). Corrosion inhibitors are necessary to minimize the deterioration of retardant tank structures and aircraft, which contributes to flight safety (Raybould et al. 1995).

The Forest Service is consulting on the use of aerially applied long-term retardants that meet the Forest Service specifications (United States Department of Agriculture, Forest Service, Specification 5100-304 Long-term Retardant, Wildland Firefighting). A summary of pertinent sections of the specification follows.

- Unacceptable ingredients (Section 3.4.1) include the following:
    - sodium ferrocyanide
    - dichromates
    - thiourea
    - borate or other boron-containing compounds

- polychlorinated biphenols
    - polybrominated diphenyl ethers
    - nonylphenol ethoxylates
    - ammonium sulfate
    - per- and polyfluoroalkyl substances (including but not limited to perfluorooctanoic acid and perfluorooctanesulfonate compounds).
- Environmental and health regulations (Section 3.4.2 of the specification) require a review of environmental regulations as they apply to the formulation and individual ingredients.
- Chemical profiles and risk assessments (Section 3.4.3 of the specification) are required prior to consultation.
- Mammalian toxicity (Section 3.5.2.1 of the specification) requirements:
    - Acute oral toxicity - median lethal dose (LD50) greater than 500 milligrams per kilogram for the concentrate and greater than 2000 milligrams per kilogram for the mixed product.
    - Acute dermal toxicity - median lethal dose (LD50) of greater than 2000 milligrams per kilogram for the concentrate and mixed product.
- Aquatic toxicity (Section 3.5.2.2 of the specification) - median lethal concentration (LC50) to rainbow trout of greater than 200 milligrams per liter.

The Qualified Products List is maintained on the Wildland Fire Chemicals website and will be updated as products are added or removed. Table 1 lists the long-term retardants on the September 5, 2020 Qualified Products List with a summary of their aquatic toxicity and active retarding ingredients. Both Fortress products are conditionally qualified per the October 5, 2021 Qualified Products List.

Table 1. Retardant active ingredients amounts reaching the ground at specified coverage levels

Retardant	Fish Toxicity (of concentrate)	4 GPC Coverage Level		8 GPC Coverage Level	
Fully qualified products	**LC_{50} (mg/L)**	**lbs NH_3/ft^2**	**lbs $P2O5/ft^2$**	**lbs NH_3/ft^2**	**lbs $P2O5/ft^2$**
Phos-Chek LC-95A-R	386	0.0095	0.0301	0.0190	0.0602
Phos-Chek LC-95A-Fx	399	0.0095	0.0273	0.0191	0.0546
Phos-Chek LC-95-W	465	0.0095	0.0276	0.0191	0.0553
Phos-Chek MVP-Fx	2,024	0.0053	0.0199	0.0105	0.0399
Phos-Chek 259-Fx	860	0.0070	0.0203	0.0140	0.0406
Phos-Chek LCE20-Fx	983	0.0073	0.0208	0.0147	0.0415
Conditionally qualified products	**LC_{50} (mg/L)**	**lbs Mg/ft^2**	**lbs Cl- $/ft^2$**	**lbs Mg/ft^2**	**lbs Cl- $/ft^2$**
Fortress FR-100	1,762	0.0093	0.0270	0.0185	0.0541
Fortress FR-200 LLX	3,672	0.0094	0.0275	0.0188	0.0549

4.3.2 Composition of Retardants

This section describes the composition of retardants currently approved and the chemical limits for new retardants to be included within the bounds of the existing Biological Opinions. Aerially delivered fire retardants are either a liquid concentrate or a dry concentrate. Water is added to each, diluting the products, prior to loading onto an airtanker. Various combinations of di-ammonium phosphate, mono-ammonium phosphate, ammonium polyphosphate, or magnesium chloride retardant salts have previously been or currently are contained in qualified retardant products that have been through consultation. Products containing ammonium sulfate, which was added to the unacceptable ingredients list (USDA Forest Service 2020b), are not considered in this discussion. In addition to salts, retardants may include thickeners, coloring agents, and performance ingredients (corrosion inhibitors, stabilizers, anti-caking agents, flow conditioners, etc.).

Fire retardant composition is described by percent of ingredient in the mixed product. Composition of retardant salts has ranged from nine to 20 percent of mixed products. Mono-ammonium phosphate and di-ammonium phosphate salts are commonly combined in the same product. Di-ammonium polyphosphate and ammonium polyphosphate are used individually. The amount (percent) of thickener in the mixed product ranges from 0.2 to 0.8 percent. Types of thickener and percent of total mixed product in previously approved products include guar (0.4 to 0.8 percent), xanthan (0.2 to 0.7 percent) and clay (0.3 to 0.5 percent). Coloring agents range from 0.1 to 0.3 percent of the total mixed product and include iron oxide, or fugitive (fading) colorant. Performance ingredients have comprised 0.1 to 0.8 percent of the mixed products.

Aerially delivered retardant is provided at specific coverage levels, expressed as gallons per 100 square feet (GPC), depending on the fuel types and conditions present. The amount of retardant salt delivered is dependent on the coverage level. The range of chemicals, in pounds per square foot, that would be delivered in a retardant drop at 8 gallons per 100 square feet coverage level for the retardants previously or currently approved are displayed in second column in Table 2.

Table 2. Range and upper limits in pounds per square foot (lbs/ft2) of allowable chemicals when applied at a coverage level of 8 gallons per 100 square feet of mixed product

Chemical	Range from previously or currently approved retardants	Proposed upper limit when delivered at 8 GPC
Ammonia (NH_3)	0.0105 – 0.0191 lbs/ft^2	≤ 0.02 lbs/ft^2
Phosphate (P_2O_5)	0.0399 – 0.0602 lbs/ft^2	≤ 0.07 lbs/ft^2
Magnesium (Mg)	0.0185 lbs/ft^2	≤ 0.02 lbs/ft^2
Chloride (Cl)	0.0541 lbs/ft^2	≤ 0.06 lbs/ft^2

The Forest Service proposes that the previously approved concentrations of ammonia, phosphate, magnesium, or chloride when delivered at 8 gallons per 100 square feet and displayed in Table 2 (third column) be used to establish the upper limit of retardant salts that can be included in newly developed retardants without the need for re-initiation of consultation. Upper limit values provided reflect small increases in constituent levels compared to existing values to allow for minor modifications in formulations as needed by the manufacturer without the need to re-initiate consultation. For any new formulation the toxicity levels must not exceed those of currently approved products. In addition, the maximum extent and duration of effects from new products cannot exceed effects of products already considered in order to be approved without re-initiation.

The Forest Service also proposes establishing the limits of thickeners (guar, xanthan, clay), coloring agents (iron oxide, fugitive) and performance ingredients based on the concentrations found in products that have been previously approved and consulted on. The proposed upper limits are:

- 1 percent thickener (guar, xanthan, and/or clay)
- 0.5 percent colorant (iron oxide and/or fugitive)
- 1.5 percent performance ingredients

Additional information regarding re-initiation is located in appendix A (Consultation Re-initiation Framework).

A full understanding about how retardant chemical components interacted with various elements of the environment was generally lacking during early use of the materials (pre-1990s). Over the past 2 decades, wildland firefighting agencies have conducted more monitoring and review of the environmental and safety aspects of retardant use (Auxilio August 2020 revised, Labat Environmental December 2013, Labat Environmental April 2007, Labat March 2003, Labat-Anderson Incorporated July 1996, Labat-Anderson Incorporated August 1994a, Finger 1997, Krehbiel 1992, Van Meter and Hardy 1975).

4.3.3 Retardant Use

4.3.3.1 Decision Authority

Incident commanders are the decision-makers for use of retardant; however, agency administrators can use delegations of authority to provide incident commanders with direction and expectations on the use of retardant. Every fire has an incident commander who will use the appropriate factors in determining the suppression strategy and tactics.

The single most important factor in determining strategy is the risk to human life—firefighters and the public. The Forest Service's first responsibility on every fire is to provide for firefighter and public safety (Forest Service Manual 5100). Strategies can range from quickly suppressing the fire on initial attack, to developing longer term management strategies that can simultaneously achieve Land and Resource Management Plan objectives.

4.3.3.2 Tools

Wildland Fire Decision Support System

One important planning tool is the Wildland Fire Decision Support System (WFDSS), which provides an analytical method for evaluating alternative management strategies that are defined by different goals and objectives, suppression costs, and impacts on the land management base.

Implementation Guide

The implementation guide is a 'one-stop' resource that provides forests and regions all of the information necessary to implement national direction for aerial fire retardant use as described in the Nationwide Aerial Application of Fire Retardant on National Forest System Lands Record of Decision (USDA Forest Service 2011d). The guide provides direction for personnel, including pilots, fire management officers, incident commanders, resource advisors, and others involved in the use of aerial fire retardant. It details the requirements for: reporting and monitoring at local and national levels, mapping avoidance areas, managing data, and coordinating and reinitiating consultation with regulatory agencies. It also describes requirements for funding of reporting and monitoring. The guide is updated as needed to include any changes required by supplemental consultations per Section 7 of the Endangered Species Act, as well as to address changes in technology, data, methodology, retardant products, or other items as appropriate. The current version was updated in 2019 and can be found online (Implementation Guide). The following is a summary of key points included in the implementation guide.

Instruction for mapping of avoidance areas includes reminders to use the most up-to-date maps of designated critical habitat and species occurrence/habitat maps from the Fish and Wildlife Service and NOAA Fisheries. Requirements for coordination meetings with local offices ensure that updated current species information is used and that discussion of any proposed changes in to buffer widths occurs are discussed.

The implementation guide chapter for pilots includes direction that pilot certification includes training in the use of retardant guidelines, and that the pilots receive maps of avoidance areas and briefings on the unit in advance of retardant use. It also provides guidance about the use of "dry runs" to better ensure protection of avoidance areas, and about evaluation of flight conditions to ensure that safety is maintained, and that retardant use guidance can be followed.

Fire operations guidance states that agency administrators will include in their delegations of authority direction and expectations for operations if the fire has the potential to include or already includes any avoidance areas. The initial incident management team briefing should address areas that have been identified as potential for high risk for public and fire fighter safety that fall within or overlap avoidance areas. The exception to apply retardant may be involved in these cases, so advance awareness of the potential safety risk(s), presence of avoidance areas, and potential need for use of the exception is critical. The guide also provides an example of documentation to provide when using the exception.

The chapter on reporting and monitoring states that intrusion reporting should occur as soon as possible after discovery but not later than 30 days after drops have occurred. The required assessment and coordination with local Fish and Wildlife Services or NOAA Fisheries offices then determines what subsequent actions may need to occur. Water quality monitoring as required by terms and conditions in current biological opinions will be conducted as described in those opinions.

The guide also provides information about annual tasks to be completed (by season), annual required training, and data reporting requirements. Specific guidance for pre-fire season requirements include annual coordination meetings and pilot briefings, and training for fire management personnel and pilots. The guide includes direction for coordination and data reporting during the fire season, as well as guidance for completion and submission of summary reports of intrusions to the Services. Annual summary reports are generally to be submitted by April 1 of each year, and will include information on retardant use, reported intrusion rate, and a list of intrusions, by forest, impacting threatened or endangered species. A meeting between the Forest Service and the Services will occur by May 15 of each year to discuss the summary reports, any changes in the program, or concerns of the agencies.

4.3.3.3 Retardant Delivery

Aircraft

The use of aircraft (fixed and rotor wing) for the delivery of fire retardant is one of many suppression tools used by fire managers. Retardant is delivered by large and very large airtankers, single engine airtankers, and helicopters, and fills an essential link in the overall suppression strategy. The main principle in the use of aerially delivered retardant is to use it early in sufficient quantity, dropped from an effective altitude with minimum time lapse between each drop.

Figure 3. Aerial retardant application for building fireline

Retardant is normally stored and mixed at an airtanker base, or in some instances, on-site near a fire incident. Containment and water treatment systems are required for retardant loading pits, mixing and pump areas, storage tanks, areas where retardant deliveries are received, and where loaded airtankers are staged for dispatch. When retardant is mixed at the incident site, a mobile retardant base (portable mixing system) is used. Water sources are typically municipal water supplies or a large lake or reservoir. Mobile retardant bases are required to have a site spill containment plan, secondary containment systems, and set up at least 300 feet from any waterway if water is present. It also requires compliance with the Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations, PMS 444 .

Figure 4. Helitanker at mobile retardant operation

Airtanker and helicopter types are distinguished by their retardant tank capacity (National Wildfire Coordinating Group Standards for Wildland Fire Resource Typing). Helicopters can deliver retardant either with a bucket or with a "fixed tank", referred to as a "helitanker.". Supplying helicopters is the primary reason for setting up mobile retardant bases. "portable retardant bases."

Operational Considerations

Fire statistics have been maintained for many years and are a key consideration in the distribution of airtankers and other aerial resources. Potential weather events are taken into consideration, as well as fuel moisture indices and whether there are multiple geographic areas experiencing high fire activity. In evaluating fire statistics and fire history, the number of fires successfully controlled at the initial and extended attack stages has generally averaged well over 90 percent nationwide.

Most retardant delivery occurs on ridge tops and adjacent to human-made or natural fire breaks, such as roads, meadows, old fire scars, and rock outcrops. Occasionally, retardant is applied adjacent to aquatic environments that are being used as a natural fire break. Applying retardant adjacent to these human-made or natural fire breaks enhances the effectiveness of fire breaks by widening the fire break. This is especially important when applying adjacent to aquatic environments.

How much fire retardant drifts depends on the height and speed of the aircraft at the time of the drop, wind direction, and wind speed. Fire retardants include a gum thickening agent which raises the viscosity and creates larger and more cohesive droplets to reduce drift. There are guidelines for the use of aircraft during suppression activities to ensure that operations can be conducted in a safe and effective manner (NWCG Standards for Aerial Supervision NFES 002544, February 2020). These include suspending flights during poor visibility and when wind conditions result in unsafe or ineffective operations.

4.3.3.4 Aerial Retardant Use Data

Monitoring and Reporting

Since 2012 the Forest Service has provided a yearly summary of retardant use and reports of retardant intrusions into avoidance areas to the Fish and Wildlife Service and NOAA Fisheries. The Forest Service has compiled data on aerial retardant use and fires from 2012 through 2019 (USDA Forest Service 2020d) and provided a summary of the data to the Services. Information in the following sections is used to monitor retardant use and to develop reports.

Retardant Use Data

Data derived from Aviation Business System indicates approximately 102 million gallons of retardant (approximately 56,868 drops) were aerially applied to National Forest System lands in the eight years from 2012 through 2019 (USDA Forest Service 2020d). It is estimated that the average annual acreage of National Forest System lands that have retardant applied is between 8,586 and 22,552 acres, which is approximately 0.004 to 0.012 percent of the total National Forest System landbase annually[1] . Forest Service Regions 1 (Northern Region), 3 (Southwestern Region), 4 (Intermountain Region), 5 (Pacific Southwest Region), and 6 (Pacific Northwest Region) apply higher amounts of retardant compared to other regions.

One of the precepts of the 2011 Record of Decision was to use aerially delivered water where possible to limit the impacts of aerially applied retardant. Table 3 displays the amount of product delivered aerially by percent of total, by year. This data is available by forest and Forest Service region in the summary report (USDA Forest Service 2020d).

Table 3. Percent of total aerially delivered fire retardant chemical by type and year

Year	Retardant Percent	Water Percent	Foam or Water Enhancer Percent
2012	11	89	0
2013	15	84	1
2014	15	84	0
2015	18	82	0
2016	20	80	0
2017	18	82	0
2018	58	41	0
2019	18	82	0

[1] The methodology used to compute acres impacted by retardant has been updated since the 2011 consultations, to better reflect actual retardant amount reaching the ground. Some difficulties in calculation remain. . During aerial retardant operations, retardant drops are usually overlapped to provide desired coverage levels. The overlap is not accounted for in these calculations, so the acres impacted as displayed here is likely overestimated.

Use of aircraft for firefighting can result in disturbances to species and habitat. There is a potential for varying levels of effects dependent upon the type of aircraft used. Table 4 displays the percent of retardant delivered by airtanker or helicopter by year. This data is available by forest and Forest Service region in the summary report (USDA Forest Service 2020d). The data is not available by airtanker or helicopter type.

Table 4. Percent of retardant by airtanker or helicopter, by year

Year	Airtanker Percent	Helicopter Percent
2012	83	17
2013	75	25
2014	82	18
2015	89	11
2016	84	16
2017	81	19
2018	98	2
2019	98	2

Use of aerially delivered retardant varies by Forest Service region, as shown in Figure 1 and Figure 6, and Table 5 below. This information is used in this analysis to estimate where aerially delivered retardant may be used in the future (refer to the ‘Effects Analysis’ section in this document for more information).

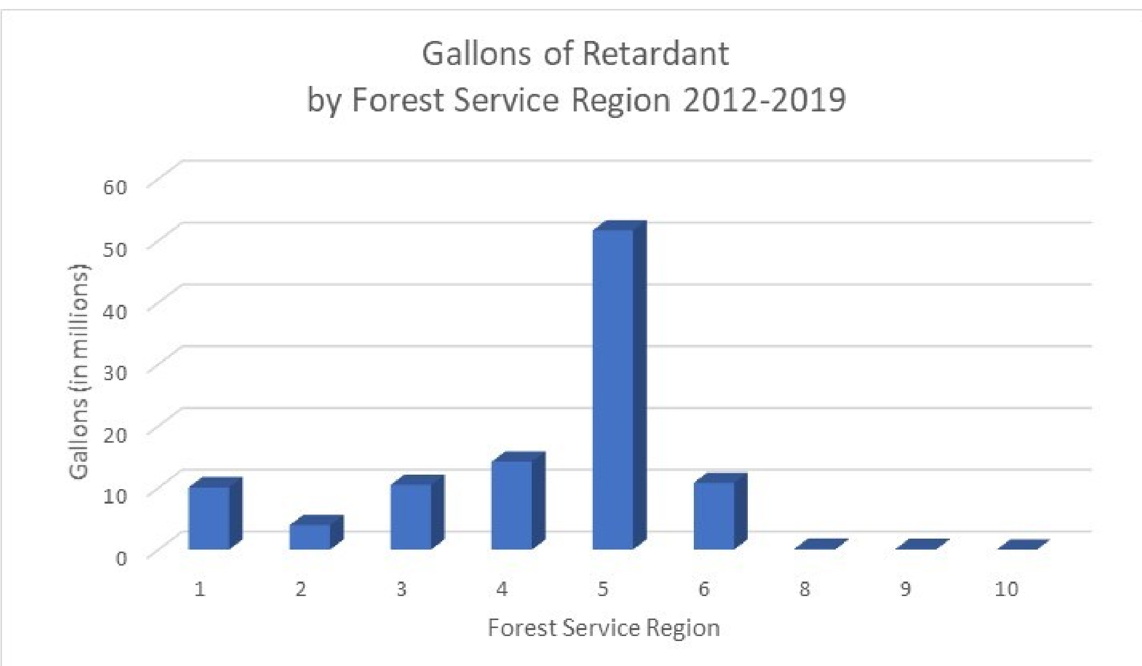

Figure 5. Fire retardant use by Forest Service region, 2012 through 2019

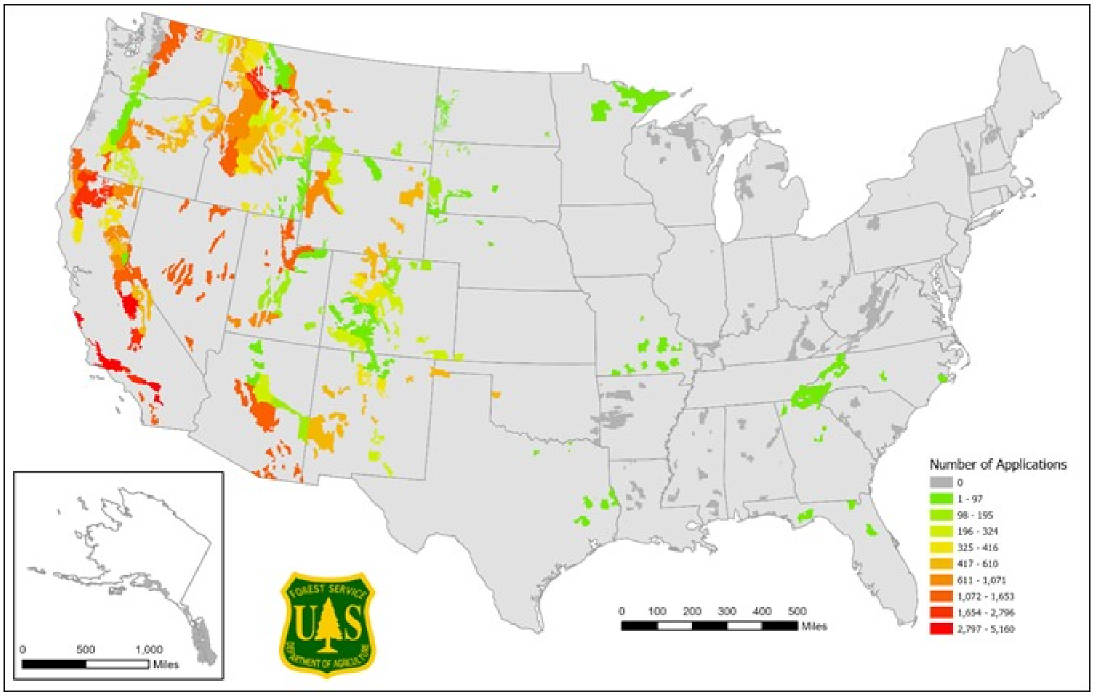

Figure 6. Aerial fire retardant applications on National Forest System lands, 2012 through 2019

Table 5. Estimated area of aerial fire retardant application on National Forest System lands, by Forest Service Region, 2012 through 2019

Region	NFS Acres	Number fires	Estimated number retardant drops	Total gallons retardant	Average gallons retardant per year	Estimated acres impacted at 4 GPC	Estimated acres impacted at 8 GPC	Maximum estimated percent NFS land impacted at 4 GPC	Maximum estimated percent NFS land impacted at 8 GPC
1	25,449,819	6,398	6,055	10,898,227	1,362,278	1056-2401	914-1890	0.0094	0.0074
2	22,056,205	4,116	2,205	3,969,286	496,161	385-874	333-688	0.0040	0.0031
3	20,530,401	8,665	5,824	10,482,975	1,310,372	878-1997	878-1572	0.0097	0.0077
4	31,786,447	5,080	7,906	14,230,632	1,778,829	1056-2401	914-1890	0.0076	0.0059
5	20,261,051	10,415	28,713	51,683,580	6,460,448	5007-11387	4335-8964	0.0562	0.0442
6	25,114,875	9,893	6,009	10,816,422	1,352,053	1048-2383	907-1876	0.0095	0.0075
8	13,425,610	4,867	93	167,817	20,977	16-37	14-29	0.0003	0.0002
9	12,177,242	3,234	63	113,092	14,137	11-25	9-20	0.0002	0.0002
10	22,148,457	115	0	0	0	0	0	0	0
Total	192,950,107	52,783	56,868	102,362,031	12,795,254	9916-22552	8586-17753	0.0117	0.0092

Intrusions

An intrusion, previously referred to as a misapplication, is defined as "any application of aerial retardant, accidental or allowed under the exception, into an avoidance area". From 2012 through 2019 there were 245 fires with intrusions (0.46 percent of the total fires). There was a total of 455 reported intrusions on those fires. Table 6 summarizes the intrusion reports and appendix C includes additional information.

Table 6. Summary of intrusion reports, by year

Year	Number of fires with intrusions	Number of intrusion reports on FS lands[1]	Number of intrusions into water	Number of intrusions into water buffer only	Number of intrusions into terrestrial avoidance areas	Number of accidental intrusions	Number of exception intrusions	Total number of fires	Total retardant used (gallons) in year	Estimated numbers of drops delivered by aircraft (gallons retardant/1800)	Total drops in avoidance areas divided by estimated drops (%)	Percent of fires with intrusions (%)	Total intrusions divided by estimated drops (%)
2012	39	72	26	44	2	52	20	7725	8,540,914	4745	2.5	0.50	1.52
2013	31	55	22	31	2	43	12	7588	12,218,348	6788	1.4	0.41	0.81
2014	31	37	21	15	1	33	4	6910	8,896,234	4942	1.2	0.45	0.75
2015	27	51	37	12	2	41	10	6835	11,594,937	6442	1.2	0.40	0.79
2016	31	60	32	14	14	46	14	5772	19,021,716	10568	1.4	0.54	0.57
2017	35	75	53	19	3	64	11	6869	18,943,573	10524	1.2	0.51	0.71
2018	35	88	46	26	16	76	12	5739	16,376,813	9098	2.1	0.61	0.97
2019	15	21	11	3	7	14	7	5412	6,769,496	3761	1.0	0.28	0.56
Total	244	459	248	164	47	369	90	52850	102,362,031	56868	1.5	0.46	0.81

[1]An intrusion report refers to each location where retardant enters the avoidance area, with the location reported by latitude and longitude. An intrusion can consist of a single retardant drop or multiple retardant drops.

Please note that this data is different than that reported to the Fish and Wildlife Service and NOAA Fisheries in the yearly monitoring report. The yearly reporting summarizes the number of intrusions into waterways and waterway buffers only. Additionally, the estimated number of drops was calculated differently over the years. The summary in Table 6 standardizes the calculation for estimated number of drops.

The Wildland Fire Chemical Misapplication Reporting database identifies intrusions by their location as identified by the reported latitude and longitude coordinates. Appendix B contains maps of the intrusions reported from 2012 through 2019. The maps identify the intrusions by area and type. Table 7summarizes the intrusion type as accidental or exception by Forest Service Region. Possible intrusion areas include waterway; waterway buffer; dry intermittent stream; aquatic threatened, endangered, proposed, candidate or sensitive species habitat; or terrestrial threatened, endangered, proposed, candidate or sensitive species habitat. Because some intrusions occur in multiple areas (i.e., waterways, buffer zones, etc.), when summarized a priority order is used to document intrusions. That order is aquatic threatened, endangered, proposed, candidate or sensitive species; terrestrial threatened, endangered, proposed, candidate or sensitive species; waterway; waterway buffer; and dry intermittent stream. In other words, if an intrusion occurs across an area that includes the waterway, buffer zones, and aquatic listed species habitat, the intrusion is indicated as occurring in aquatic listed species habitat. Table 8 summarizes the intrusions by area as mapped.

Table 7. Summary of intrusion reports by Forest Service region, identified as 'accident' or 'exception', for the period 2012 through 2019

Region	Accidental	Exception	Total
Region 1	30	2	32
Region 2	10	5	15
Region 3	11	4	15
Region 4	110	11	121
Region 5	190	62	252
Region 6	19	2	21
Region 8	0	2	2
Region 9	0	1	1
TOTAL	370	89	459

Table 8. Summary of intrusion reports by Forest Service region, identified by location of intrusion

Region	Aquatic TEPCS	Terrestrial TEPCS	Waterway	Waterway buffer	Dry intermittent stream	unknown	TOTAL
Region 1	9	0	16	6	1	0	32
Region 2	1	0	8	4	2	0	15
Region 3	5	1	4	4	1	0	15
Region 4	20	11	45	28	12	5	121

Region	Aquatic TEPCS	Terrestrial TEPCS	Waterway	Waterway buffer	Dry intermittent stream	unknown	TOTAL
Region 5	56	22	92	48	33	1	252
Region 6	10	2	6	3	0	0	21
Region 8	1	0	1	0	0	0	2
Region 9	1	0	0	0	0	0	1
Total	103	36	172	93	49	6	459

Some intrusions have resulted in take of threatened and endangered species, as described in the Incidental Take Statements (ITS) in the Biological Opinions (USDI Fish and Wildlife Service 2011, USDC National Oceanic and Atmospheric Administration 2011). There are incidental take statements for 73 species: 33 plants, 23 fish, 3 birds, 1 reptile, 4 amphibians, and 7 terrestrial invertebrates; 15 evolutionarily significant units of salmon; 11 distinct population segments of steelhead; and 4 anadromous fish species. The amount of take for a species was described as acres affected or miles of stream impacted, or in some cases as a number of drops/intrusions in a specified area. For some species with wide distribution, take was allocated for each Forest based on the amount of occupied or suitable habitat that occurs on the Forest. Table 9 provides a summary of intrusions that resulted in take from 2012 through 2019. A complete listing of intrusions into avoidance areas is found in appendix C.

Table 9. Intrusion events resulting in take of threatened or endangered species

Species	Forest	Incident	ITS Authorized Take	Reported Take	Take Remaining
Quino checkerspot butterfly	San Bernardino	2013 Mountain 2019 Bautista	46.0 acres	25.1 acres 8.68 acres	20.9 acres 12.22 acres
Snake River sockeye salmon, spring/summer-run chinook salmon, and steelhead	Sawtooth	2013 210 Road	one intrusion event	one intrusion event	none
upper Columbia River steelhead	Okanagon-Wenatchee	2014 Carlton Complex	one intrusion event	one intrusion event	none
bull trout	Okanagon-Wenatchee	2014 Carlton Complex	6.7 miles	0.3 miles	6.4 miles
bull trout	Boise	2014 Bull Creek	5.0 miles	1.0 miles	4.0 miles
bull trout	Lolo	2017 Lolo Peak 2017 Rice Ridge 2017 Sunrise	1.6 miles	5.1 miles 24.97 miles 13.5 miles	take exceeded

Species	Forest	Incident	ITS Authorized Take	Reported Take	Take Remaining
Snake River spring/summer-run chinook salmon and steelhead	Sawtooth	2016 Dry Creek	one intrusion event	second intrusion event	take exceeded
Arroyo toad	Los Padres	2016 Rey 2016 Sobaranes	10.0 miles	unknown unknown	
Southern California coastal steelhead	Los Padres	2017 Thomas	one intrusion event	one intrusion event	none
Southern Oregon northern California coast coho salmon	Rogue River	2018 Nachez	one intrusion event	one intrusion event	none

Take for bull trout was exceed in 2017 on the Lolo National Forest and consultation was reinitiated. The Supplemental Amendment Biological Opinion (USDI Fish and Wildlife Service 2019) adopted seven additional Conservation Measures, valid through the term of the original action, January 1, 2022.

4.3.3.5 Avoidance Areas

Avoidance areas were mapped beginning in the 2012 fire season. Each year Forests update their avoidance area maps prior to the fire season. They provide two data layers, an aquatic avoidance area layer based on water bodies, and a species avoidance area layer. These layers are combined to create avoidance area maps. In 2019 a summary of the percent of total National Forest System lands in perennial stream avoidance areas, intermittent stream avoidance areas, and threatened, endangered, proposed, candidate and sensitive species avoidance areas was completed. In total, 20 percent of National Forest System lands were included in avoidance areas as of 2020. Of that, approximately 10.1 percent are perennial stream avoidance areas, 7.9 percent are intermittent stream avoidance areas, and 3.5 percent are terrestrial species avoidance areas. The individual percentages do not total to 100 percent because of overlap in the categories. The summary report (USDA Forest Service 2020d) includes data for each Forest and Forest Service Region.

4.3.3.6 Fire Season

The term 'fire season' generally refers to the time of the year when fires occur. It varies by location and yearly weather patterns. In general, the peak seasons are described by Forest Service region as shown in Table 10.

Table 10. Peak fire season, by Forest Service region, based on historical data

Region	Peak fire season
1	April - October
2	June – October
3	May – July
4	June - October

Region	Peak fire season
5	August - October
6	June - October
8	September - July
9	April - October
10	June - September

This information can be helpful in determining the potential for retardant use during critical life stages for a species. In order to look at potential changes over time, in a given year, or between regions or forests, a summary of fire statistics from 2000 through 2019 was completed from the Firestat database (USDA Forest Service 2020d). Summarized data includes number of fires by month, percent of total fires by month, acres burned by month, and percent of acres burned by month. The data is tabulated in the following groups:

- By Region for the period 2000-2019
- By Region for each year in the period 2000-2019
- By National Forest for the period 2000-2019

Charts were also created for a visual representation. Examples of the available data are provided below (Table 11, Figure 7, Figure 8, Figure 9).

Table 11. Acres burned, by Forest Service Region and by month for the period 2000 through 2019. Total fire acres are attributed to the month in which the fire started

Region	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
1	183.45	338.36	7127.86	23338.62	6801.96	291052	2194360	2500531	203901	5101.57	689.11	170.15	5233595.2
2	6393.03	12725.94	41488.43	27370.9	67441.06	996410.2	516573	473715.9	120333	76968.75	7910.16	387.55	2347717.9
3	3243.12	27332.08	504249.9	393431.2	1888943	2192153	704472.9	202722.5	89003.8	16049.66	23471.28	8648.99	6053721.1
4	3184.71	224	363.6	1339.94	55250.16	579648.8	3008946	2818069	366080.5	21633.05	3564.73	6.18	6858310.4
5	15954.66	22778.68	2238.84	11034.57	100500.6	1219670	3056888	1799669	740832.1	1226349	54577.4	306505.4	8556998.3
6	7	7.52	158.13	427.29	2626.65	237832.7	2413662	2514558	357797.7	10646.03	1909.03	120.37	5539752
8	40502.64	103835	220135.2	230986.3	189498.7	88771.44	33592.63	32947.72	26464.66	112578.8	155043.7	23276.72	1257633.5
9	6213.95	17333.66	41750.73	56408.77	94431.52	2537.5	40199.43	95998.08	6945.91	4097.29	23907.26	1514.09	391338.19
10	0	0	1.5	327.52	207.74	170639.4	23.68	24.71	13.35	0.65	0.3	0	171238.81

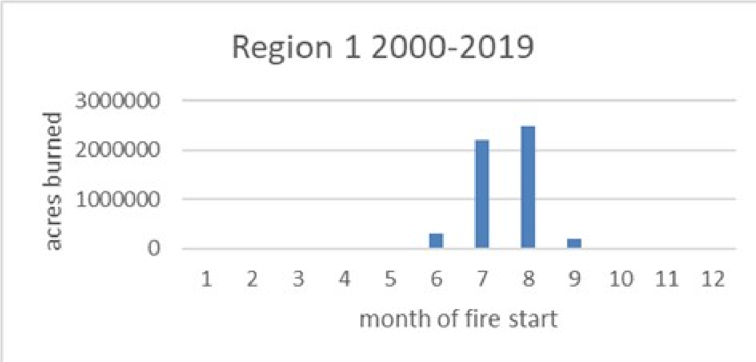

Figure 7. Acres burned, by month of fire start in Forest Service Region 1, from 2000 through 2019

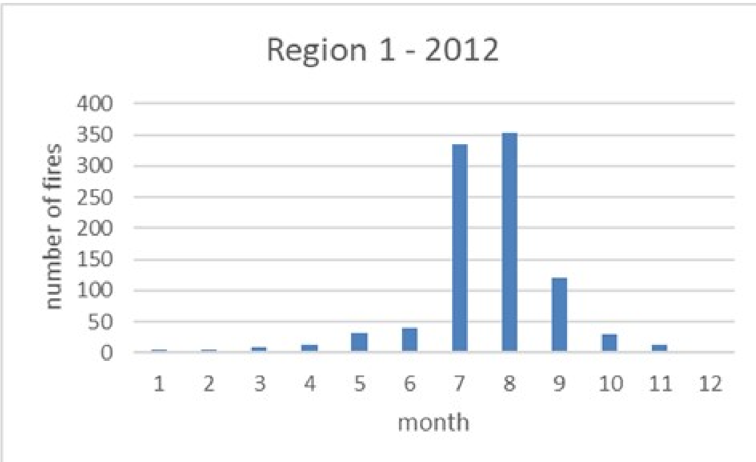

Figure 8. Number of fires in 2012, by month, in Forest Service Region 1

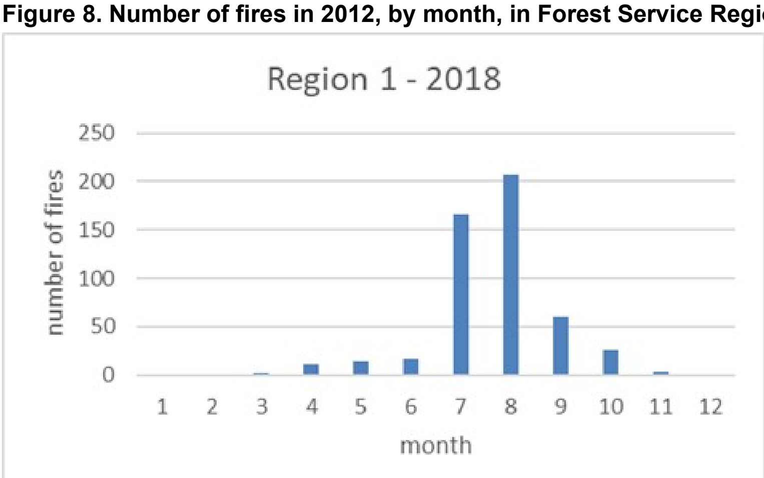

Figure 9. Number of fires in 2018, by month, in Forest Service Region 1

In addition to the analysis of Firestat data, the following table (Table 1) was developed from retardant use data from 2012 through 2019. It provides the dates that aerially delivered retardant began and ended each year by Forest Service region. An entry of a single date indicates that is the only date when retardant was aerially delivered. This data is also found in the summary report broken out by each forest and delivery method (airtanker or helicopter) and for each Forest the number of days retardant was flown is indicated.

Table 12. Beginning and ending dates of aerially delivered retardant, by Forest Service region and by year. Region 10 (Alaska) has not used retardant on National Forest System lands, so it is not included in the table. 'No use' indicates that aerially delivered

Year	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
2012	Jul 9 - Sep 17	Apr 24 – Sep 23	May 8 – Nov 4	Jun 6 – Oct 13	May 28 – Nov 25	Jul 9 – Sep 28	no use	no use
2013	Jul 8 – Sep 7	Jun 2 – Aug 31	May 8 – Jul 1	Jun 13 – Sep 2	Mar 23 – Oct 27	Jul 12 – Aug 29	no use	no use
2014	Jul 16 – Sep 16	Jul 7 – Aug 9	Apr 10 – Jul 2	Jun 3 – Sep 20	Jan 16 – Nov 24	Jul 5 – Sep 21	no use	Jun 2
2015	Jul 1 – Oct 12	Aug 1 – Sep 29	May 2 – Aug 31	Jun 12 – Sep 30	Apr 7 – Oct 29	Jun 9 – Oct 6	Oct 6	May 2 – May 7
2016	Jun 29 – Sep 4	Jun 15 – Oct 23	Mar 26 – July 29	Jun 15 – Sep 10	Jun 4 – Nov 19	Jun 6 – Oct 1	May 5 - Nov 17	May 6 – May 20
2017	Jul 8 – Sep 13	Mar 10 – Sep 19	Apr 4 – Jul 9	Jun 9 – Nov 13	Apr 22 – Dec 5	Jun 21 – Sep 17	Feb 25 – Apr 9	no use
2018	Jul 16 – Sep 14	May 10 – Oct 1	Mar 23 – Sep 15	Jun 7 – Sep 30	May 27 – Nov 14	Jun 25 – Oct 19	no use	Feb 15
2019	Jul 26 – Sep 4	Jun 11 – Oct 23	Mar 6 – Sep 22	Jul 11 – Sep 16	Apr 19 – Nov 26	Jul 13 – Sep 15	May 29 – Jun 2	no use

4.3.3.7 Compliance with Endangered Species Act Section 7(a)1 Requirements

Section 7(a)(1) of the Endangered Species Act states that Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of the act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of the Endangered Species Act. This is a summary of aerial retardant program activities that the Forest Service has undertaken in order to conserve threatened and endangered species.

The Forest Service has entered in an agreement with the United States Geological Survey, Columbia Environmental Research Center to conduct research regarding environmental impacts of firefighting chemicals. Results of multiple research studies are expected to be published over the next two years. The studies include:

- Impacts of water temperature, pH, or presence of ash on dispersal of retardant in water.
- Influence of the flow rate, water hardness, and application rate on pulsed exposure of rainbow trout to retardant chemicals.
- Influence of the duration of exposure and application rate on toxicity to rainbow trout of a pulsed retardant exposure.
- Determine 96-hour mortality to rainbow trout after a second pulsed retardant exposure
- Influence of substrate and duration of weathering on toxicity in a simulated runoff event.

- Effects of ultraviolet (UV) exposure on chemical toxicity.
- Toxicity of pulsed chemical exposure to ceriodaphnia (an aquatic invertebrate).
- Determine the concentration of chemical lethal to rainbow trout at various timepoints under 24-hours.

Additional studies, including repeating these studies on new retardant formulations, will occur as funds allow.

The Forest Service continues to explore and use technology to increase the precision and accuracy of retardant drops to reduce the exposure of fish. During the past eight years, all National Forests with Endangered Species Act listed species and designated critical habitat have mapped avoidance areas electronically. These maps are geo-referenced allowing an interface with digital platforms, for use in reporting and monitoring, and use with applications on small electronic devices such as tablet computers. Maps are updated annually as needed. Some aircraft now carry electronic devices that display electronic versions of the maps. All tanker bases have the most current annually updated maps for use by pilots.

The United States Forest Service Fire Retardant Misapplication Calculator, developed in collaboration with United States Geological Survey, was released in April of 2019. This tool is commonly referred to as the spill calculator and it replaced the previous spill calculator. It provides three results: (1) the load of tank mix delivered to the stream, (2) the affected reach length, and (3) the maximum exposure time over the specified toxicity value. The toxicity value is taken as 10 percent of the median lethal concentration for the specified retardant. This tool is useful for determining potential effects of retardant intrusions into water.

In 2020 the Forest Service updated the specification for long-term retardant (United States Department of Agriculture, Forest Service, Specification 5100-304 Long-term Retardant, Wildland Firefighting). The updated version of the retardant specification changed the allowable aquatic toxicity (Section 3.5.2.2) from a median lethal concentration (LC_{50}) to rainbow trout of greater than 100 milligrams per liter to greater than 200 milligrams per liter. This addresses the conservation recommendation in the West Coast Region Biological Opinion (USDOC NOAA Fisheries 2019, WCRO-2018-00288) to use less toxic formulations. As advancements are made in the retardant industry, the Forest Service will continue to consider lowering the aquatic toxicity threshold in future revisions of the specifications.

5 Effects Analysis

5.1 Analysis Process - General

Environmental effects have been analyzed on a nationwide, programmatic scale. Because the analysis is at such a large scale and addresses a nationwide program rather than a specific action (i.e., we cannot predict when, where, in what habitat type, or how large or long-lasting a wildfire event will happen, nor can we predict when, where, or how much aerial fire retardant may be used on a specific wildfire incident), the analysis is generally not quantitative. Details regarding analyses for species groups or individual species or habitats are provided as needed in the appropriate sections below.

The following information sources were used to identify species to be considered and to evaluate environmental consequences at a national scale:

- Current Forest Service lists of known and suspected occurrences of species occurring on or near National Forest System lands (refer to each section on wildlife, fish, and plants),
- Current Forest Service lists of designated critical habitats occurring on or near National Forest System lands (refer to each section on wildlife, fish, and plants),
- Species-specific and habitat-specific information including listing packages, recovery plans, critical habitat designations, status reviews, NatureServe information, and other available information regarding species needs, habitats, threats, and other factors influencing potential impacts of aerial retardant use.

This Biological Assessment includes species identified and confirmed by each Forest Service Regional threatened and endangered species coordinator in November 2019, and in their November 2020 review of the draft Biological Assessment. The analysis considers 438 listed or proposed species and their designated or proposed critical habitats. Appendix D identifies each species considered and indicates the Forest Service region and units where each species occurs, and which units include critical habitat. In total there are 20 amphibians, 1 spider (arachnid), 25 birds, 65 bivalves (mussels), 10 crustaceans, 60 fish, 1 fungi, 12 gastropods (snails), 22 insects, 31 mammals, 170 plants, and 22 reptiles considered.

All species were evaluated through the screening process described in the following section (National Effects Screening Process). Additional review and analysis are described within each group (wildlife, aquatic, plants) or for individual species as needed. All analyses used the most recent available information on fire occurrence, retardant use, species status and distribution, threats, and others.

Determinations were made for proposed species or critical habitat as if they were fully listed, in order to include all necessary information for consultation upon publication of final rules. This proposal is not likely to jeopardize the continued existence of any proposed species or adversely modify any proposed critical habitat. Additionally, where experimental, non-essential populations occur on National Forest System lands along with the corresponding listed populations, determinations were made based on the listed entity. Aerial retardant use is not likely to jeopardize the continued existence of any experimental, non-essential populations.

5.2 National Effects Screening Process

5.2.1 Information and Assumptions Used in the National Effects Screening Process

Because the proposed action is programmatic across the entire National Forest system, a screening process was developed in order to standardize the process by which species determinations were made. The process was developed for the consultation completed in 2011 and updated for use in the current consultation. In order to develop the screen and to be consistent in how it was applied, the following information was developed and assumptions used.

5.2.1.1 Retardant Application Potential

The occurrence of past fires and retardant drops provide a baseline and indicator for considering when and where retardant may be used in the future (refer to Table 10, Table 11, Table 12, and Figure 6). That information was summarized for use in the national screens as follows; complete data by National Forest is available in a separate report (USDA Forest Service 2020d).

Retardant application potential is described as ‘very low’, ‘low’, ‘moderate’ or ‘high’ based on the average annual retardant use by forest between 2012 and 2019 (USDA Forest Service 2020d, appendix G) and the maximum amount (maximum total gallons of retardant used in any given year from 2012 through 2019). These category assignments may be adjusted for a specific unit based on the percent of National Forest System land on which aerially delivered retardant is used annually, on average, along with the frequency (number of years retardant was used over the 8-year period) of use for that unit. This adjustment takes into consideration that smaller units could experience greater impact if a larger proportion of the land base is affected by retardant annually. Refer to appendix G for lists of all National Forests and their retardant application potential.

- ‘Very low’ retardant application potential:
  - annual average of less than 25,000 gallons,
  - maximum of 100,000 gallons,
  - average aerial retardant used on up to 0.01 of forest unit annually, and
  - frequency of generally less than 0.375.

- ‘Low’ retardant application potential:
  - less than 50,000 gallons on average annually,
  - less than 200,000 gallons maximum,
  - average aerial retardant used on up to 0.01 of forest unit annually, and
  - generally less than 0.625 frequency.

- ‘Moderate’ retardant application potential:
  - less than 150,000 gallons on average annually, and
  - less than 500,000 gallons maximum,
  - average aerial retardant used on up to 0.01 of forest unit annually, and
  - generally between 0.5 to 0.8 frequency.

- ‘High’ retardant application potential:
  - 150,000 gallons on average annually,
  - greater than 500,000 gallons maximum,
  - average aerial retardant used on more than 0.01 of forest unit annually, and
  - greater than 0.8 frequency.

5.2.1.2 Other Assumptions

- Fire season statistics since 2012 provide a reasonable representation of the rate of retardant delivery in the next 10 to 15 years relative to the Forest Service land base even though past or future decades could have more fires (Geier-Hayes 2011).
- Where avoidance areas are identified for known species occurrences or critical habitat, we assume that those avoidance areas would provide protection from adverse impacts. Designated critical habitat where the aerial application of fire retardant does not affect or change primary constituent elements, or the physical and biological features of critical habitat, does not require protection or avoidance mapping.
- Based on 8 years of intrusion data, out of an estimated 56,868 retardant drops there were 248 intrusions into water (0.43 percent) and 164 intrusions into the waterway buffer only (0.29 percent). There were 47 intrusions into terrestrial avoidance areas (0.08 percent).

Overall, there were 459 intrusions into avoidance areas (0.81 percent). The intrusion rate is not expected to increase.

- Intrusions into avoidance areas are assumed to have a higher potential to occur on those units that have a high rate of use of aerially applied retardant.

In addition to those assumptions, the following Forest Service actions would occur after an intrusion into an aerial retardant avoidance area:

- If assessment or monitoring at an intrusion site determines that effects occurred to threatened, endangered, proposed or candidate species or critical habitat, the Forest Service would consider whether additional restrictions to aerial retardant use are needed. The Forest Service would discuss potential changes in retardant use, including buffer size changes, with the Fish and Wildlife Service and NOAA Fisheries.
- All retardant intrusion locations will be reported to the Forest resource specialist and / or the assigned Burned Area Emergency Rehabilitation team. The potential for non-native invasive plant species issues will be assessed by these entities, and additional measures included in forest plans would be implemented as needed.

Additional information, including other data on past retardant use, intrusions, fire history, and other information that was used in analyses and determinations is described as needed for each group (wildlife, aquatic species, and plants) or for individual species as needed.

5.2.2 National Effects Screens

Table 13 displays the standardized process used for evaluating all listed species and habitats for potential effects of aerial retardant use. Additional analysis may have been used to arrive at determinations, as described for each species group or individual species in the appropriate sections below.

Table 13. National effects screening process for analyzing aerial retardant impacts to federally listed species and critical habitat

Impact[1]	National Screening Factor Aerially Applied Retardant	Aerial Retardant Application Potential
NE	Species/habitat occur in areas with no fires, therefore no potential retardant use. Examples: cliffs, caves, estuaries, marshes, lakes, ocean shoreline, sand dunes.	none
NE	Species occurs near, but not on national forest lands and effects from aerial retardant use on forest lands are not possible	low - high
NE	No retardant use recorded on forests where species occur, are suspected, or critical habitat is designated.	none
NE	Use of aerial fire retardant does not impact or change the Primary Constituent Elements, or physical and biological features of critical habitat.	low
Aquatics		
NLAA	Species occurs on forest with very low aerial retardant use and is protected with an avoidance area	very low
NLAA	Critical habitat is protected with avoidance area mapping, or use of aerial retardant would result in discountable or immeasurable	low-moderate

Impact[1]	National Screening Factor Aerially Applied Retardant	Aerial Retardant Application Potential
	changes to primary constituent elements or the physical and biological features of critical habitat	
LAA	Species occurs on forest with moderate to high aerial retardant use.	moderate - high
LAA	Changes to primary constituent elements, or physical and biological features of critical habitat, are anticipated.	moderate-high
Terrestrial		
NLAA	Species is not an isolated population and aerial fire retardant is applied on less than 0.01 percent of forest landbase on average annually where species occurs or is suspected of occurring.	low
NLAA	Species occurs or is suspected of occurring on a forest with more than 0.01 percent of its landbase impacted by aerial retardant on average annually but occurs in habitats with very low likelihood of retardant application. Examples include alpine habitat, talus/scree slopes, desert,	low - moderate
NLAA	Critical habitat is protected with avoidance area mapping or use of aerial retardant would result in discountable or immeasurable changes to primary constituent elements or the physical and biological features of critical habitat.	low - high
LAA	Aerial fire retardant is applied on more than 0.01 percent of forest landbase on average annually where species occurs or is suspected.	moderate - high
LAA	Species is a small isolated population[2] and occurs on any forest where aerial retardant application is likely to occur – recognizing potential impact to these species from an intrusion or invoking an exception.	low - high
LAA	Changes to primary constituent elements, or physical and biological features of critical habitat, are anticipated.	low - high

[1]NE = No Effect; NLAA = may affect, not likely to adversely affect; LAA = may affect, likely to adversely affect
[2] A small, isolated population is a population in which the number of individuals is low, and the area occupied is geographically limited, such as occurring on a single National Forest or within a single drainage.

5.3 Cumulative Effects Analysis

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." These include activities on adjacent lands, private or state-owned inholdings, or on rights of way across National Forest lands. Future Federal actions will be reviewed through separate section 7 consultation processes. Past Federal actions have already been added to the environmental baseline in the action area.

State or private activities, including use of aerial retardant, salt mixtures for deicing or dust abatement, or agricultural fertilizers, are likely to continue affecting Endangered Species Act-listed fish, animal, and plant species. The cumulative effects in the action area are difficult to analyze, considering the broad geographic landscape included in the action area, and the uncertainties associated with state and private actions are difficult to predict, including determining if those actions will increase or decrease in the future. However, effects from state and private actions are likely to increase.

Effects from these activities on listed species and habitats are expected to be similar to those that occur on Federal lands, although the size, magnitude, and potential for adverse effects may differ due to different levels of restriction or regulation by state or private entities.

5.4 Wildlife Analysis and Determinations

5.4.1 Introduction

This section (wildlife) includes 122 species identified as proposed, threatened, or endangered under the Endangered Species Act listed and/or their designated or proposed critical habitat. Effects to those species and to critical habitat are analyzed on a nationwide, programmatic scale. Because the analysis is at such a large scale and addresses a nationwide program rather than a specific action (i.e., we cannot predict when, where, in what habitat type, or how large or long-lasting a wildfire event will happen, nor can we predict when, where, or how much aerial fire retardant may be used on a specific wildfire incident), the analysis is generally not quantitative. Refer to the next section (Wildlife Effects Screening Process) for information about how this broad scale analysis has been carried out. Local information is provided by individual national forests to Fish and Wildlife Service Field offices when more detailed or specific analysis is required.

5.4.2 Wildlife Effects Screening Process

5.4.2.1 General information about the wildlife screening process

As part of the analysis framework established for the 2011 biological assessments (USDA Forest Service 2011b), a National Effects Screening Process (as described in the 'Effects Analysis Process – Analysis Process Used' section of this document) was developed for all Endangered Species Act (ESA) listed threatened, endangered, proposed and candidate species, and designated or proposed critical habitat. The national screens represent a coarse filter consideration of species distribution, habitat, and probability of retardant application where species occur. The screening process was further refined for wildlife species (see below).

In order to be consistent with the previous analyses and consultation documents, (USDA Forest Service 2011b, USDA Forest Service 2011c, USDI Fish and Wildlife Service 2011, USDA Forest Service 2017, USDI Fish and Wildlife Service 2017, USDA Forest Service 2018, USDI Fish and Wildlife Service 2018), this analysis applied the same coarse filter and fine filter screening processes. The screens have been updated to reflect recent information about retardant use, and have been edited for clarity, including incorporating edits from supplemental consultations and comments from the Fish and Wildlife Service.

The wildlife effects screening process (also referred to in this document as "wildlife screens") was developed to provide a consistent approach to considering the potential impacts of aerial retardant on a wide variety of wildlife species and habitats. Potential impacts of aerial retardant use on wildlife species are influenced by the likelihood of exposure through direct application or ingestion, as well as through disturbance caused by aircraft used to deliver retardant. Direct exposure is influenced by the ability of individuals of species to avoid areas where fires are burning or where retardant may be used, as well as their ability to avoid using areas in which retardant has been applied. Large, mobile, wide-ranging species such as lynx, fisher, or grizzly bear are much less likely to be affected by aerial application of retardant than species such as small rodents or amphibians, many of which are dependent on localized or highly specific habitats. Direct exposure is also influenced by the likelihood of an animal ingesting retardant through consumption of treated foliage or predation on other species (such as insects or small mammals) that may have retardant on them or that may have ingested retardant. Risk of ingestion is based on a species' preferred forage or prey and how widely individuals range in search of forage or prey. The risk of an animal being affected by ingested retardant is dependent on the amount consumed and the species' physiological response to retardant chemicals. Potential for impacts due to ingestion were identified in a risk assessment (Auxilio Management Services 2021) that was considered in the wildlife screening process. Finally, aerial retardant application could result in disturbance to species in the area due to the presence (sight and/or sound) of low-flying aircraft used to deliver retardant. The degree of potential effects from that disturbance depend on the frequency and duration of flights as well as whether a particular species is at a vulnerable time (such as breeding or nesting). The wildlife screens add consideration of the potential impacts described in the above paragraph, as displayed in Figure 10Figure 11Figure 12 and Figure 13 (Wildlife Screening Process screens). Terminology, assumptions, and other information for each screen is described in the following sections.

Although the analysis of wildlife species incorporated use of the wildlife screens, other information was used as needed to arrive at determinations for each species or critical habitat. Such things as whether a species is widely distributed or occurs as a local endemic, whether it is restricted to specific habitats, timing of retardant use relative to critical life history stages, foraging habits, and other species-specific or habitat-specific information was considered where needed, and documented in the individual species effects discussions.

5.4.2.2 Information and assumptions common to all wildlife screens

The wildlife screening process relied on the same assumptions used for the National Screening Process (refer to the 'Effects Analysis Process – Analysis Process Used' section of this document for details). Assumptions used in the wildlife screens also include:

- Aerial fire retardant use will be similar in the future to use from 2012 through 2019.
- Aerial retardant drops are not allowed in avoidance areas, except where human life or public safety is threatened and retardant use in the avoidance area could be reasonably expected to mitigate that threat. Use of avoidance areas reduces likelihood that aerial retardant use will impact species or habitats, but the degree to which potential impacts might still occur would vary based on the species or habitat and the type of effect being considered.
- The rate of intrusions would remain low, similar to the rate observed from 2012 through 2019.

In addition to the assumptions described above, the wildlife screens incorporate consideration of retardant application potential, defined in the 'Effects Analysis Process – Analysis Process Used' section of this document. For all wildlife screens, where a species or designated critical habitat occurs on more than one unit that differs in retardant application potential, the highest retardant application potential of those units is used for the screening process. This approach is intended to ensure a conservative approach to compliance with the Endangered Species Act.

All designated or proposed critical habitat is screened through wildlife screen 1, and the determinations reached by using this screen apply only to critical habitat. All species are screened through wildlife screen 2 (mobility). Based on the outcome of wildlife screen 2, some species may also require assessment through wildlife screen 3 (disturbance) and wildlife screen 4 (ingestion). If screens 3 and 4 are applied after screen 2, the more conservative determination is used; for example, if use of screen 2 leads to a May Affect, Not Likely to Adversely Affect, but use of screen 3 leads to a May Affect, Likely to Adversely Affect determination, then the May Affect, Likely to Adversely Affect determination is used for the species as a whole.

5.4.2.3 Wildlife screen 1: Effects to Critical Habitat (Figure 10)

This screen applies only when critical habitat is designated or proposed for a species. This screen was updated from the corresponding one used in 2011, adding consideration of physical and biological features. Use of the screen includes the following information and assumptions:

- If avoidance areas for designated or proposed critical habitat potentially affected by aerial fire retardant are required or recommended, guidelines would be developed by the local unit to ensure that the primary constituent elements or physical and biological features of the critical habitat are protected.
- Annual coordination will occur between local units of the Forest Service and the Fish and Wildlife Service; these efforts will help in reducing impacts to species and habitats by discussing, prior to each fire season, changes to designated critical habitats, monitoring needs, and any new information.
- The screen considers the potential effects of aerial retardant use on the primary constituent elements or physical and biological features of the designated critical habitat, and also considers the effectiveness of mapped avoidance areas at reducing impacts to those elements and features.

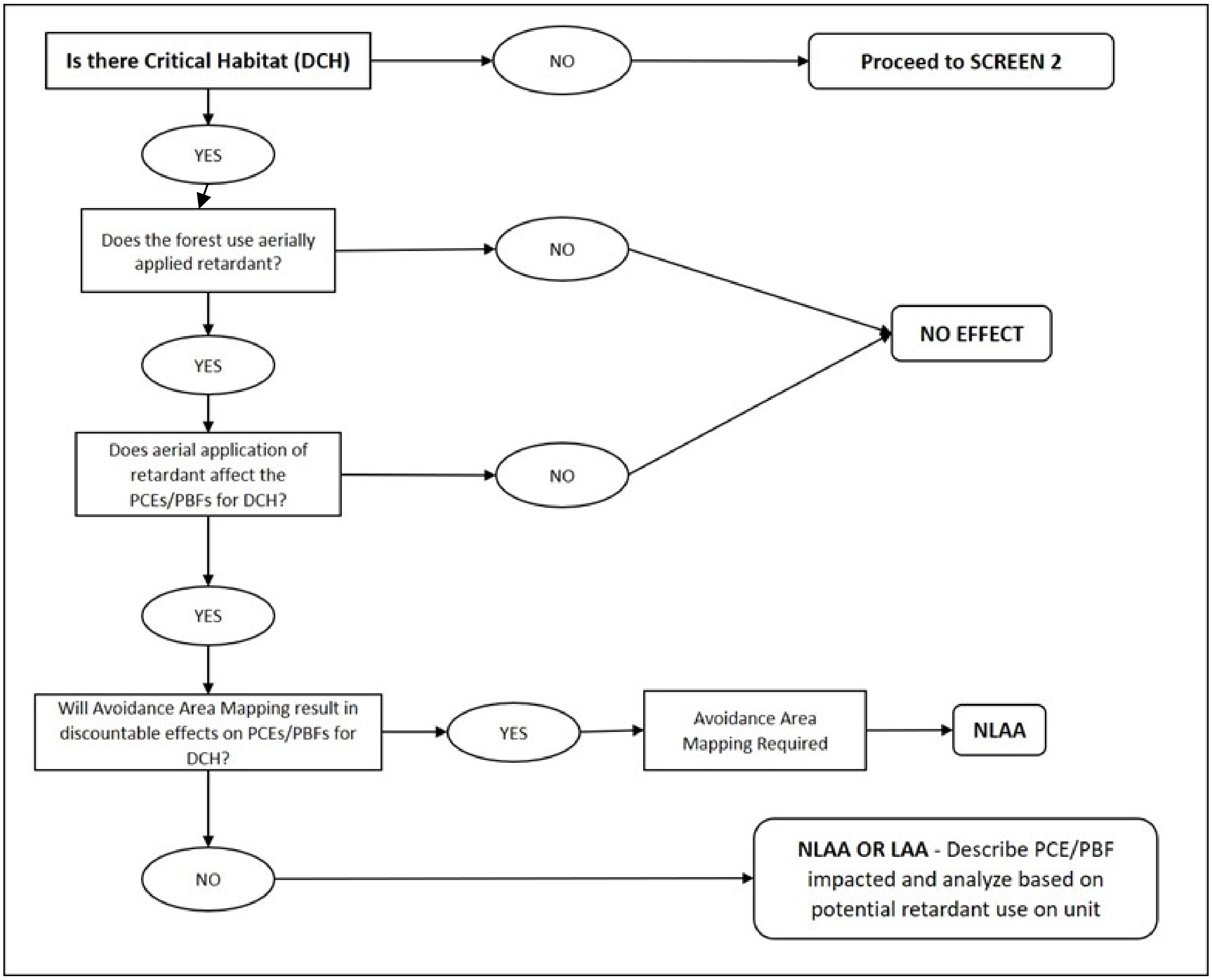

Figure 10. Wildlife screen 1: effects to critical habitat

5.4.2.4 Wildlife screen 2: Mobility of Individuals (Figure 11)

Wildlife screen 2 addresses whether individuals of a species can potentially move away from areas impacted by aerial retardant, in the context of the retardant application potential of national forest units on which they occur. For consistency in applying the screen, home range sizes were considered in relation to the average acreage of individual retardant drops. The following definitions were used to estimate mobility of the individuals of a species:

- Not mobile: Species is small or slow (such as a turtle or caterpillar) and home range is less than ten acres.
- Limited: Individuals are small (such as a ground squirrel) and are capable of moving out of the way of an approaching danger but have small to moderate home ranges (ten to 100 acres) that could be mostly impacted by one or more retardant drops.
- Mobile: Individuals are medium to large in size (such as deer) and relatively large daily movements are common. Individual home ranges are greater than one hundred acres.
- Very mobile: Individuals are medium to large in size and move regularly or rapidly (such as coyote). Individual home ranges are generally larger than 1000 acres.

When using this screen, consideration is given to whether individuals of a mobile or very mobile species are able to avoid aerial retardant based on the timing of retardant use on the national forest units where they occur (refer to Table 10, Table 11, and Table 12) and the season or life history stage of that species. For example, nesting birds, young non-volant bats, larval insects, and others may be unable to avoid aerial retardant use that occurs during those seasons or life stages. Where local units deem it necessary, avoidance areas may be mapped for to limit potential impacts during those times.

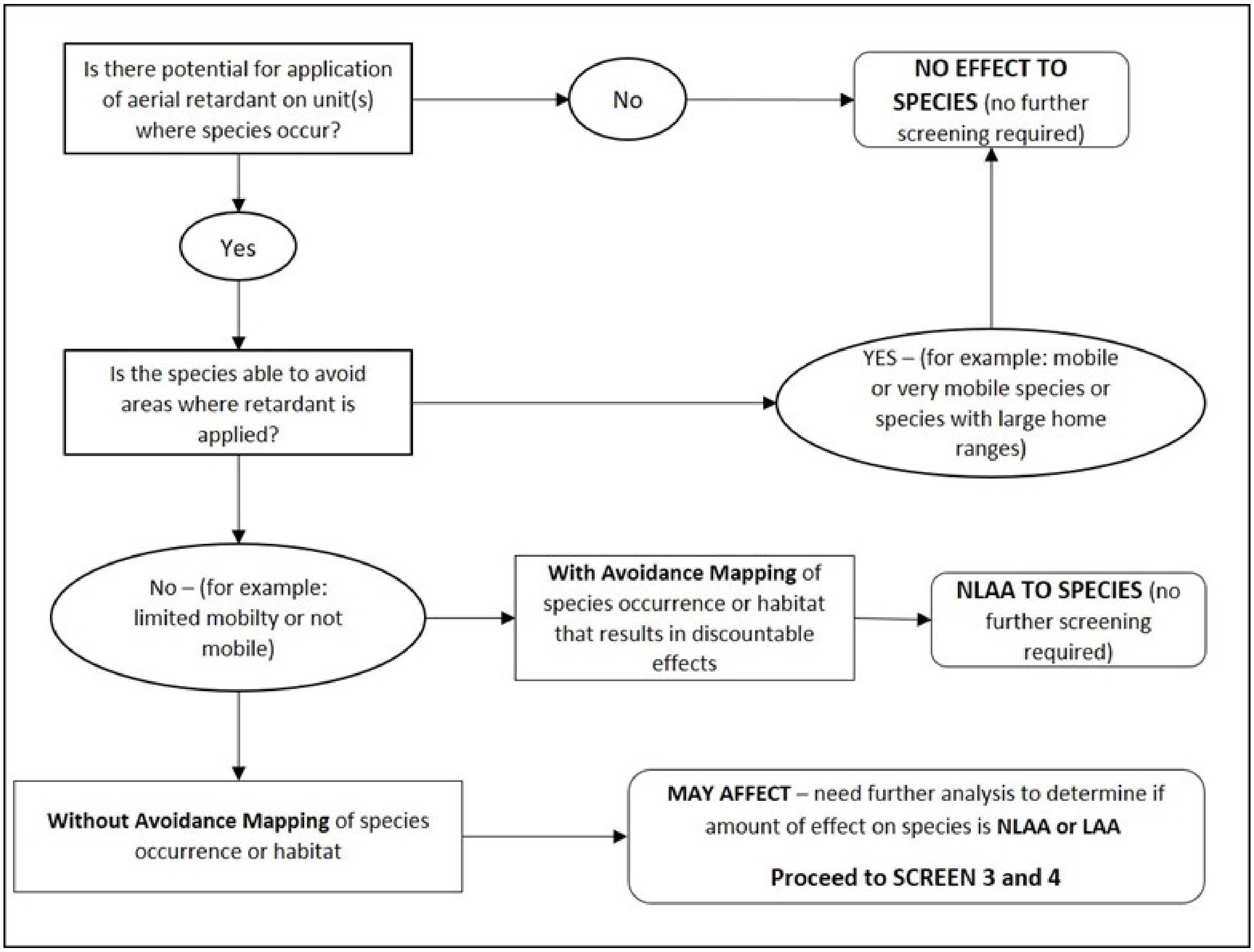

Figure 11. Wildlife screen 2: mobility of individuals

5.4.2.5 Wildlife screen 3: disturbance from low-flying aircraft (Figure 12)

The use of aircraft to deliver fire retardant has the potential to disturb some species due to noise or the visual impact of approaching aircraft or falling retardant. Disturbance can involve at a minimum some expenditure of energy that would not otherwise be used, or may involve movement away from preferred foraging or other habitat, movement away from or abandonment of nests or dens leaving young vulnerable to mortality, displacement of individuals into home ranges of other individuals, or other impacts.

Use of this screen involves the assumption that the effect of potential disturbance is influenced by the duration of the disturbance, and by the timing of when it occurs (i.e., during nesting, denning, or other time periods of critical importance to individuals of the species). Expected timing of aerial retardant use is based on retardant use data gathered since 2000 for each Forest Service Region (refer to Table 10, Table 11, and Table 12); that timing is used to determine whether aerial retardant use is likely to occur during a species' critical time period(s).

Disturbance from aircraft is categorized as short-term or long-term. Short-term disturbance is one to three flyovers at altitudes below 500 feet above ground level occurring over a 48-hour period or less. Long-term disturbance is more than three flyovers occurring over a period longer than 48 hours. Duration of disturbance or of a fire incident cannot be predicted in advance. Therefore, this screen uses retardant application potential as an indicator of the likelihood of short or long-term disturbance as follows:

- Units with very low or low retardant application potential are assumed to primarily experience short-term disturbance
- Units with moderate or high retardant application potential are assumed to likely experience long-term disturbance.

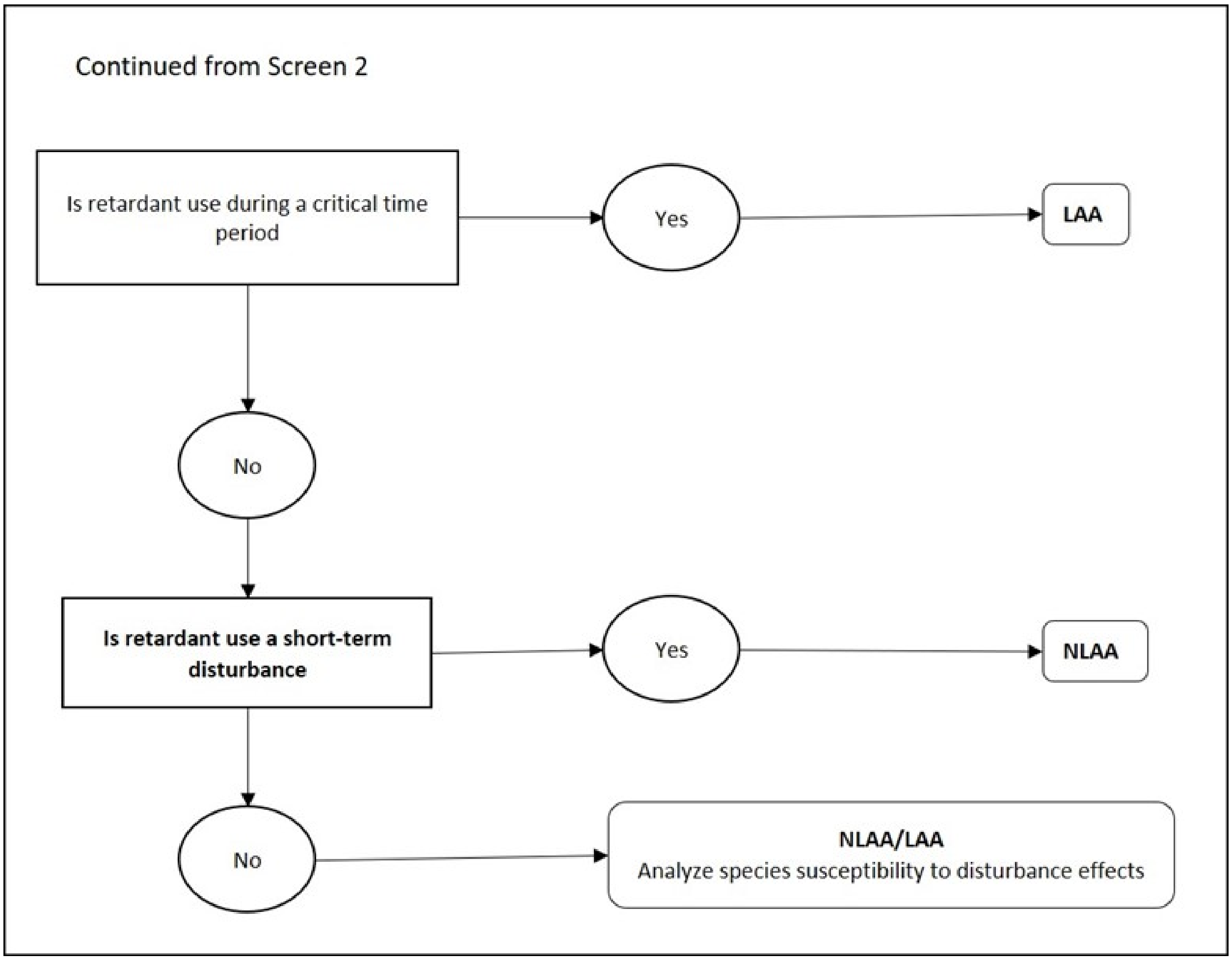

Figure 12. Wildlife screen 3: disturbance from low-flying aircraft

5.4.2.6 Wildlife screen 4: Ingestion of retardant (Figure 13)

Retardant chemicals may be ingested directly, through consumption of vegetation or prey coated with retardant or consumption of water with retardant in it, or indirectly through consumption of prey that has consumed retardant. The potential for individuals of a species to ingest retardant, and the potential for retardant chemicals to affect individuals if consumed, was summarized in an ecological risk assessment (Auxilio Management Services 2021). That assessment used data on wildlife species selected to represent a range of taxonomic classes, body sizes, foraging habitat, and diets, for which parameters are generally available. The risk assessment determined an estimated dose for each species based on the above factors, compared it to the published LD50 (the dose at which 50 percent of the sample dies after an established period of time), and used a method established by the Environmental Protection Agency's Office of Pesticides Programs to assign a risk quotient to each species. Risk of negative effects was indicated at levels one-tenth the LD50 for a given species. Refer to the ecological risk assessment (Auxilio Management Services 2021).

Potential direct impacts of aerial retardant application vary based on ecoregion, because of differing vegetation types and other factors. Use of this screen involves identifying whether a species is represented by one for which risk was predicted in the ecological risk assessment, and then identifying whether the species occurs in an ecoregion in which the rate of application would result in the predicted risk.

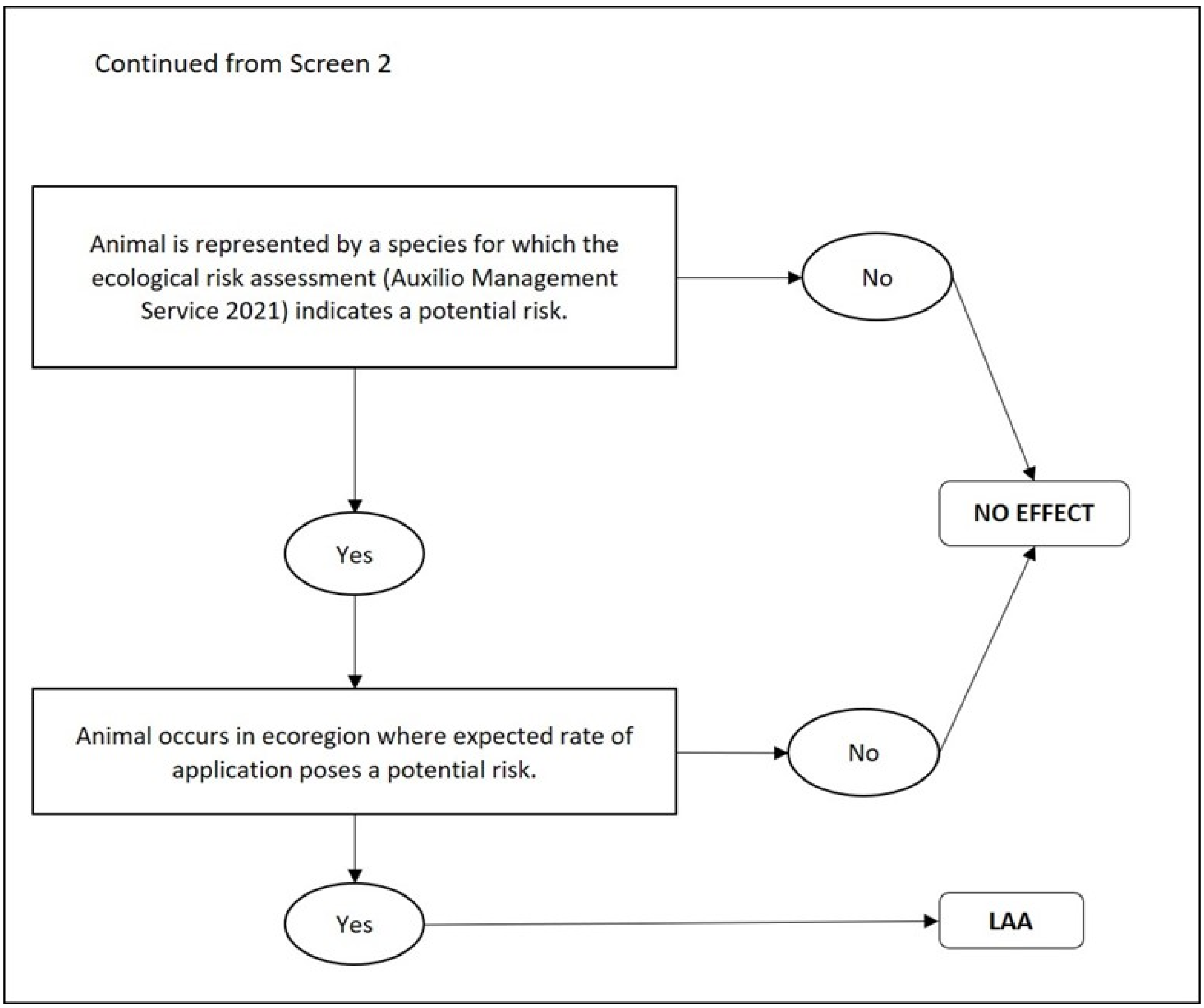

Figure 13. Wildlife screen 4: ingestion of retardant

5.4.3 Other Wildlife Effects Analysis Information and Assumptions

Species distributions, habitat requirements, critical habitat primary constituent elements or physical and biological features, general conservation status, threats, and any other information needed to apply the wildlife screens and complete analyses and determinations were found on the Fish and Wildlife Service endangered species website (https://www.fws.gov/endangered/), the Fish and Wildlife Service Environmental Conservation Online website (https://ecos.fws.gov/ecp/), NatureServe (https://www.natureserve.org/), federal register listing or status review documents, and other sources as needed.

The analyses and determinations rely on available information regarding retardant impacts to similar species or habitats, or on information about general retardant effects to ecological systems or habitats, as described throughout this document, including in species discussions.

5.4.3.1 Distribution

As discussed in the Wildlife Effects Screening Process section, factors such as species distribution maybe considered in making determinations. For consistency in analysis, distribution has been categorized in a general way as follows:

- Very limited distribution: species is known to occur only in a single or few populations, or occurs in a small area such as a single watershed, or a single National Forest unit.
- Limited distribution: Species occurs in a few populations or occurs in a few watersheds or National Forest units.
- Moderate distribution: Species occurs in several or many populations or is spread across several National Forest units, more than one state, or throughout a region.
- Wide distribution: Species occurs in a number of populations spread across several states or regions.

5.4.3.2 Avoidance Areas

Avoidance areas may be mapped for species occurrences, critical habitat, or both. The analysis and determinations rely on the following assumptions:

- Where avoidance areas are identified for known species occurrences or critical habitat, we assume that those avoidance areas would provide protection from adverse impacts.
- Designated critical habitat where the aerial application of fire retardant does not affect or change primary constituent elements, or the physical and biological features of critical habitat, does not require protection or avoidance mapping.
- For larger designated critical habitats, it is expected that only a portion of a critical habitat recovery unit would be exposed to aerial fire retardant chemicals, in the event of an intrusion.
- For aquatic wildlife species (amphibians) and habitat that may be affected by an intrusion of aerial retardant into water, the analysis assumes that expanding the avoidance area from 300 to 600 feet around designated critical habitat and occupied habitat areas would reduce the risk of an intrusion occurring directly into the waterway and into the buffer area. This may be particularly true in steep terrain.

- It is reasonable to expect an intrusion (0.01 percent possibility assumption) may occur over the term of this consultation for National Forest System lands, possibly resulting in an intrusion that affects species and critical habitat Primary Constituent Elements or Primary Biological Features.

Additionally, avoidance area mapping is required for species with a determination of May Affect, Likely to Adversely Affect (LAA). Exceptions can be made where Forest Service and Fish and Wildlife Service personnel determine at a local level that avoidance areas are not required.

Avoidance area mapping is recommended for some species and critical habitats with determinations of May Affect, Not Likely to Adversely Affect (NLAA). The need for avoidance areas for these species or habitats should be determined at the region or National Forest level where the species or habitat occurs.

5.4.4 Effects Common to all Wildlife Species

Given the national programmatic nature of this consultation, and the fact that the Forest Service cannot predict when or where the aerial application of fire retardant will occur but can only estimate based on data from aerial retardant use in the last 20 years since 2000, the specific effects to individuals resulting from the proposed action cannot be described. The potential effects of the use of aerial fire retardant on all wildlife species is summarized here. The information in this section is applied to evaluation of individual species in the sections that discuss and provide determinations for those species.

5.4.4.1 Direct Effects

Auxilio Management Services (2021) prepared an ecological assessment of fire retardant chemicals, using data on wildlife species selected to represent a range of taxonomic classes, body sizes, foraging habitat, and diets, for which parameters are generally available. The risk assessment determined whether potential risk would occur to any representative species. Potential direct impacts of aerial retardant application vary based on ecoregion, because of differing vegetation types and other factors. Some wildlife species might have a risk of negative effects resulting from direct ingestion of aerial retardant chemicals, in some areas (Auxilio Management Services 2021). Risks are generally higher for aquatic species than for terrestrial species, some of which could be affected by direct physical contact with chemicals.

Labat Environmental (2017) noted that the effects of ingestion of vegetation or insects coated or covered with fire retardant on a species depends on the amount of retardant used (the amount of coverage by vegetation/eco-region type), timing of ingestion after application, ability of the animal to avoid feeding on chemicals, and availability of alternate food supplies in the immediate area. Some of these parameters were included in the assessment done by Auxilio Management Services (2021), which used representative wildlife species to determine potential risk of effects from retardant ingestion.

The ecological assessment (Auxilio Management Services 2021) looked at potential concentrations of retardant ingredients that would result from contaminated runoff or as a result of a retardant drop or an accidental spill directly into a stream. Concentrations of chemicals that could occur in streams were modelled, using information from the fifteen ecoregions (Bailey 1995) representative of areas where retardants are applied. Each assessed retardant posed a potential risk to certain aquatic species, including tadpoles, if dropped directly into a stream. The risk assessment also indicated potential risk to some bivalves as a result of long-term exposure if retardant chemicals persist or accumulate in waterbodies such as ponds.

For magnesium chloride, Jones (2017) examined the direct and indirect effects of the most commonly used road salt (sodium chloride) and a proprietary salt mixture (sodium chloride, potassium chloride, magnesium chloride), at three environmentally relevant concentrations on freshwater wetland communities in combination with one of three biotic stressors (control, predator cues, and competitors). They found potential impacts to activity of toads and tadpoles (see section 4.4.5.2).

In general, the application of retardants composed of inorganic fertilizers is likely to temporarily degrade water quality, impair light penetration, decrease dissolved oxygen, increase nonnative vegetation, and increase the rate of eutrophication. The severity of the effect will differ depending on the amount of retardant that enters the unit and the environmental characteristics at the time of delivery: wind speed, topography and vegetation. These effects could occur both in the short-term due to immediate ammonia toxicity, and in the long-term if residence time of retardant compounds, and their consequences for eutrophication, lasts through multiple seasons.

The potential risks or impacts to terrestrial species from the use of fire retardants are expected be minimal or minor. Risks to terrestrial wildlife are likely to be:

- Small in scale, and they are not likely to affect more than a few individuals or a portion of a population or habitat at any one time (for most species).
- Small in quantity, as most drops are less than 1,000 gallons and the chance of all gallons from the drop hitting occupied habitat is low (per recorded intrusion data).
- Short in duration, as the retardant is not likely to have a lasting effect on most of the species. These effects are temporary or short-term in nature (less than 30 days as compounds break down).

Additionally, aerially delivered fire retardant is water soluble, so it is expected to be dispersed during the first wet weather event.

Small, endemic (or localized) populations with limited mobility or a specialized habitat may be affected by the aerial application of fire retardant if directly hit. However, given the mobility of most species and their instinct to avoid a fire, direct application of retardants on wildlife species is expected to be rare (refer to wildlife screen 2, Figure 11).

Direct impacts from the application of retardant may occur where nest trees or breeding sites are occupied at the time of aerial retardant application or if the mobility of the individual species is such that it cannot avoid the area of application, such as with nestlings, fledglings and juvenile individuals (refer to wildlife screen 2, Figure 11).

Aerial application of fire retardant may also cause disturbance associated with low-flying aircraft that could stress animals (disrupt calving, rearing, or nesting) or displace animals to areas of less suitable habitat (refer to wildlife screen 3, Figure 12). Although short in duration, this activity may cause a change in behavior for any wildlife that may be present or within the vicinity of the fire retardant drop. It is generally assumed that species such as raptors and other large birds may be disturbed by low-flying aircraft within one mile of nesting or roosting sites.

It is important to note that by the time aircraft are ordered to fly retardant on an incident, the fire may have already burned a portion of the landscape or of the habitat for individuals also experiencing disturbance from aircraft noise. Species with a moderate to high rate of mobility that have the ability to escape the fire area or move out of the way of retardant drops can still be affected by the aircraft flying overhead or in the vicinity.

Another possible direct effect to habitat is the breaking of treetops/vegetation by a low, fast drop of a large load (1,800 gallons, which is a typical large airtanker load) of aerially applied fire retardant. The possibility of this occurring would depend on the vegetation and on other factors related to both the location and the delivery method.

5.4.4.2 Indirect Effects

Retardant impacts to vegetation used by wildlife species may include fertilization that results in growth of species used for foraging or other life history needs, growth of other species and changes to species composition in the affected area, and growth of or increased presence of invasive non-native plant species that may be present in the area. Other impacts may include direct physical effects (leaf loss, plants physically knocked down), or effects on plant growth and health as a result of over-fertilization or toxicity. Any of these changes could have indirect impacts by changing forage availability or other habitat characteristics.

Use of aerially delivered retardant could potentially result in bioaccumulation in individual animals as a result of eating vegetation coated with retardant chemicals, or as a result of eating prey that had consumed retardant. Bioaccumulation is unlikely, particularly in terrestrial environments, because individuals would need to consume a large amount of retardant-coated vegetation or prey species over an extended period of time. Retardants do not persist in the environment for lengthy periods, and most wildlife species would not be expected to forage only in areas where retardant has been applied.

In aquatic environments, retardant salts have been demonstrated in experimental conditions to decrease pH and reduce zooplankton abundance. If these conditions were to persist, impacts could occur through the food chain. However retardant chemicals become diluted and dispersed through streamflow, limiting the risk of this effect.

5.4.4.3 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State, local, tribal, or private activities, not involving federal activities that are reasonably certain to occur within the action area of the federal action subject to consultation." Effects from state, local, tribal, and private actions on or near public lands could affect wildlife are discussed in this biological assessment, although the size, magnitude and potential for adverse effects may differ due to differences in management practices and scale of actions. Because wildlife distribution often occurs across ownership boundaries, non-federal activities could occur within the ranges of some species and could be additive to Forest Service aerial fire retardant activities. Non-federal, or state and private activities that could have impacts to Endangered Species Act listed wildlife species include aerial delivery of retardant, use of salt mixtures for deicing or dust abatement, and use of fertilizers for agriculture. For the purposes of this analysis, we assume that these activities will continue at current levels.

For species that are wide-ranging and have larger populations, aerial application of fire retardant on a specific fire would occur only on a very small portion or fraction of a population; therefore, cumulative effects would be very minor.

5.4.5 Determinations of Effect to Listed Wildlife Species and Critical Habitats

Because of the national scale of this analysis and the need to address more than a hundred wildlife species listed as threatened, endangered, or proposed, and associated critical habitats, that occur on National Forest System lands affected by the proposed action, the analysis was organized into the following groupings:

- Each group is a major animal type: Amphibians, Birds, Invertebrates, Mammals, and Reptiles.
- Each subgroup is by similar species: frogs, small mammals, bats, ungulates, etc.

For the same reasons of scale and number of species addressed, only a short summary on each species habitat and distribution is provided; refer to the Fish and Wildlife Service Environmental Conservation Online website (https://ecos.fws.gov/ecp/), or to NatureServe (https://www.natureserve.org/) for complete species account information.

The analysis for each species includes listing date, previous consultation information, occurrence by National Forest unit and associated retardant application potential, anticipated effects to the species, critical habitat (if designated) description and anticipated effects, and determination(s) for the species and any designated critical habitat. The analysis also considered the information and determinations from the 2011 or subsequent consultations.

Because this is a national, programmatic action, determinations are made for species across their entire ranges rather than by individual National Forest. Each assessment considers the retardant application for all units where the species occurs, and determinations are based on the highest retardant application potential. For example, if a species occurs on three National Forests, one of which does not use retardant, one of which has low application potential, and one which has high application potential, the determination will be based on the assumption of high application potential. Similarly, requirements or recommendations for avoidance areas are for the entire species across its range, rather than by individual population or National Forest. Adjustments to avoidance areas may be made by local units, in coordination with the local Fish and Wildlife Service office.

5.4.5.1 Summary of Effects and Determinations

The Forest Service identified 122 terrestrial and aquatic wildlife species federally listed as either threatened, endangered, proposed or candidate under the Endangered Species Act, that are found on National Forest System lands and are under jurisdiction of the Fish and Wildlife Service.

The following summary is for all species considered in this consultation:

- Aerial application of fire retardant was found to have no effect on 35 species and 14 critical habitats. No further information is provided here; please refer to appendix F for a list of those species and summary of rationale.

- 56 species and 27 critical habitats would have a ‘may affect - not likely to adversely affect’ (NLAA) determination due to lesser impacts expected from either from change in habitat, disturbance, or toxicity expected from the use of aerial application of fire retardants.
- 30 species and 6 critical habitats would have a may affect – is likely to adversely affect (LAA) determination due to impacts expected from either from change in habitat, disturbance, or toxicity expected from the use of aerial application of fire retardants.
- One species identified as nonessential would have a ‘not likely to jeopardize the continued existence of the species’ determination based on factors as described above.

To aid in understanding, summary tables and species discussions that follow are organized by taxonomic groupings

5.4.5.2 Amphibians: Salamanders, Toads, and Frogs

Effects common to all amphibians

Data on the toxicity of retardants to amphibian species is limited, however as a group amphibians are sensitive to chemicals in their environment. The ecological risk assessment (Auxilio Management Services 2021) indicated risk to threatened or endangered amphibian species from one retardant (PhosChek MVP-Fx) from an accidental stream application of 6 gallons per 100 square feet in a small stream. Risks were not identified for other retardants accidently applied to a stream, accidental application of any retardant to a large stream, or application outside the 300-foot avoidance area. Jones (2017) examined effects of commonly used road salt (sodium chloride) and found that the highest concentrations of sodium chloride in their experiments reduced toad activity, but was associated with increased tadpole activity due to competitive stress. Because of the limited toxicity information, retardant in the aquatic environment is assumed to be detrimental to the reproduction, growth and survival of aquatic life stages of threatened and endangered amphibians.

All aquatic habitat is included in avoidance areas. At a minimum, there is a 300-foot buffer from the edge of the aquatic habitat; for some amphibian species, the buffer is larger. The purpose of the avoidance area is to reduce the probability of retardant entering the water. Retardant use in avoidance areas is not allowed, except when human life or safety is threatened and use of retardant would alleviate the threat. As previously discussed, from 2012 through 2019 intrusions of retardant into avoidance areas occurred on 0.46 percent of all fires. Intrusions into the water, both accidental and due to an exception, occurred at a rate of 0.43 percent of all retardant drops. The intrusion rate into the buffer area around aquatic habitat, where it did not enter the water, was 0.29 percent of all retardant drops. It is assumed that units with a greater application potential have a higher probability of intrusions occurring. It is also assumed that increased retardant use would result in an increase in number of intrusions, but would not alter the intrusion rates.

Salamanders

Table 14. Summary of determinations for salamander species and critical habitat

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Ambystoma cingulatum	frosted flatwood salamander	T, CH	NLAA	NLAA

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Ambystoma tigrinum stebbinsi	Sonora tiger salamander	E	na	LAA
Ambystoma californiense	California tiger salamander, central population	T, (CH)	na	NLAA
Plethodon neomexicanus	Jemez Mountains salamander	E, CH	NLAA	NLAA
Cryptobranchus alleganiensis bishopi	Ozark hellbender	E	na	NLAA
Cryptobranchus alleganiensis alleganiensis	eastern hellbender - Missouri distinct population segment	E	na	NLAA
Necturus lewisi	Neuse River waterdog	T	na	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Aerially applied retardant was found to have No Effect on black warrior waterdog (*Necturus alabamensis*), Cheat Mountain salamander (*Plethodon netting*), and Shenandoah salamander (*Plethodon shenandoah*). A summary of the rationale for each species in found in appendix F.

Frosted-flatwoods salamander – *Ambystoma cingulatum*

The frosted flatwoods salamander was listed as threatened on April 1, 1999 and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Terrestrial habitat is best described as a topographically flat or slightly rolling wiregrass-dominated grassland having little to no midstory and an open overstory of widely scattered longleaf pine. It occurs in low-growing shrubs, such as saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*) and blueberries (*Vaccinium* spp.) and co-exists with grasses and forbs in the groundcover. Groundcover plant diversity is usually very high. The underlying soil is typically poorly drained sand that becomes seasonally inundated.

The species range is limited to eight counties in Georgia, five counties in Florida, and five counties in South Carolina. There are known populations on the Apalachicola and Osceola National Forests (National Forests in Florida) and the Francis Marion National Forest in South Carolina. The Osceola National Forest has one population, with only three breeding ponds, of frosted flatwoods salamanders. In South Carolina, the species is known to occur in Berkeley County on the Francis Marion National Forest and Charleston county, on the Santee Coastal Reserve. Designated critical habitat occurs on the National Forests in Florida on the Apalachicola and Osceola National Forests, and on the Francis Marion National Forest (74 FR 6700).

The Francis Marion National Forest used aerial application of fire retardant 12 times from 2000 to 2010. However, since 2012, this forest has not used aerially applied fire retardant. The National Forests in Florida have very low retardant use and retardant application potential.

Critical habitat Primary Constituent Elements are breeding habitat, non-breeding habitat and dispersal habitat. Breeding habitat is small (1 to 10 acre), acidic, depressional standing bodies of fresh water that are seasonally flooded in late fall or early winter and dry in late spring or early summer; isolated from other water bodies; within the pine flatwoods-savannah communities; dominated by grasses and grass-like species in the understory with an overstory or pond-cypress, blackgum and slash pine; with a relatively open canopy; and with a burrowing crayfish fauna. Non-breeding habitat is upland pine flatwoods-savanna habitat that is open moist woodland maintained by frequent fires. Non-breeding habitat is within 1500 feet of breeding ponds; contains crayfish burrows or other underground habitat; has organic hardpan that inhibits subsurface soil penetration; and often has wiregrass as the dominant grass. Dispersal habitat is upland habitat between breeding and non-breeding habitat that allows movement between them. It consists of a mix of vegetation types representing the transition between wetland and upland vegetation; open canopy and abundant native herbaceous species; moist soils; and subsurface structures.

The only primary constituent element of critical habitat that aerially applied retardant may impact is the burrowing crayfish fauna in breeding habitat. Retardant applied in the breeding habitat could reduce the crayfish fauna. This is unlikely, however, because:

- breeding habitat is within required aquatic avoidance areas,
- the Francis Marion National Forest does not use retardant,
- the National Forests in Florida use very little aerially applied retardant, and
- the breeding season is during the wetter months, outside of the primary fire season.

Because the habitat is avoidance area mapped, the probability of retardant entering the breeding habitat is greatly reduced and any potential effect are discountable. Therefore, aerially applied fire retardant **may affect, but is not likely to adversely affect, frosted flatwoods salamander critical habitat** (wildlife screen 1). ***Avoidance Area Mapping is Required (300 foot buffer) for this species' critical habitat***.

Frosted flatwoods salamanders have limited mobility (see wildlife screen 2, Figure 11) and a small home range, which could make them vulnerable to retardant drops. However, they are fossorial in nature and are underground during most of the fire season. Although this would make it likely they could avoid the direct effects of a retardant drop, there is some possibility of them being above ground and directly affected. This species has a moderate distribution (found in more than one county and more than one National Forest). For the known occupied sites on National Forest System lands, Avoidance Area Mapping is recommended to minimize impacts to this species (Wildlife screen 2, Figure 11).

Adult frosted flatwoods salamanders eat small invertebrates, including earthworms, that share their fossorial habitat. Fossorial food items would not be exposed to aerial retardant. Larvae of this species feed primarily on small crustaceans in their breeding habitat. Breeding habitat is seasonally-flooded depressional standing bodies of fresh water. Because these areas have water only seasonally, they may not be mapped as avoidance areas but operating guidelines direct pilots to avoid dropping retardant where water is present.. Retardant may be used during the early portion of the breeding season (October), but disturbance is unlikely as the adults breed during rainy evenings, outside the time of day that aerial retardant would be dropped.

Based on the above information, aerially applied fire retardant **may affect but is not likely to adversely affect frosted flatwoods salamander**. ***Avoidance Area Mapping is recommended*** in order to reduce impacts.

Sonora-tiger salamander – *Ambystoma tigrinum-stebbensi*

The Sonora tiger salamander was listed as endangered on January 6, 1997. This salamander was analyzed the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The Sonora tiger salamander breeds in cattle ponds and spends much of the remainder of the year underground in rodent burrows, rotted logs, and other moist cover sites. Typical habitat ranges in elevation from 4,000 to 6,300 feet. It breeds at about 50 sites within the headwaters of the Santa Cruz and San Pedro Rivers on the Coronado National Forest. Breeding sites occupied by the Sonora tiger salamander are often very small and may not be recognized as waterways or important aquatic sites; therefore, they may receive direct application of fire retardant (USDA Forest Service 2011b). Because the species has a limited distribution and limited mobility due to its small size and small home ranges, it is susceptible to localized applications of fire retardant.

The Coronado National Forest has high aerial fire retardant application potential. Because of the high retardant potential and likelihood of a pilot not seeing the breeding habitat from the air, there is some likelihood of retardant entering the breeding pools. Retardant could kill the food source or the larval salamanders if dropped on a breeding (cattle) pond. Therefore, aerially applied fire retardant **may affect, and is likely to adversely affect Sonora tiger salamanders**. ***Avoidance area mapping with a 300-foot buffer around the breeding habitat is required*** for this species to minimize the potential for retardant use in the area.

California tiger salamander – *Ambystoma californiense*

The California tiger salamander occurs as three distinct population segments (Santa Barbara, Sonoma, and Central Valley), all of which are listed as threatened. The central population was listed as threatened on August 4, 2004 (69 FR 47212) and is the only population segment that potentially occurs on National Forest System lands (see below). Critical Habitat has been designated for this species (70 FR 49380) but it does not include National Forest System lands. This species was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011).

The California tiger salamander (central population) is restricted to grasslands and foothill regions typically below 2000 feet elevation, where lowland aquatic sites are available for breeding. They prefer natural ephemeral pools, or cattle ponds that are allowed to dry seasonally. Larvae require approximately 4 months to transform into juvenile adults. California tiger salamanders require refuges provided by ground squirrels and other burrowing mammals in which they become dormant during the dry months.

There is habitat for this species on the Sequoia National Forests in Region 5, although the species has not been found on the forest. The Sequoia National Forest has high retardant application potential.

Waterways/waterbodies needed for breeding habitat are included in aquatic avoidance areas; in areas with known occurrences avoidance areas would be extended to 600 feet (Krueger 2011). If fire retardant enters aquatic breeding habitat during the breeding and rearing season it could impact larval salamanders and their food supply. The potential for impacts is discountable for California tiger salamander because:

- the habitat on the Sequoia National Forest is not occupied,
- breeding occurs during the rainy season,
- occupied breeding habitat would be protected by expanded aquatic avoidance areas so the probability of retardant entering occupied breeding habitat in the future is very low (intrusion rate into aquatic avoidance areas is less than one percent),
- Fires on the Sequoia National Forest primarily occur from May to October, when adults are located in burrows. In addition, most migrations to (adults) and from (juveniles) breeding sites occur from November to April when retardant use is less likely.

Therefore, aerially applied fire retardant **may affect, but is not likely to adversely affect the central population of California tiger salamander** (wildlife screen 2, Figure 11) on National Forest System lands.

Jemez Mountains salamander – *Plethodon neomexicanus*

The Jemez Mountains salamander was listed as Endangered on October 10, 2013 (78 FR 55599). This is a recently listed species that was covered by Forest Service Region 3 consultation in 2013 (USDI Fish and Wildlife Service 2013). This species occurs in mixed conifer habitat with abundant rotted logs and surface rocks; vegetation is dominated by Douglas-fir, blue spruce, Engelmann spruce, ponderosa pine, and white fir, with occasional aspen, Rocky Mountain maple, New Mexico locust, oceanspray, and various shrubby oaks. The Jemez Mountains salamander is found only on the Santa Fe National Forest in Region 3 which has moderate retardant application potential. The fire season occurs prior to the start of the summer rainy season.

Critical Habitat was designated November 20, 2013 (78 FR 69569) and consists of 87,840 acres in two units on the Santa Fe National Forest. Primary constituent elements of critical habitat include: (1) moderate to high tree canopy cover, typically 50 to 100 percent canopy closure, that provides shade and maintains moisture and high relative humidity at the ground surface; (2) elevations from 6,988 to 11,254 feet; (3) ground surface in forest areas; and (4) underground habitat in forest or meadow areas containing interstitial spaces.

Use of aerial retardant would not change the tree or understory composition of primary constituent element one, nor would it affect the canopy cover, shade, moisture or humidity. Retardant would have no effect on the elevations of critical habitat. The components of the ground surface in critical habitat include moderate to high volumes of large fallen trees and other woody debris, and structural features, such as rocks, bark, and moss mats, that provide the species with food and cover. If retardant were to contact moss mats it could result in fertilizing effects, or overfertilization could result in die-back. These effects are unlikely, however, because the forest has only moderate application potential, and the high canopy cover in the critical habitat would intercept any retardant prior to reaching the ground surface. Therefore, the effect is discountable. Use of aerial retardant would not change the interstitial spaces of underground habitat provided by igneous rocks or rotted tree root channels. Use of retardant could impact the rodent and large invertebrate populations that create burrows for the salamander, however the potential effect would not be measurable.

Based on the above discussion, use of aerial fire retardant **may affect, but is not likely to adversely affect Jemez Mountains salamander Critical Habitat**. ***Avoidance Area Mapping is not recommended for critical habitat***, because the large size of the two critical habitat units (almost 88,000 acres) would make it difficult to effectively manage for fire suppression on the National Forest System lands where designated critical habitat occurs (USDA Forest Service, Santa Fe National Forest 2013).

Jemez Mountains salamanders are restricted in range, with 90 percent of the known population believed to occur on the Santa Fe National Forest. This species does not have an aquatic larval stage. They remain below the surface throughout most of the year but may be active on the surface from July to October, during the summer rains. They forage at night on a variety of invertebrates including ants, beetle and moth larvae, spiders and small snails. This salamander has a small home range.

There is a possibility of direct effects to Jemez Mountains salamander from aerial retardant application because of their very limited distribution, small home ranges and limited mobility. As discussed under Critical Habitat, ***avoidance area mapping for this completely terrestrial (i.e. non-aquatic) species is not recommended***. Because the species may not be able to avoid areas where retardant is applied and avoidance areas do not exist, aerial retardant may affect Jemez Mountains salamander (wildlife screen 2, Figure 11). The effects to this salamander are discountable because:

- Individuals of the species is on the surface during the rainy season after the fire season,
- individuals are active at night, not during the day when retardant is applied,
- retardant is not used during a critical time period and is not anticipated to be a short-term disturbance, however since the species is active at night below the surface sound or sight disturbance from aircraft is not expected (wildlife screen 3, Figure 12),
- there is no information about the effects of ingesting retardant on amphibian species, however because the Jemez Mountains salamander feeds on invertebrates also located below the surface it is unlikely they will be exposed to retardant from their food.

Aerial application of fire retardant **may affect, but is not likely to adversely affect Jemez Mountains salamander**.

Ozark hellbender – *Cryptobranchus alleganeiensis bishopi* and Eastern hellbender (Missouri distinct population segment) – *Cryptobranchus alleganiensis alleganiensis* and Neuse River waterdog – *Necturus lewisi*

The Ozark hellbender was listed as Endangered on 7 November 2011 (76 FR 61956). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The Missouri distinct population of eastern hellbender was listed as Endangered on 9 March 2021 (86 FR 13465). Both species occur on the Mark Twain National Forest in Region 9. The Ozark hellbender also occurs on the Ozark National Forest in Region 8. The Ozark National Forest does not use retardant. The Mark Twain National Forest used aerially applied fire retardant only once from 2000 through 2010 and only twice since 2012, and therefore has very low potential for aerial retardant application.

The Neuse River waterdog was listed as threatened on 9 July 2021 (86 FR 30688). Critical habitat was also designated but does not occur on National Forest System lands. This waterdog is native to North Carolina, in the Neuse and Tar River drainages. A small portion of its range adjacent to the Trent River occurs on the Croatan National Forest. The National Forests of North Carolina have very low retardant application potential.

These salamanders are fully aquatic species which rely on swift and shallow high oxygenated waters. Ozark and eastern hellbender habitat is rocky, clear creeks and rivers, usually where there are large shelter rocks. Males prepare nests beneath large, flat rocks or submerged logs. The Neuse River waterdog is a stream dweller requiring relatively high oxygen levels and water quality. It can be found among large accumulations of submerged leaves in eddies or backwater areas. In the spring eggs are attached to the underside of objects in the water. They hatch from June to July. This species is seldom seen in summer. Neuse waterdog eats crayfish, snails and insects.

These species have low mobility, but effects would be discountable because:

- aquatic habitat of these species is restricted from aerial application of fire retardant through standard aquatic avoidance areas.
- these species occur on the Mark Twain National Forest, which has very low application potential.

Therefore, aerially applied fire retardant **may affect, but is not likely to adversely affect Oxark hellbender, the Missouri distinct population of eastern hellbender, and the Neuse River waterdog.**

Frogs and Toads

Aerially applied retardant was found to have No Effect on Wyoming toad (*Bufo baxteri*) and dusky gopher frog (*Rana sevosa;* also known as *Lithobates sevosus*). A summary of the rationale for each species in found in appendix F.

Table 15. Summary of determinations for frog and toad species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Rana chiracahuensis	Chiricahua leopard frog	T, CH	NLAA	LAA
Rana pretiosa	Oregon spotted frog	T, CH	NLAA	LAA
Anaxyrus californicus	arroyo toad	E, CH	NLAA	LAA
Rana (aurora) draytonii	California red-legged frog	T, CH	NLAA	LAA
Rana muscosa	mountain yellow-legged frog (southern California distinct population segment)	E, CH	NLAA	LAA
Rana muscosa	mountain yellow-legged frog (northern	E, CH	NLAA	LAA

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
	California distinct population segment)			
Rana sierrae	Sierra Nevada yellow-legged frog	E, CH	NLAA	LAA
Anaxyrus canorus	Yosemite toad	T, CH	NLAA	LAA

[1]T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Chiricahua leopard frog – *Rana chiricahuensis*

The Chiricahua leopard frog was listed as threatened on 13 June 2002 (67 FR 40790). This species was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). At that time critical habitat was proposed. The final critical habitat rule was published 20 March 2012 (77 FR 16324).

This frog is historically an inhabitant of cienegas, pools, livestock tanks/cattle ponds, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet in ten counties in central, east-central, and southeastern Arizona, and in six counties in west-central and southwestern New Mexico. Adults prey upon invertebrates while larvae eat algae, organic debris, plant tissue, and minute organisms in the water. The species in inactive in cold temperatures. It is now often restricted to springs, livestock tanks/cattle ponds, and streams in the upper portions of watersheds where non-native predators either have yet to invade or habitats are marginal.

The Chiricahua leopard frog occurs in Region 3 in Arizona on the Apache–Sitgreaves National Forest, which has low potential for aerial retardant application; on the Coconino National Forest, which has moderate retardant application potential; and on the Coronado and Tonto National Forests, both of which have high retardant application potential. In New Mexico, it occurs on the Cibola and Gila National Forests, both of which have moderate aerial retardant application potential.

The final critical habitat designation for Chiricahua leopard frog includes 10,346 acres, with 270 acres on the Apache-Sitgreaves National Forest, 417 acres on the Tonto National Forest; 232 acres on the Coconino National Forest, 1,213 on the Gila National Forest and 1,674 acres on the Coronado National Forest.

The primary constituent elements specific to the Chiricahua leopard frog are: (1) Aquatic breeding habitat and immediately adjacent uplands, and (2) dispersal and nonbreeding habitat, consisting of areas with ephemeral, intermittent, or perennial water that are generally not suitable for breeding, and associated upland or riparian habitat that provides movement corridors for frogs among breeding sites. Components of the aquatic breeding habitat that may be impacted by aerially applied fire retardant are standing or slow moving bodies of water with pollutants absent or minimally present, and emerged or submerged vegetation. Retardant could be considered a pollutant in the water. At low levels retardant has the potential to cause fertilization of vegetation, and at higher levels retardant may cause eutrophication in standing water. Retardant would not impact the components of dispersal and non-breeding habitat.

Aquatic breeding habitat and the immediately adjacent uplands are included within the 300-foot buffer aquatic avoidance areas. These avoidance areas reduce the probability of retardant entering the water to the point of making potential effects discountable (wildlife screen 1, Figure 10). Therefore, aerial retardant use **may affect, but is not likely to adversely affect Chiricahua leopard frog critical habitat.**

This species has a limited mobility but moderate distribution. It can be very susceptible to localized applications of fire retardant. The sensitive aquatic habitats occupied by the Chiricahua leopard frog are often very small and may not be recognized as "waterways" or important aquatic sites (e.g. stock tanks/cattle ponds, springs) and may receive direct applications of fire retardants (Barrera 2011, USDA Forest Service 2011b).

Required aquatic avoidance areas minimize the impacts of aerial fire retardant application on this species since the sites where the Chiricahua leopard frog occurs are limited in distribution and occur primarily within aquatic habitat (wildlife screen 2, Figure 11). However, because of the moderate to high retardant application potential on most of the national forests where the species occurs, the difficulty in identifying their sensitive aquatic habitats from the air, and the environmental stressors of the current long-term drought, we determine that aerial application of fire retardant **may affect and is likely to adversely affect Chiricahua leopard frog**.

Oregon spotted frog – *Rana pretiosa*

The Oregon spotted frog was listed as threatened on 29 August 2014 (79 FR 51657). This species was analyzed in 2018 under a Forest Service Region 6 consultation (USDA Forest Service 2017, USDI Fish and Wildlife Service 2018 reference number O1EWFW00-2017-F-0653). Currently Oregon spotted frog is found within 15 subbasins ranging from extreme southwestern British Columbia south through the Puget Trough, and the Cascade Range from south-central Washington to at least the Klamath Basin in southern Oregon (79 FR 51662). The Oregon spotted frog life cycle requires shallow water areas for breeding, oviposition, and egg and tadpole survival. It requires perennial water with moderately vegetated pools for adult and juvenile survival in the dry season, and perennial water for protecting all age classes during cold wet weather.

The Oregon spotted frog occurs in Forest Service Region 6 on the Mt. Baker-Snoqualmie National Forest, which does not use retardant; the Mt. Hood National Forest, which has very low retardant application potential; the Gifford Pinchot and Willamette National Forests, which have low retardant application potential; the Fremont-Winema National Forest, which has moderate application potential; and the Deschutes National Forest, which has high application potential.

In Region 5, there currently are no known occupied sites but there are historic records at sites that have not been recently surveyed. Therefore, the species may occur on the Modoc and Klamath National Forests, which have high retardant application potential. Since there are populations of Oregon spotted frog in the Klamath Basin, this species is being analyzed as occurring on the Modoc and Klamath National Forests in this consultation

Critical habitat for the Oregon spotted frog was designated on 11 May 2016 (81 FR 29335). It includes 65,038 acres and 20.3 stream miles in Washington and Oregon, in 14 units delineated by river sub-basins where Oregon spotted frog are extant. The units or portions of units on National Forest System lands are as follows:

- Gifford Pinchot National Forest
  - 110 acres of the White Salmon River unit (unit 5)
- Mt. Hood National Forest:
  - 90 acres (entire unit) of the Lower Deschutes River Unit (unit 7)
- Deschutes National Forest
  - 1,605 acres of unit 8A, and 22,031 acres (entire unit) of unit 8B of the Upper Deschutes River unit (unit 8)
  - 7,715 acres of the Little Deschutes River unit (unit 9)
- Willamette National Forest
  - 98 acres (entire unit) of the McKenzie River unit (unit 10)
  - 292 acres of the Middle Fork Willamette River unit (unit 11)
  -
- Fremont-Winema National Forest
  - 620 acres of the Williamson River unit (unit 12)
  - 352 acres of the Upper Klamath Lake unit (unit 13)
  - 67 acres of the Upper Klamath unit (unit 14).

Primary constituent elements consist of (1) ephemeral or permanent freshwater bodies, (2) aquatic movement corridors of ephemeral or permanent freshwater, and (3) habitat that provides refugia from predators. Use of aerially applied fire retardant would not alter most of the characteristics of the primary constituent elements. Retardant may impact herbaceous wetland vegetation with its fertilizing effects. At low application levels vegetation growth could be increased. At higher application rates the increased growth could result in eutrophication of pools or ponds

As a result of the 2018 consultation for Oregon spotted frog, the Forest Service committed to 600-foot buffers of the following critical habitat units:

- Gifford Pinchot National Forest, White Salmon River unit (unit 5),
- Deschutes National Forest, Upper Deschutes River unit (units 8a and 8b) and Little Deschutes River unit (unit 9),
- Willamette National Forest, Middle Fork Willamette River unit (unit 11)
- Fremont-Winema National Forest, Williamson River unit (unit 12), Upper Klamath Lake unit (unit 13), and Upper Klamath unit (unit 14).

On the Mt. Hood National Forest, the Lower Deschutes River unit (unit 7) avoidance area was expanded to between 300 to 1,500 feet beyond the designated critical habitat. The McKenzie River unit (unit 10) on the Willamette National Forest has been expanded to a 12 square mile (7,680 acre) avoidance area. There are no proposed changes to any buffers, ***and all of the above avoidance areas and expanded buffers are required***.

The larger buffers implemented for Oregon spotted frog critical habitat render any potential impacts of fertilization discountable (wildlife screen 1, Figure 10). Use of aerially applied fire retardant **may affect, but is not likely to adversely affect Oregon spotted frog critical habitat.**

Oregon spotted frogs breed as early as February or March at lower elevations, and as late as May or early June at higher elevations. Metamorphosis occurs in mid- to late summer (NatureServe 2021). Amphibian species are very susceptible to chemicals (Auxilio Management Services 2021). Although the expanded buffers on critical habitat described above would greatly reduce the probability of retardant entering the species habitat, there is still a small potential for retardant to be applied in the water or uplands where they occur. Oregon spotted frog juveniles are not highly mobile and would not be able to avoid retardant drops (wildlife screen 2, Figure 11). Because retardant is used when larvae are present (USDA Forest Service 2020d), impacts could occur; therefore, aerial application of fire retardant **may affect, and is likely to affect Oregon spotted frog.**

Arroyo toad – *Anaxyrus californicus (Bufo californicus)*

The arroyo toad was listed as Endangered on 16 December 1994 (59 FR 64859). This toad breeds in stream channels and uses stream terraces and uplands for foraging in eight counties in southern California. It was analyzed for consultations in 2008 (USDI Fish and Wildlife Service 2008) and again in 2011 (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). It occurs on the Cleveland, Angeles, San Bernardino and Los Padres National Forests, all of which have high aerial retardant application potential.

Critical habitat was designated on 9 February 2011 (76 FR 7245). Four primary constituent elements were identified:

- rivers or streams with hydrologic regimes that supply water to provide space, food, and cover needed to sustain eggs, tadpoles, metamorphosing juveniles, and adult breeding toads,
- riparian and adjacent upland habitats, particularly low-gradient (typically less than 6 percent) stream segments and alluvial streamside terraces with sandy or fine gravel substrates,
- a natural flooding regime, and
- stream channels and adjacent upland habitats that allow for movement to breeding pools, foraging areas, overwintering sites, upstream and downstream dispersal, and connectivity to areas that contain suitable habitat.

Successful arroyo toad reproduction requires breeding pools less than 6 inches deep, flowing water with velocities less than 1.3 feet per second, and surface water that lasts a minimum of 2 months during the breeding season.

There are 6,412 acres of critical habitat on the Los Padres National Forest, 1,884 acres on the Angeles National Forest, 4,275 acres on the Cleveland National Forest and 2,562 acres on the San Bernardino National Forest for a total of 15,133 acres on National Forest System lands. Aerial retardant use would have no impacts on most of the primary constituent elements of arroyo toad critical habitat. However, any retardant that entered the breeding pools could alter the water quality sufficiently to render the pool unsuitable for sustaining eggs, tadpoles, metamorphosing juvenile or breeding adults in that year. Avoidance area mapping of waterways would limit the potential for retardant to enter the waterways. Avoidance areas with expanded buffers (to include 600-feet on either side of waterways) have been established to provide protection to the species upland habitat; ***these avoidance areas and expanded buffers are required***.

The aerially application of fire retardant **may affect but is not likely to adversely affect arroyo toad critical habitat** because the expanded buffer will reduce the probability of retardant entering the waterway to a discountable level (wildlife screen 1, Figure 10).

Since 2012, there have been several intrusions, resulting in incidental take for arroyo toad on each national forest where it occurs; allowed incidental take has not been exceeded. Most, if not all the intrusions reported in arroyo toad habitat mapped avoidance areas are the result of using the exception for public and fire fighter safety in southern California. The Pilot Fire (2016) on the San Bernardino National Forest is an example of the exception being used. The result was retardant was dropped in the outer 50-foot edge of the avoidance area buffer for arroyo toad; and there were no impacts to species or habitat.

As noted previously, amphibian species are susceptible to the toxic effects of aerially applied fire retardant. Because the arroyo toad occurs on units with high application potential, and the larvae are not able to avoid retardant, these impacts may occur. The 600-foot buffers on habitat will reduce the likelihood that the retardant would enter waterways and upland areas occupied by the species (wildlife screen 2, Figure 11), However, airtanker bases in California primarily use PhosChek MVP-Fx, which is the retardant identified in the risk assessment (Auxilio Management Services 2021) as having a risk to tadpoles. Based on the slight potential for retardant to enter the water, aerial fire retardant **may affect and is likely to adversely affect, arroyo toad.**

California red-legged frog – *Rana (aurora) draytonii*

The California red-legged frog was listed as threatened on 23 May 1996 (61 FR 25813). It was analyzed in 2008 (USDI Fish and Wildlife Service 2008) and again in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Revised critical habitat for the California red-legged frog was designated on 3 March 2010 (75 FR 12816).

This species may occur on the Angeles, Cleveland, Eldorado, Los Padres, Mendocino, Plumas, San Bernardino, Shasta-Trinity, Sierra, Stanislaus and Tahoe National Forests. Critical Habitat is designated on the Angeles, Eldorado, Los Padres, Plumas and Tahoe National Forests. The Mendocino National Forest has moderate application potential, while the remaining forest have high application potential of aerial retardant.

The California red-legged frog requires a variety of habitat elements. Breeding sites of the California red-legged frog are in aquatic habitats including pools and backwaters within streams and creeks, ponds, marshes, springs, sag ponds, dune ponds, and lagoons. Additionally, California red-legged frogs frequently breed in artificial impoundments, such as stock ponds. The species also requires that breeding areas be embedded in a matrix of riparian and upland dispersal habitats.

There are four primary constituent elements of critical habitat:

- Aquatic breeding habitat includes standing bodies of fresh water that typically become inundated during winter rains and that hold water for a minimum of 20 weeks.
- Aquatic non-breeding habitat include freshwater pond and stream habitats which provide for shelter, foraging, predator avoidance, and aquatic dispersal.

- Upland habitat includes areas adjacent to or surrounding aquatic habitat and riparian habitat, up to a distance of 1 mile, with various vegetation types that provide shelter, forage, and predator avoidance.
- Dispersal habitat is accessible upland or riparian habitat between occupied or previously occupied sites that are within 1 mile of each other.

The designated critical habitat includes large watershed areas. California red-legged frog critical habitat occurs on forests with high retardant application potential. ***Aquatic avoidance areas in red-legged frog critical habitat have been expanded to 600 feet***, which reduces but does not eliminate the potential for retardant intrusions; therefore, there is potential for aerial retardant application to impact the water quality of aquatic critical habitats. Larger avoidance areas could also contribute to larger fires that could, in turn, exacerbate the risks to the species (Krueger 2011, USDA Forest Service 2011b). Aerially applied fire retardant **may affect but is not likely to adversely affect California red-legged frog critical habitat.**

California red-legged frog are widely distributed but occur in low numbers. Occurrences on National Forest System lands are limited and are isolated from other occurrences (NatureServe 2021). Breeding habitat is ponds or slow moving, low gradient streams where retardant would not be readily diluted or distributed. ***Aquatic avoidance areas in red-legged frog habitat have been expanded to 600 feet***, which will greatly reduce the potential for retardant intrusions in water. Aerially delivered retardant **may affect and is likely to adversely affect California red-legged frog** because:

- the retardant used in airtankers loaded in California poses a risk to tadpoles (refer to the Effects common to all amphibians section above, and to the ecological risk assessment (Auxilio Management Services 2021)),
- there is a slight chance of retardant intrusion into water,
- and numbers of breeding individuals on National Forest System lands is low.

Mountain yellow-legged frog (Southern California Distinct Population Segment)– *Rana muscosa*

The southern California distinct population segment of mountain yellow-legged frog was listed as Endangered on 2 July 2002 (67 FR 44382). This species was analyzed in 2008 (USDI Fish and Wildlife Service 2008) and again in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The species occurs at only a few sites in high elevation, fast-moving cold-water streams on the San Bernardino and Angeles National Forests. Both of those Forests have high aerial retardant application potential.

The number of individuals of species in this Distinct Population Segment was estimated as of 2012 at fewer than 200 individuals (USDI Fish and Wildlife Service 2012), in 10 small populations (USDI Fish and Wildlife Service 2018). Because of its limited distribution and numbers, the southern California distinct population segment is critically imperiled (USDI Fish and Wildlife Service 2008). A captive breeding program has been established for this species with the San Diego, Fresno, and Los Angeles Zoos to improve survival of tadpoles and allow re-introduction back into historic habitat (USDI Fish and Wildlife Service 2007).

Critical Habitat was designated on 14 September 2006 (71 FR 54344) in the Angeles and San Bernardino National Forests, in three units, that also function as recovery units (USDI Fish and Wildlife Service 2018):

- The San Gabriel Mountains unit consists of 5,117 acres along 53.3 stream miles on the Angeles and San Bernardino National Forests.
- The San Bernardino Mountains unit consists of 1,534 acres along 14 miles of stream on the San Bernardino National Forest.
- The San Jacinto Mountains unit consists of 1,501 acres along 12.4 miles of stream on the San Bernardino National Forest.

Primary constituent elements include: (1) permanent water sources found between 1,214 to 7,546 feet in elevation, and 2) riparian habitat and upland vegetation extending 262 feet (80 meters) from each side of the centerline of each identified stream and its tributaries. Aerial retardant application would not alter the physical characteristics of critical habitat (bank and pool substrates, sunning posts, refugia pools with cover). Retardant in the riparian habitat and upland vegetation may result in fertilization effects to existing plants, but this is not expected to alter their use as frog habitat. If retardant were to enter the permanent water source, it could prevent that location from contributing to critical habitat until the chemical is diluted or decomposes.

Avoidance areas for mountain yellow-legged-frogs in southern California have been extended to 600-feet from the edge of the waterway. On the San Bernardino National Forest intermittent tributaries upstream of occupied habitat is included in avoidance areas. These expanded avoidance areas will minimize the likelihood of retardant entering the critical habitat, therefore aerial application of fire retardant **may affect but is not likely to adversely affect the southern California distinct population segment of mountain yellow-legged frog critical habitat** (wildlife screen 1, Figure 10).

Since 2012, there have been multiple intrusions into mountain yellow-legged frog habitat. Three occurred on the San Bernardino National Forest in the 2012 Lawler Fire, the 2012 Tahquitz Fire, and the 2013 Mountain Fire (appendix B and appendix C). Fire has also impacted this species' habitat; on the Angeles National Forest, the 2020 Bobcat Fire burned through a watershed containing two populations of mountain yellow-legged frog. Because of the loss of habitat due to the fire, the remaining individuals were collected and relocated.

Because of the limited numbers and limited distribution of this species, the inability for tadpoles to avoid retardant if it enters the water, use of a retardant that poses a risk to tadpoles (refer to the Effects common to all amphibians section),, and impacts to habitat and populations that have occurred since 2012, aerial application of fire retardant **may affect and is likely to adversely affect the southern California distinct population segment of mountain-yellow legged frog**.

Mountain yellow-legged frog (Northern California Distinct Population Segment) – *Rana muscosa*

The northern California distinct population segment of mountain yellow-legged frog was listed as endangered on 29 April 2014 (79 FR 24255). It was analyzed in a supplemental Biological Assessment (USDA Forest Service 2017) and consultation was reinitiated (USDI Fish and Wildlife Service 2018a and 2018b). It occurs on the Inyo, Sierra, and Sequoia National Forests, all of which have high retardant application potential.

Habitat for this species includes sunny riverbanks, meadow streams, isolated pools, and lake borders in the Sierra Nevada and cool rocky stream courses fed by springs and snow melt in southern California. Mountain yellow-legged frogs in this population seems to prefer sloping banks with rocks or vegetation extending to the water's edge. Individuals are seldom is found away from water, but may cross upland areas when moving between summer and winter habitats. Wintering sites include areas near the shore, under ledges and in deep underwater crevices.

Critical habitat was designated 26 August 2016 (81 FR 59045) and is found on the Sequoia and Inyo National Forests. Primary constituent elements include:

- breeding and rearing habitat that consists of permanent water bodies, or aquatic habitat hydrologically connected to permanent water bodies. The habitat must:
    - ♦ be of sufficient depth (lakes) to not freeze solid: no less than 5.6 feet but generally greater than 8.2 feet, and optimally 16.4 feet or deeper,
    - ♦ maintain a natural flow pattern and provide sufficient productivity and a prey base to support growth and development,
    - ♦ be free of predators,
    - ♦ maintain water for the entire tadpole growth phase (minimum 2 years), and
    - ♦ contain varying substrate for basking and cover, shallower microhabitat with solar exposure to foster primary productivity, open gravel banks and rocks at or above the water surface for adult sunning, aquatic refugia to provide cover from predators, and sufficient food resources to provide for tadpole growth and development.
- aquatic non-breeding habitat that contains bank and pool substrates of varying sizes for basking and cover, open gravel banks and rocks at or above the water surface for adult sunning, aquatic refugia to provide cover from predators, sufficient food resources to support juvenile and adult foraging, overwintering refugia to protect hibernating life stages from freezing, and streams or wet meadow habitat for movement corridors between breeding and/or foraging sites; and
- upland areas adjacent to aquatic habitat that provide for feeding and movement by mountain yellow-legged frogs and provide for the natural hydrologic regime (water quantity and quality). Upland areas:
    - ♦ extend 25 meters (82 feet) from the bank or shoreline or a stream,
    - ♦ have sufficiently thin overstory in the riparian vegetation to allow sunlight to reach the aquatic habitat and thereby provide basking areas for the species,
    - ♦ include the area between suitable aquatic habitats that are within 984 feet of each other,
    - ♦ in wet habitat are suitable for dispersal and foraging.

Aerial application of fire retardant has the potential to affect the productivity and invertebrate food availability elements of critical habitat. Retardants have fertilizing properties and could cause increased growth of plants, including algae. In standing or slow-moving water this could result in eutrophication. Retardant could also result in loss of invertebrate prey due to its toxic properties. ***Avoidance areas in critical habitat for this species (northern California distinct***

population segment) have been extended to 600-feet from the edge of the waterway, which greatly reduces the likelihood of retardant entering the waterway. Retardant drops would also only affect a small portion of critical habitat at any given time. Therefore, the potential effects are discountable (wildlife screen 1, Figure 10). Aerial application of fire **retardant may affect but is not likely to adversely affect critical habitat for the northern California distinct population segment of mountain yellow-legged frog**.

The northern California Distinct population segment of mountain yellow-legged frog occurs on three forests with high retardant application potential. Because this species is closely tied to their aquatic habitat and is susceptible to the chemicals found in retardants, aerial application of fire retardant **may affect and is likely to adversely affect this distinct population segment of mountain yellow-legged frog.**

Sierra Nevada yellow-legged frog – *Rana sierrae*

Sierra Nevada yellow-legged frog was listed as endangered on 29 April 2014 (79 FR 24255). It was analyzed in a supplemental Biological Assessment (USDA Forest Service 2017) and consultation was reinitiated (USDI Fish and Wildlife Service 2018a and 2018b). It occurs on the Toiyabe National Forest in Forest Service Region 4, and on the Lake Tahoe Basin Management Unit, and the Eldorado, Inyo, Lassen, Plumas, Sierra, Stanislaus, and Tahoe National Forests in Forest Service Region 5. The Lake Tahoe Basin Management Unit has very low retardant application potential. The Lassen National Forest has moderate retardant application potential. The remaining forests have high retardant application potential. Habitat for Sierra Nevada yellow-legged frog includes sunny river margins, meadow streams, isolated pools, and lake borders in the Sierra Nevada Mountains. The species is most abundant in high elevation (4,500 to 12,000 feet) lakes and slow-moving portions of streams. They are seldom are found away from water but may cross upland areas in when moving between summer and winter habitats. Breeding success depends on perennial bodies of water because larvae require multiple years of development before metamorphosis. This species tends to spend the winter at the bottom of frozen lakes.

Critical habitat was designated 26 August 2016 (81 FR 59045) and consist of larger areas of habitat or "Clades" of watershed areas on several National Forests. Critical habitat is designated on Toiyabe Lassen, Plumas, Tahoe, Stanislaus, Eldorado, Inyo, Sierra, and Sequoia National Forests and the Lake Tahoe Basin Management Unit. Primary constituent elements for Sierra Nevada yellow-legged frog are the same as those described above for the northern California distinct population segment of mountain yellow-legged frog. Effects are also as descried above. ***All waterways within Sierra Nevada yellow-legged frog critical habitat are included in avoidance areas buffered by 600-feet from the shoreline***. This reduces the potential effects to critical habitat to a discountable level (wildlife screen 1, Figure 10). Aerial application of fire retardant **may affect but is not likely to adversely affect Sierra Nevada yellow-legged frog critical habitat**.

Although Sierra Nevada yellow-legged-frog is widespread, occurring on nine separate units, its numbers are limited. Adults are rarely found more than a few feet from water, and tadpoles take two to three years to metamorphose (wildlife screen 2, Figure 11). Any retardant entering the aquatic habitat has the potential to impact individuals. Therefore, **aerial application of fire retardant may affect and is likely to adversely affect Sierra Nevada yellow-legged-frog.**

Yosemite toad – *Anaxyrus canorus*

Yosemite toad was listed as threatened on 29 April 2014 (79 FR 24255). It was analyzed in a supplemental Biological Assessment (USDA Forest Service 2017) and consultation was reinitiated (USDI Fish and Wildlife Service 2018a and 2018b). This species occurs on the Humboldt-Toiyabe National Forest in Forest Service Region 4, which has high use retardant application potential; and on the Lake Tahoe Basin Management Unit with very low application potential, and the Inyo, Eldorado, Stanislaus and Sierra National Forests in Region 5, all with high retardant application potential for use of aerial fire retardant. Habitat includes moist mountain meadows and borders of forests at high elevations (4,800 to 12,000 feet). Individuals shelter in rodent burrows as well as in dense vegetation. Breeding occurs in shallow edges of snow melt pools and ponds or in shallows or along edges of lakes and slow-moving streams. Some breeding sites dry up before larvae metamorphose.

Critical habitat was designated 26 August 2016 (81 FR 59045) and is found on the Toiyabe National Forest in Forest Service Region 4 and on the Eldorado, Inyo, Sierra and Stanislaus National Forests in Region 5. Primary constituent elements include aquatic breeding habitat and upland areas. Aquatic breeding habitat consists of bodies of fresh water, including wet meadows, slow-moving streams, shallow ponds, spring systems, and shallow areas of lakes, that are inundated during snowmelt and hold water for a minimum of 5 weeks, but more typically 7 to 8 weeks; and contain sufficient food for tadpole development. During periods of drought or less than average rainfall, these breeding sites may not hold surface water long enough for individual Yosemite toads to complete metamorphosis, but they are still considered essential breeding habitat because they provide habitat in most years. Upland areas are adjacent to or surrounding breeding habitat up to a distance of 0.78 miles, including seeps, springheads, talus and boulders, and areas that provide sufficient cover to provide summer refugia; foraging habitat; adequate prey resources; physical structure for predator avoidance; overwintering refugia for juvenile and adult Yosemite toads; dispersal corridors between aquatic breeding habitats; dispersal corridors between breeding habitats and areas of suitable summer and winter refugia and foraging habitat, and/or; the natural hydrologic regime of aquatic habitats (the catchment). These upland areas should also maintain sufficient water quality to provide for the various life stages of the Yosemite toad and its prey base.

Aerial retardant application will not alter most of the components of critical habitat. Retardant can cause effects to the foraging habitat and water quality. Breeding occurs at snowmelt, with metamorphosis completing within 6 to 9 weeks of egg laying. It is unlikely that aerial retardant will be applied during this portion of the life cycle, as the habitat would be too wet to sustain a fire. Retardant can alter water quality, causing loss of invertebrate prey or sublethal toxic effects to juveniles or adults. These effects would only last a single season in the critical habitat.

Waterways within Yosemite toad critical habitat are included in avoidance areas buffered by 600-feet from the shoreline, which greatly reduces the probability of retardant entering the critical habitat, resulting in discountable effects (wildlife screen 1, Figure 10). Aerial application of fire retardant **may affect but is not likely to adversely affect Yosemite toad critical habitat**.

There have been no intrusions of retardant into Yosemite toad habitat since 2012. Although avoidance areas will reduce the probability of retardant entering occupied habitat, this amphibian is susceptible to the toxic effects of retardant. The small home ranges limit their ability to avoid areas of retardant drops (wildlife screen 2, Figure 11). Therefore, aerial application of fire retardant **may affect and is likely to adversely affect Yosemite toad.**

5.4.5.3 Birds

Aerially applied retardant was found to have No Effect on Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*), Puerto Rican parrot (*Amazona vittata*), Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*), rufa red knot (*Calidris canutus rufa*), ivory-billed woodpecker (*Campephilus principalis*), piping plover (*Charadrius melodus*), western snowy plover (*Charadrius nivosus nivosus*), whooping crane (*Grus americana*), Mississippi sandhill crane (*Grus canadensis pulla*), wood stork (*Mycteria americana*), Yuma ridgeways rail (*Rallus obsoletus yumanensis*), elfin-woods warbler (*Setophaga angelae*), and roseate tern (*Sterna dougallii*). A summary of the rationale for each species with a 'No Effect' determination is found in appendix F.

Raptors/Birds of Prey

Species in this sub-group are known as birds of prey; they actively hunt animals as food, with some relying on carrion exclusively or in addition to hunted prey. Birds of prey occur in a variety of habitats including open prairie, mature and old growth forest, and mixed conifer-hardwood forests.

Table 16. Summary of Determinations for raptors/birds of prey species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Falco femoralis septentrionalis	Northern aplomado falcon	XN	n/a	NLJ
Gymnogyps californicus	California condor	E, CH, XN	NE	NLAA / NLJ
Strix occidentalis caurina	Northern spotted owl	T, CH	NLAA	NLAA
Strix occidentalis lucida	Mexican spotted owl	T, CH	NLAA	LAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Northern aplomado falcon – *Falco femoralis septentrionalis*

The northern aplomado falcon was listed as endangered on 25 February 1986 (51 FR 6686). On 26 July 2006 a final rule was published establishing of a nonessential experimental population in Arizona and New Mexico (71 FR 42298). National Forest System lands occur within the nonessential experimental population area. The Fish and Wildlife Service reintroduced an experimental population in southern New Mexico and Arizona, and reintroductions have also occurred in Texas.

Northern aplomado falcon was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The species occurs in Mexico and historically ranged northward into the open rangeland in semi-arid habitats of southwestern Texas, southern New Mexico, and the very southeastern corner of Arizona. Habitat consists of open rangeland and savanna and semiarid grasslands with scattered trees and shrubs. Northern aplomado falcons nest in old stick nests built by other bird species (e.g., hawks, caracaras, ravens) and may sometimes nest on cliffs. This species feeds primarily on birds (up to rock dove size), and to a lesser extent on insects (moths, beetles, cicadas, orthopterans) and uncommonly on small mammals, lizards, and snakes.

Although currently no nesting or foraging northern aplomado falcons are known to occur on National Forest System lands (Barrera 2011), this species may occur on the Lincoln, Cibola, and Gila National Forests, which have moderate application potential, and on the Coronado National Forest, which has high application potential. There is no designated critical habitat.

Raptors are highly mobile species that can escape from areas with fire activities. The likelihood of a direct application is extremely low due to the species' mobility (wildlife screen 2). The exception is when birds are nesting; although the adults may be able to flee, the young are confined to the nest and could be affected by direct application. However, no nesting is known on National Forest System lands.

Low flying aircraft may cause disturbance to perching or roosting birds, but effects are short term. Because the northern aplomado falcon is not known to nest on National Forest System lands, disturbance would not happen during a critical time period. (wildlife screen 3).

Indirect effects are not expected because these raptors can travel outside of the burned areas to forage on prey species in adjacent unburned areas. If foraging in areas of retardant application, individual falcons would need to eat several contaminated prey items in a relatively short period of time in order to be affected. Therefore, the ingestion of retardant chemicals through prey is not expected to occur (wildlife screen 4).

Aerially applied fire retardant is **not likely to affect the nonessential experimental population, and therefore is not likely to jeopardize this species**. ***Avoidance Area Mapping is not recommended for raptor species due to the wide distribution and high mobility of individuals of these species.***

California condor – *Gymnogyps californicus*

The California condor was initially listed as endangered on 11 March 1967 (32 FR 4001) under the Endangered Species Preservation Act of 1966. It was listed as a non-essential experimental population on 16 October 1996 for specific portions of Arizona, Utah and Nevada. Effects to populations in California and Arizona were analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Additional analysis was completed in 2017 for the nonessential experimental population in Arizona and Utah (USDA Forest Service 2017, USDI Fish and Wildlife Service 2018). In March 2021 a second nonessential experimental population was listed in the Pacific Northwest (86 FR 15602).

This species historically ranged from Baja California to Washington, and inland to Idaho, Nevada, Utah, and Arizona. The California condor became nearly extinct, but due to a successful captive breeding program, has been re-introduced into most of its former range. Condor nesting habitat consists of mountains with open cliffs for nesting and tall, open grown trees for roosting. This species feeds on carrion, primarily on mammal carcasses.

Condors that are endangered and not part of the non-essential experimental population occur on the Los Padres and Angeles National Forests in California; and observations have been recorded for the San Bernardino, Sequoia, and Sierra National Forests, all of which have high retardant use potential.

Condors from the non-essential experimental population that was introduced into northern Arizona are known to occur on National Forest System lands as follows:

- Kaibab National Forest in Arizona, which has very low retardant application potential,
- Apache-Sitgreaves National Forest in Arizona, which has low application potential
- Coconino National Forest also in Arizona, which has moderate application potential,
- Prescott National Forest in Arizona and the Dixie National Forest in Utah, both of which have high retardant application potential.

The geographic boundaries of the newly-designated nonessential experimental population for the Pacific Northwest include northern California, northwest Nevada, and Oregon. The primary release site is in the Bald Hills in Redwood National Park, with condors anticipated to use portions of the Rogue River-Siskiyou, Six Rivers, Klamath and Shasta-Trinity National Forests. All of those national forests have high retardant application potential.

Critical habitat was designated on 22 September 1977 (42 FR 47840). Critical habitat for the California condor is designated in California. Of the nine designated critical habitat units, six occur on the Los Padres National Forest. There are units adjacent to the Sierra and Sequoia National Forests. The critical habitat listing pre-dates the identification of primary constituent elements, but it identified the areas according to their contributions. The critical habitat units on the Los Padres National Forest were considered critical for either nesting and related year-long activity, or for roosting. Aerial retardant application would not alter the cliff or large tree nesting and roosting habitat of California condor, therefore **there would be no effect to critical habitat** (wildlife screen 1).

Condors are a highly mobile, wide-ranging species that can escape from areas with fire activities. The likelihood of a direct application from aerial application is extremely low (wildlife screen 2), but birds nesting in trees and their young could receive direct drops of retardant if a fire occurs during the breeding season in the vicinity of a nest.

Low flying (less than 500 feet above ground/canopy) aircraft may cause disturbance to perching or roosting birds, causing them to flush. Disturbance resulting from a single drop would be very short duration, lasting less than one minute. Multiple drops in one location, particularly during a large wildfire, are common. It is likely, however, that condors would have already left the area of the disturbance due to the fire; therefore, aircraft disturbance would have only a small negative effect (wildlife screen 3). Because fire seasons have lasted longer, and have begun earlier in recent years, disturbances to breeding/nesting condors during that critical time period could occur.

Indirect effects are not expected since these raptors would travel outside of the burned areas to forage on prey species in adjacent unburned areas; or would need to eat several contaminated prey items in a relatively short period of time in order to be affected, thus the ingestion of retardant chemicals through prey is not expected to occur (wildlife screen 4).

Trees with active California condor nests are protected with 600-feet avoidance areas, while unoccupied ***historic nest trees, particularly sequoias and redwoods, are protected from fire***

with retardant. Hack sites were previously protected with ¼ mile buffers, however the Forest Service found during the 2018 Sobranes and 2020 Dolan fires on the Los Padres National Forest that these large avoidance areas where retardant is not allowed are detrimental to the habitat (Krueger 2020). The Forest Service is ***reducing the avoidance areas around hack sites to 600-feet.***

Based on the preceding discussion, and the implementation of avoidance areas and measures to protect nesting habitat, aerial application of fire retardant **may affect, but is not likely to adversely affect the endangered California condor**, and **is not likely to jeopardize the continued existence of the nonessential experimental populations in the Pacific Northwest and in Arizona, Utah, and Nevada.**

Northern spotted owl – *Strix occidentalis caurina*

The northern spotted owl was listed as threatened on 26 June 1990 (55 FR 26114). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The northern spotted owl occurs in mature and old-growth Douglas fir and mixed coniferous forest across the Pacific Northwest and into northern California. It is found on National Forests on the west side of the Cascade Range and Klamath Mountains of Washington (21 counties), Oregon (23 counties), and California (14 counties).

Typical habitat characteristics include moderate to high canopy closure; a multilayered, multispecies canopy dominated by large over-story trees; a high incidence of large trees with large cavities, broken tops, and other indications of decadence; numerous large snags; heavy accumulations of logs and other woody debris on the forest floor; and considerable open space within and beneath the canopy. Generally, these conditions are found in old growth (at least 150 to 200 years old), but sometimes they occur in younger forests that include patches of older growth. The northern spotted owl may nest on broken treetops, cliff ledges, in natural tree cavities, or in trees on stick platforms, often the abandoned nest of hawks or mammals.

Small mammals, particularly nocturnal arboreal or semi-arboreal species, dominate the diet; flying squirrels, woodrats, and lagomorphs are common prey items, with pocket gophers, red tree voles, and deer mice as regionally important. Flying squirrels are consumed more often at higher latitudes and higher elevations, woodrats more often at lower latitudes and lower elevations.

In Forest Service Region 6, the northern spotted owl occurs on:

- the Olympic, Mount Baker-Snoqualmie, and Siuslaw National Forests, which do not use aerial retardant
- the Columbia River Gorge National Scenic Area and Mount Hood National Forests, which have very low retardant application potential
- the Willamette and Gifford Pinchot National Forests, which have low retardant application potential
- the Umpqua and Fremont-Winema National Forests, which have moderate retardant application potential
- the Deschutes, Okanogan-Wenatchee and Rogue River-Siskiyou National Forests, all of which have high retardant application potential.

In Forest Service Region 5, the northern spotted owl occurs on the Lassen and Mendocino National Forests, which have moderate retardant application potential; and the Klamath, Modoc, Shasta-Trinity and Six Rivers National Forests, all of which all have high retardant application potential.

The final rule for designation of critical habitat was published on 4 December 2012 (77 FR 71875). A total of 131,766 acres of National Forest System lands is designated as northern spotted owl critical habitat, with 11,864 acres in Washington, 55,788 acres in Oregon, and 64,114 acres in California. Critical habitat was revised under a 15 January 2021 final rule (86 FR 4820) that would have excluded approximately 3.4 million acres of designated critical habitat. However, the Fish and Wildlife Service has proposed to withdraw that rule and to exclude 204,797 acres primarily on Bureau of Land Management lands (86 FR 38246).

Primary constituent elements include:

- Forest types that may be in early-, mid-, or late-seral stages and that support the northern spotted owl across its geographical range. This element must occur in concert with one of the remaining elements.
- Habitat that provides for nesting and roosting. Nesting and roosting habitat provides structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risks for adults and young. These habitats must provide sufficient foraging habitat to meet the home range needs of territorial pairs throughout the year, and have stands for nesting and roosting with specific characteristics.
- Habitat that provides for foraging, which varies widely across the northern spotted owl's range, in accordance with ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions. Across most of the owl's range, nesting and roosting habitat is also foraging habitat, but in some regions northern spotted owls may additionally use other habitat types for foraging as well.
- Habitat to support the transience and colonization phases of dispersal, which in all cases would optimally be composed of nesting, roosting, or foraging habitat (elements 2 or 3), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, and foraging habitat.

More specific information regarding each of the primary constituent elements can be found in the 2012 final rule (77 FR 71875).

Most use of aerial retardant is along ridges or open areas, or younger tree stands where it can penetrate to the ground and is more effective at stopping fire spread. Aerial retardant may not be effective in old-growth forest conditions because the retardant does not penetrate the multi-canopy structure of mature and old growth forests. Because of this, retardant is not likely to be used in spotted owl nesting habitat. Retardant may be used in adjacent forested stands. Aerial use of retardant could impact the primary constituent elements on the rare occasion when a drop causes physical damage to the vegetation, including breaking of treetops and creating small openings in the canopy. These openings would contribute to the diversity of structures that make up nesting, roosting and foraging habitat. Because retardant is generally not used in mature and old growth habitat, much of the critical habitat would not be impacted. Impacts in any fire year would also only occur on a limited number of acres. Use of retardant would be beneficial to critical habitat by limiting fire damage to habitat components. Based on the very small acreage expected to be impacted in any year and because the changes won't eliminate any acres of critical habitat (wildlife screen1), aerial use of retardant **may affect, but is not likely to adversely affect northern spotted owl critical habitat.** ***Avoidance area mapping for critical habitat is not recommended due to the wide distribution of critical habitat for the species***.

Northern spotted owl is a highly mobile species that can escape from areas with fire activities. The likelihood of a direct application from aerial application is extremely low (wildlife screen 2). The exception to this is when birds are nesting; although the adults may be able to flee, the young are still confined to the nest and may experience direct application. Because nesting and roosting habitat is found in mature and old growth, where aerially delivered retardant would not be effective against fire and therefore is generally not used, the chance of direct application to a nest is very limited.

Low flying aircraft may cause disturbance to perching or roosting birds. Disturbance from a single retardant drop would last for several minutes, while multiple drops in the same area would result in longer disturbance. Because several of the Forests where spotted owls occur have high retardant application potential, disturbance effects are considered to last more than a couple of days, i.e., long term (wildlife screen 3). In Region 5 the peak fire season on the forests with northern spotted owl occurs from July through September. For Region 6, the peak fire season is from June to October. Aerially applied fire retardant may impact some late fledging young, although as stated above retardant use in nesting and roosting habitat is not expected to occur frequently.

In 2011 the Fish and Wildlife Service determined that noise and activity associated with aerial application of fire retardant is likely to result in incidental take of northern spotted owl nesting in close proximity to retardant drops on National Forest System lands (USDI Fish and Wildlife Service 2011). A term and condition of the Biological Opinion (USDI Fish and Wildlife Service 2011) directed the Forest Service to "compile the number and approximate locations (pre-drop geographic positioning system coordinates of fire) of each aerial application of fire retardant drops by Forest" to "determine that (1) the number of retardant drops within the range for northern spotted owl for each National Forest, and (2) the estimated acres of suitable habitat exposed directly to retardant and aircraft noise has not exceeded the incidental take level for a given forest." The Northwest Region of the Forest Service submitted reports from 2014 to 2016 and again in 2018 (Table 17). This term and condition has been difficult to follow, as pre-drop global positioning system coordinates of retardant drops are not available to the Forest Service and mapping of drop locations is not consistently available. The data in Table 17is based on estimates from the amount of retardant used by Forests each year and the amount of available spotted owl habitat on those forests.

Table 17. Summary of Northwest Region northern spotted owl term and condition reporting

Forest	Year	Estimated drops in spotted owl range	acres exposed to direct retardant	acres exposed to aircraft noise disturbance	nesting habitat exposed to direct retardant	Acres nesting habitat exposed to aircraft noise disturbance
Deschutes	2014	8.0	11.0	1664.0	11.0	1664.0
Deschutes	2016	2.2	3.1	467.7	5.6	832.0
Mt. Hood	2014	14.0	19.0	2832	19	2833
Mt. Hood	2018	2.0	2.8	416.0	2.8	416.0

Forest	Year	Estimated drops in spotted owl range	acres exposed to direct retardant	acres exposed to aircraft noise disturbance	nesting habitat exposed to direct retardant	Acres nesting habitat exposed to aircraft noise disturbance
Okanagon-Wenatchee	2014	189.0	265.0	39346.0	265.0	39346.0
Okanagon-Wenatchee	2016	3.2	4.5	665.6	2.8	416.0
Rogue River-Siskiyou	2014	179.0	251.0	37233.0	251.0	37232.0
Rogue River-Siskiyou	2015	4.3	6.0	885.2	6.0	894.4
Rogue River-Siskiyou	2018	224.5	314.3	46690.0	313.6	46592.0
Umpqua	2015	46.6	65.3	9695.9	51.8	7696.0
Umpqua	2018	52.0	72.8	10816.0	72.8	10816.0
Willamette	2014	13	15.0	2288.0	15.0	2288.0
Willamette	2015	2.6	2.6	540.8	3.6	540.8
Willamette	2018	5.0	9.0	104.0	9.0	104.0

In April 2017, the Forest Service and the Fish and Wildlife Service held a Technical Conference meeting to discuss the difficulties associated with the monitoring Term and Condition and the need to revise or drop this requirement. The Service's analysis for disturbance in the 2011 Biological Opinion assumed that all retardant is delivered during the nesting season by Type 1 helicopters at canopy height, thus creating excessive noise disturbance. Data from 2012 to 2019 shows that on the Forests that have northern spotted owl, on average retardant was delivered by helicopter 15 percent of the time, while airtankers account for 85 percent of deliveries. The proportion delivered by airtanker or helicopter varies from year to year and unit to unit (USDA Forest Service 2021). Data is not available to determine what type helicopter was used. Because of their greater maneuverability helicopters can drop retardant at or near vegetation height. Standards for aerial supervision (https://www.nwcg.gov/sites/default/files/publications/pms505.pdf) indicate that helicopter drop height is critical in terms of accuracy, effectiveness, and effect of rotor wash on fire behavior. The standards also provide minimum heights for drops from airtankers. The minimum height above the top of vegetation for airtankers is 60 feet for single engine airtankers, 150 feet for large airtankers, and 250 feet for very large airtankers. Generally, drop heights should increase when using higher retardant coverage levels.

In its 2011 Biological Opinion, the Service also assumed that breakage of treetops is reasonably likely to occur, thus degrading habitat. This occurs on a very limited basis and would depend on the stand conditions where drops are occurring. Since use of retardant in mature and old growth stands is unlikely, the potential for breakage and damage in these stands is also unlikely. In addition, Furthermore, the analysis of northern spotted owl habitat done in 2011 overestimates the number of owl territories impacted (Poopatanapong 2020).

After the April 2017 meeting the Fish and Wildlife Service was to provide a Technical Assistance letter to modify this Term and Condition; however, the letter was never received. Based on that discussion and the information presented above, the Forest Service is requesting that tracking aircraft flight paths and drop locations not be required.

The ecological risk assessment (Auxilio Management Services 2021) indicated that threatened and endangered raptors that reenter an area after firefighting activities have subsided have risk of effects to survival, growth, and reproduction of each individual from ingestion of retardant in areas with application rates of 4 gallons per 100 square feet and above. Application rates in forested areas would be at 4 gallons per 100 square feet or greater, therefore individual spotted owl may be at risk (wildlife screen 4). The assessment uses American kestrel as a representative species for raptors. Because spotted owl are larger than kestrel, and eat larger prey, the risk is reduced.

Although the potential for effects to northern spotted owl are limited based on lack of retardant use on many forests with the species, no use in nesting habitat, limited use in other habitat, and asynchronous timing of retardant flights and foraging, there is still a small potential to affect some spotted owls. Therefore, aerially applied fire retardant **may affect and is likely to adversely affect northern spotted owl**. ***Avoidance area mapping is not recommended due to the wide distribution and high mobility of northern spotted owls.***

Mexican spotted owl – *Strix occidentalis lucida*

The Mexican spotted owl was listed as Threatened on 16 March 1993 (58 FR 14248). This species was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This species occurs in 11 counties in Utah, 13 in Arizona, 32 in Colorado, 22 in New Mexico, and 4 in Texas. In 2002, the Forest Service reported 987 occupied owl sites on National Forest System lands in Arizona and New Mexico. Current information suggests there are also 15 sites in Colorado, 105 sites in Utah. In total, 1,176 sites have been identified. Based on this number of known owl sites, the Fish and Wildlife Service (69 FR 53182) estimated that the total known owl numbers on Federal lands in the southwestern United States at 1,176 to 2,352.

In the southwestern United States, Mexican spotted owls are most common where unlogged, closed-canopy forests occur in steep canyons. Uneven-aged stands with high basal area and many snags and downed logs are favored. In Arizona, they occur primarily in mixed-conifer, pine-oak, and evergreen oak forests and in ponderosa pine forest and rocky canyon lands. In southern Utah, mesa tops, benches, and warm slopes above canyons are used in fall and winter, and relatively cool canyons are used primarily in summer. In New Mexico, breeding and roosting occurs in mixed-conifer forests that contain an oak component more frequently than expected by chance. Generally, Mexican spotted owls do not use pinyon pine-alligator juniper woodlands for nesting or roosting. Selected roost and nest sites in forests are characterized by mature trees with high variation in tree heights and canopy closure greater than 75 percent. Nests are built on broken treetops, cliff ledges, in natural tree cavities, or in trees on stick platforms (dwarf mistletoe), often the abandoned nest of hawks or mammals. Diet varies with location and includes woodrats, mice, voles, and cottontail rabbits.

The Mexican spotted owl occurs on all national forests in Forest Service Region 3, with retardant application potential ranging from very low to high. In Forest Service Region 4, the Dixie National Forest has high application potential and the Fishlake and Manti-LaSal National Forests have low application potential. In Forest Service Region 2, Mexican spotted owls are known to occur on the Pike-San Isabel and San Juan National Forests, both of which have moderate retardant application potential. They are suspected occur but are unconfirmed on the Grande Mesa Uncompahgre and Gunnison National Forest, which has very low application potential, the Arapahoe Roosevelt National Forest, which has low application potential, and the White River National Forest, which has moderate application potential. Mexican spotted owls are not known or suspected to occur on the Rio Grande National Forest, but may occur on adjacent lands and are therefore considered for indirect effects.

Critical habitat was designated on 31 August 2004 (69 FR 53182). Protected areas include all known owl sites (Protected Activity Centers), all areas in mixed-conifer and pine-oak types with greater than 40 percent slopes where timber harvest has not occurred in the past 20 years, and administratively reserved lands, such as Wilderness Areas or Research Natural Areas. Restricted habitat includes mixed-conifer forest, pine-oak forest, and riparian areas adjacent to or outside of protected areas. A total of 5,704,438 acres on National Forest System lands is designated as critical habitat, with 3,228,145 acres in Arizona; 2,056,536 acres in New Mexico; 263,026 acres in Colorado; and 156,732 acres in Utah.

Critical habitat for the Mexico spotted owl is described (69 FR 53182) as primary constituent elements related to

- forest structure, the specific elements of which are a range of tree species composed of different sizes with 30 to 40 percent with a trunk diameter of 12 inches, a shade canopy of 40 percent or greater, and snags at least 12 inches in diameter;
- maintenance of adequate prey species, which requires high volumes of fallen trees and other debris, a wide range of tree and plant species, and adequate levels of residual plant cover, and
- canyon habitat, which includes the presence of water; clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, or riparian vegetation; canyon walls with crevices, ledges, or caves; and a high percentage of ground litter and woody debris.

As described for northern spotted owl, aerially delivered fire retardant has a small potential to alter the structure of a stand if the retardant drop were to break trees or branches. This happens rarely and therefore can be considered discountable (wildlife screen 1). Therefore aerially applied fire retardant **may affect, but is not likely to adversely affect critical habitat for the Mexican spotted owl.** ***Avoidance area mapping is not recommended due to the wide distribution of critical habitat for the species***.

Mexican spotted owl are highly mobile species that can escape from areas where fire activities are occurring. The likelihood of a direct application from aerial application is extremely low (wildlife screen 2). The exception to this is when birds are nesting; although the adults may be able to flee, the young are still confined to the nest, thus may experience direct application. Retardant use in mature and old growth stands is less likely to occur than on ridgetops or in openings.

The peak fire season for Region 3 occurs from May to July, which corresponds with the breeding and nesting season for the Mexican spotted owl. Although retardant use in nesting and roosting habitat is unlikely to occur, disturbance to Mexican spotted owls is possible. Low flying aircraft may cause disturbance to birds perching or roosting; effects can be short term, or less commonly may last several days (wildlife screen 3).

Because disturbance in Arizona, New Mexico and southern Utah could occur during the breeding/nesting season, aerially applied fire retardant **may affect and is likely to adversely affect Mexican spotted owl**. ***Avoidance area mapping is not recommended for this or other raptor species due to the wide distribution and high mobility of these species.***

Riparian Birds

Table 18. Summary of determinations for riparian bird species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Empidonax trailli extimus	southwestern willow flycatcher	E, CH	NLAA	NLAA
Vireo bellii pusillus	least Bell's vireo	E, CH	NLAA	NLAA
Coccyzus americanus (occidentalis)	western yellow-billed cuckoo	T, CH	NLAA	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Southwestern willow flycatcher – *Empidonax trailli extimus*

The southwestern willow flycatcher was listed as endangered on 27 February 1993 (60 FR 10695). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). It lives in thickets and scrubby brush areas in both riparian and open woodland throughout California, Utah, Arizona, Nevada, New Mexico, Colorado, and Texas. This species has a population status of less than 2,500 individuals, with 95 percent of the known sites having fewer than 10 breeding pairs.

The flycatcher currently breeds in areas from near sea level to over 8,500 feet, in vegetation along rivers, streams, or other wetlands (i.e., riparian habitat). It establishes nesting territories, builds nests, and forages where mosaics of relatively dense and expansive areas of trees and shrubs are established, near or adjacent to surface water or underlain by saturated soil. Habitat characteristics such as dominant plant species, size and shape of habitat patch, tree canopy structure, vegetation height, and vegetation density vary widely among breeding sites. Nests are typically placed in trees where the plant growth is most dense, where trees and shrubs have vegetation near ground level, and where there is a low-density canopy. Some of the more common tree and shrub species currently known to comprise nesting habitat include Gooddings willow (*Salix gooddingii*), coyote willow (*Salix exigua*), Geyer's willow (*Salix geyeriana*), arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), yewleaf willow (*Salix taxifolia*), boxelder (*Acer negundo*), tamarisk (also known as saltcedar, *Tamarix ramosissima*), and Russian olive (*Elaeagnus angustifolia*).

Southwestern willow flycatcher occurs on the Rio Grande and Carson National Forests, which have very low retardant application potential; the Apache-Sitgreaves and Manti-LaSal National Forests, which have low application potential; the San Juan and Gila National Forests, which have moderate application potential; and the Angeles, Cleveland, Los Padres, San Bernardino, Sequoia, Toiyabe and Tonto National Forests, all of which have high application potential.

Critical habitat was designated on 3 January 2013 (78 FR 344). Designated critical habitat is found on the Angeles, Cleveland, Los Padres, San Bernardino, and Sequoia National Forests in Forest Service Region 5 and the Apache-Sitgreaves, Carson, Gila, and Tonto National Forests in Forest Service Region 3. Primary constituent elements include riparian vegetation and insect prey populations. Riparian vegetation is the habitat along a river or lake comprised of trees and shrubs with some combination of:

- dense riparian vegetation with thickets of trees and shrubs that can range in height from about 6 to 98 feet. Lower stature thickets (6 to 13 feet tall) are found in higher elevation riparian forests, and tall-stature thickets are found at middle- and lower elevation riparian forests;
- areas of dense riparian foliage at least from the ground level up to approximately 13 feet above ground or dense foliage only at the shrub or tree level as a low, dense canopy;
- sites for nesting that contain a dense (about 50 to 100 percent) tree and/or shrub canopy; and
- dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.25 acre or as large as 175 acres.

Insect prey populations include a variety of insects found within or adjacent to riparian floodplains or moist environments.

Aerially applied retardant could impact both riparian vegetation and insect prey populations. Retardants have fertilizing properties that at low application levels could boost riparian vegetation growth. Retardant can also result in a boost to growth of non-native invasive species if they are present in the area. Retardant can also impact insect populations by causing physical injury or death if they are impacted with a retardant drop or toxic effects to retardant in their environment.

Required Aquatic Avoidance Area mapping (300-foot buffer along waterways) will minimize impacts to habitat and population areas for southwestern willow flycatcher (wildlife screen 1). In addition, ***critical habitat that extends beyond the 300-foot riparian buffer, into adjacent floodplains and upland in some cases, should also be included as avoidance areas***. Although avoidance area mapping will greatly reduce the potential of retardant entering habitat, there is still a small possibility (less than one percent) of retardant intruding into the avoidance area, leading to discountable effects. Therefore, aerial application of fire retardant **may affect but is not likely to adversely affect southwestern willow flycatcher critical habitat**.

Southwestern willow flycatchers are migratory. They are found on National Forest System lands coincident with fire season in all Forest Service Regions. As described above, required avoidance areas would minimize the possibility of retardant entering willow flycatcher habitat (wildlife screen 2). However, there is still a small chance (less than one percent) of a retardant intrusion. Therefore, there is potential of disturbance to nesting birds (wildlife screen 3). The ecological risk assessment (Auxilio Management Services 2021) indicated that threatened and endangered songbirds that reenter an area after firefighting activities have subsided have risk of effects to individual survival, growth, and reproduction from ingestion of retardant in areas with application rates of 3 gallons per 100 square feet and above. Application rates in willow flycatcher habitat would be at 3 gallons per 100 square feet or greater, therefore individual willow flycatcher may be at risk (wildlife screen 4). However, as previously described the probability of getting retardant into habitat is less than one percent, therefore the potential effects are discountable. Aerially applied fire retardant **may affect but is not likely to adversely affect southwestern willow flycatcher**.

Least Bell's vireo – *Vireo bellii pusillus*

The least Bell's vireo was listed as endangered on 2 May 1986 (51 FR 16474). It was analyzed for the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The least Bell's vireo is a small, migratory songbird that has declined dramatically in both numbers and distribution. This subspecies was once widespread and abundant throughout the Central Valley and other low-elevation riverine areas of California. Least Bell's vireos historically bred in riparian woodlands from the interior of northern California (near Red Bluff, Tehama County) to northwestern Baja California, Mexico. Its current breeding distribution is restricted to a few localities in southern California and northwestern Baja California, Mexico. Least Bell's vireos nest primarily in willows (*Salix spp*.) but also use a variety of other shrub and tree species for nest placement. Least Bell's vireos forage in riparian and adjoining upland habitats.

This species occurs on the Angeles, Cleveland, Los Padres, Sequoia and San Bernardino National Forests, all of which have high retardant application potential.

Critical habitat was designated on 2 February 1994 (59 FR 4845). The primary constituent elements are described as riparian woodland vegetation that generally contains both canopy and shrub layers and includes some associated upland habitats. Vireos meet their survival and reproductive needs (food, cover, nest sites, nestling and fledgling protection) within the riparian zone in most areas. In some areas they also forage in adjacent upland habitats.

As described for southwestern willow flycatcher, aerially applied retardant could impact riparian vegetation. Retardants have fertilizing properties that at low application levels could boost riparian vegetation growth, and could boost growth of non-native invasive species if those are present in the area. Retardant can also affect insect prey populations by causing physical injury or death if individuals are impacted with a retardant drop, or through toxic effects of retardant in their environment.

Required Aquatic Avoidance Area mapping (300-foot buffer along waterways) will minimize impacts to habitat and population areas for least Bell's vireo (wildlife screen 1). Although avoidance area mapping will greatly reduce the potential of retardant entering habitat, there is still a small possibility (less than one percent) of retardant intruding into the avoidance area, leading to discountable effects. Therefore, aerial application of fire retardant **may affect but is not likely to adversely affect least Bell's vireo critical habitat**.

Least Bell's vireo is migratory. They migrate into southern California near the end of March and leave their breeding areas from late July to late September. They are found on National Forest System lands coincident with the fire season in southern California. As described for southwestern willow flycatcher, avoidance areas would minimize, but not eliminate, the possibility of retardant entering habitat (wildlife screen 2). Vireos would therefore still be susceptible to disturbance (wildlife screen 3), and ingestion (wildlife screen 4). The probability of getting retardant into habitat is less than one percent, therefore the potential effects are discountable. Aerially applied fire retardant **may affect but is not likely to adversely affect least Bell's vireo.**

(Western) Yellow-billed cuckoo – *Coccyzus americanus (occidentalis)*

The western distinct population segment of yellow-billed cuckoo was listed as threatened on 3 October 2014 (79 FR 59991). It was analyzed as a newly listed species in the 2017 Supplemental Biological Assessment for Wide-Ranging Newly Listed Wildlife Species (USDA Forest Service 2017, USDI Fish and Wildlife Service 2018). Eastern yellow-billed cuckoos are known to occur on some National Forest System lands (Black Hills and Pike-San Isabel National Forests and the Cimmaron and Comanche National Grasslands) but they are not listed under the Endangered Species Act, and are therefore not analyzed here.

Western yellow-billed cuckoos breed in riparian habitat along low gradient (surface slope less than 3 percent) rivers and streams, and in open riverine valleys that provide wide floodplain conditions (greater than 325 feet). They require patches of at least 25 acres of dense riparian forest with a canopy cover of at least 50 percent in both the understory and overstory, and typically nests in mature willows.

Western yellow-billed cuckoos that are part of the western distinct population segment are found on a number of national forest units as follows (grouped according to Forest Service Regions):

- Region 1: limited documented occurrences, with detections near the Bitterroot National Forest and known suitable habitat on the Lolo National Forest. The Bitterroot has moderate retardant application potential, and the Lolo has high retardant application potential.
- Region 2: known to occur on the Thunder Basin and Pawnee National Grasslands and the Nebraska National Forest National Forest, all of which have very low application potential for retardant, and suspected to occur on the San Juan National Forest, which has high application potential. Not known or suspected to occur on National Forest System lands on the Grand Mesa Uncompahgre and Gunnison, Arapahoe Roosevelt Medicine Bow-Routt, Shoshone and Rio Grande National Forests, but may occur may occur on adjacent lands and are therefore considered for indirect effects.
- Region 3: known on the Carson National Forest, which has very low application potential; on the Apache-Sitgreaves National Forest, which has low application potential; on the Coconino, Gila, and Santa Fe National Forests, which have moderate application potential; and on the Coronado, Prescott, and Tonto National Forests, all of which have high application potential of aerial retardant.
- Region 4: occurs on the Ashley and Targhee National Forests, both of which have very low application potential; on the Fishlake and Manti-La Sal National Forests, which have low application potential; on the Salmon-Challis and Sawtooth National Forests, both of which have moderate application potential; and on the Boise, Bridger-Teton, Dixie, Humboldt-

Toiyabe and Payette National, Uinta Wasatch-Cache Forests, all of which have high application potential.

- Region 5: occurs on the Angeles, Cleveland, Los Padres, Modoc, Sequoia, Shasta-Trinity, and Six Rivers National Forests, all of which have high aerial retardant application potential.
- Region 6: sightings have been documented for the Colville National Forest, which has low retardant application potential, and the Columbia River Gorge National Scenic Area , which has very low retardant application potential.

Critical habitat was designated on 21 April 2021 (86 FR 20798). It occurs on the Coconino, Coronado, Gila, Prescott and Tonto National Forests in Forest Service Region 3.

Three Physical and Biological Features were identified as essential for the conservation of western yellow-billed cuckoo:

- Rangewide breeding habitat, which is composed of riparian woodlands within riparian areas or upland areas or terraces, often greater than 325 feet in width and 200 acres of more in size adjacent to intermittent or perennial watercourses. In Arizona and New Mexico (Southwest, Forest Service Region 3) breeding habitat occurs within or along perennial, intermittent, or ephemeral drainages in montane canyons, foothills, desert floodplains and arroyos. Southwestern breeding habitat is composed of varying combinations of riparian, xeroriparian, and or non/riparian tree and large shrub species.
- Adequate prey base, which consists of large insects, lizards, and frogs in breeding areas during the nesting season and in post-breeding dispersal areas.
- Hydrologic processes, which are the movement of water and sediment that maintains and regenerates breeding habitat.

Pertinent threats to critical habitat as identified in the listing are pesticide drift and the impacts of human caused wildfires. Control of the expansion of non-native vegetation where control benefits the native vegetation is identified as a special management consideration.

Aerially applied retardant would not alter hydrologic processes. Retardant chemicals may fertilize vegetation, which can promote growth of native and nonnative vegetation. It may also result in browning of leaves. These changes would occur on small areas and are not expected to reduce the amount or quality of breeding habitat. Retardant may provide beneficial effects to breeding habitat by helping to control wildfires and limiting loss of the habitat. Aerially applied retardant use could reduce the prey base, particularly insect prey, in localized areas, although cuckoos could forage in areas unimpacted by the retardant. Retardants contain thickeners that increase the cohesiveness of the drop as it falls through the air, resulting in larger droplets and a more compact retardant cloud and decreasing the possibility of drift.

Breeding habitat that occurs within 300-feet of waterways are protected within avoidance areas; however, there is a fair amount of designated critical habitat and occupied habitat areas that occur outside of these buffers. Where this occurs, ***avoidance area mapping should be extended to include the critical habitat***.

Because aerially applied retardant would impact relatively small areas of designated critical habitat in any given year, retardant may benefit habitat by protecting it from wildfires, and avoidance area buffers will greatly reduce the probability of retardant entering the critical habitat (wildlife screen 1), the proposed action **may affect but is not likely to adversely affect the western distinct population segment of yellow-billed cuckoo critical habitat**.

Yellow-billed cuckoo is a migratory species that summers on National Forest Service lands. Territory size in California averages 50 to 60 acres (Riparian Joint Venture 2000). Avoidance area mapping of all yellow-billed cuckoo critical habitat, all known nest locations and occupied upland habitat, and 300-foot buffers on all waterways would minimize the probability of retardant entering occupied habitat (wildlife screen 2). There is still a small chance (less than one percent) of a retardant intrusion, or of retardant use in occupied areas that have not yet been identified and mapped.

This species is a relatively fast breeder, with young fledging within 17 days of egg laying. In Forest service Region 3 (Arizona and New Mexico) the breeding season coincides with fire season, whereas in other regions breeding is complete prior to the peak of fire season. In Montana (Region 1), for example, the species is known to occur only in the months of June and July (Montana Field Guide 2021). Despite the use of avoidance areas as described above, and the timing of breeding in most areas, there is also a small potential of disturbance to nesting birds (wildlife screen 3).

The ecological risk assessment (Auxilio Management Services 2021) indicated that threatened and endangered songbirds that reenter an area after firefighting activities have subsided have risk of effects to individual survival, growth, and reproduction from ingestion of retardant in areas with application rates of 3 gallons per 100 square feet and above. Application rates in cuckoo habitat would be at or above this application level, therefore individual cuckoos may be at risk (wildlife screen 4). Because of the low likelihood of retardant being applied in cuckoo habitat, the potential effects are discountable. In addition, application of retardant can provide protection to habitat from wildfires, which would ultimately be beneficial to the species. Aerially applied fire retardant **may affect but is not likely to adversely affect the western distinct population segment of yellow-billed cuckoo**.

Avoidance area mapping is required for all known western yellow-billed cuckoo distinct population segment known nest locations and occupied upland habitat sites, and all designated critical habitat to provide protection for nesting birds and habitat. The Forest Service is not including additional areas identified in the 2018 Biological Opinion for wide ranging species (USDA Fish and Wildlife Service 2018) in avoidance areas in this proposed action. Larger avoidance areas limit the ability to use retardant to help control wildfires and may result in greater habitat loss to the species. In addition, local units will have more flexibility to choose suppression actions that meet each fire's unique conditions.

Woodland and Upland Birds

Table 19. Summary of determinations for woodland and upland bird species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Centrocercus minimus	Gunnison sage grouse	T, CH	NLAA	NLAA
Polioptila californica californica	Coastal California gnatcatcher	T, CH	NLAA	LAA

Aphelocoma coerulescens	Florida scrub jay	T	n/a	NLAA
Brachyramphus marmoratus	Marbled murrelet	T, CH	NLAA	LAA
Picoides borealis	Red-cockaded woodpecker	E	n/a	NLAA

[1] T=

1Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
2 NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Gunnison sage grouse – *Centrocercus minimus*

The Gunnison sage grouse was listed as Threatened on 20 November 2014 (79 FR 69191). It was initially analyzed in the Wide-Ranging Newly Listed Wildlife Species Supplemental Biological Assessment (USDA Forest Service 2017 for the Grand Mesa-Uncompahgre and Gunnison National Forest. It may also occur on the Rio Grande National Forest, which has very low retardant application potential, and on the and San Juan and Pike-San Isabel National Forests, which have moderate retardant application potential.

Sage grouse are considered obligate users of sagebrush and require large, contiguous areas of sagebrush across the landscape for long-term survival. Several species of sagebrush provide the specific food, cover, and reproduction habitats critical for sage-grouse survival. Leks (breeding grounds) are typically open areas with short vegetation within sagebrush habitats, often located on broad ridges, benches, or valley floors where visibility and hearing acuity are optimal. Males perform courtship displays on leks from mid-March through early June. Nesting occurs from March to July (USDI Fish and Wildlife Service 2018), often near leks. Female nesting sites typically are in relatively tall and dense stands of sagebrush, about 0.2-8.0 kilometers from the leks. Nest sites also have grass and forbs that provide additional hiding cover. From mid-September into November all individuals use upland areas with 20 percent or greater sagebrush cover and some green forbs. Roosting and foraging is typically restricted to south- or west-facing slopes where snow is typically shallower and less extensive. Small foraging areas that have 30 to 40 percent big sagebrush canopy cover also are important.

Critical habitat was designated on 20 November 2014 (79 FR 69311) on the Grand Mesa, Uncompahgre, and Gunnison National Forest. Four primary constituent elements were identified:

- extensive sagebrush landscapes capable of supporting a population of Gunnison sage-grouse,
- breeding habitat composed of sagebrush plant communities with specific structural characteristics
- summer-late fall habitat composed of sagebrush plant communities with specific structural characteristics, and
- winter habitat composed of sagebrush plant communities with sagebrush canopy cover between 30 to 40 percent and sagebrush height of 15.8 to 21.7 inches that are not covered by snow.

Specific structural characteristics are described in the critical habitat designation.

The Grand Mesa, Uncompahgre, and Gunnison is the only National Forest that has Gunnison sage grouse critical habitat; all other critical habitat areas for this species are located at lower elevations, mainly on Bureau of Land Management lands in southwestern Colorado and southeastern Utah (USDA Forest Service 2017, Jacobson 2015, McDonald 2015). Gunnison sage grouse occurs in a habitat type which has the highest probability for the use of aerial fire retardants (USDA Forest Service 2011a, appendix O; USDA Forest Service 2011e). Aerial fire retardant acts as a fertilizer to vegetation. In low amounts it can promote growth of plant species, including both native species and non-native invasive species where they are present. In higher amounts it can result in over-fertilization, which can kill some vegetation. A study on the effect of retardant in the Great Basin shrub steppe ecosystem showed declines in species richness in the first year, and no difference among treatments after a year (Larson et al. 1999).

If there is a wildfire in or near Gunnison sage grouse habitat, the recommended suppression tactic is to avoid/minimize loss of sagebrush habitat (USDA Forest Service 2017; M. Vasquez personal communication 2015) as sagebrush does not respond well to fire. The Gunnison Sage Grouse Range-wide Conservation Plan (http://cpw.state.co.us/learn/Pages/GunnisonSagegrouseConservationPlan.aspx; appendix I) includes a conservation measure to maintain a 0.6 mile buffer around lek sites. ***Retardant avoidance areas around leks will include the 0.6 mile buffer.***

Because retardant application potential on the Grand Mesa Uncompahgre and Gunnison National Forest is very low, leks are protected with 0.6 mile avoidance areas following the conservation plan (wildlife screen 1), and retardant has a potential to impact the sagebrush habitat that constitutes the primary constituent elements, aerially applied fire retardant **may affect but is not likely to adversely affect Gunnison sage grouse critical habitat**.

Gunnison sage grouse has limited distribution on National Forest System lands, and is found primarily on lower elevation Bureau of Land Management and private lands. Sage grouse tend to travel slowly on foot unless threatened, when they will hide or fly (NatureServe 2021). It is expected that wildland fire activities would result in grouse leaving the area. (wildlife screen 2) unless they are nesting or brood rearing and cannot/will not. Retardant avoidance areas around leks, as described above for critical habitat, would likely protect some nest sites from direct impacts, where nests are located in the vicinity of leks.

Most impacts are expected to result from the use of low flying aircraft causing disturbance to individual grouse. Each retardant drop would last several minutes, resulting in a short term disturbance. More than one retardant drop in an area can result in longer disturbance. Retardant application potential is used as an indicator of the length of disturbance. Application potential is very low on the Rio Grande and Grand Mesa Uncompahgre and Gunnison National Forests, and moderate on the San Juan and Pike-San Isabel National Forests. Moderate retardant application potential indicates the possibility of longer term disturbance (wildlife screen 3). The peak fire season for units where Gunnison sage grouse occur is from June to October, which overlaps with the end of the breeding season; therefore, some effects from disturbance may occur.

Sage grouse eat sagebrush, forbs, and insects. Retardant has the potential to impact vegetation and insects, as described under the critical habitat discussion. The risk assessment (Auxilio Management Services 2021) found that the representative songbird species (red-winged blackbirds) are at risk through dietary exposure for most retardants at various application levels. No risks were identified for species represented by bob-white quail (ground nesters) or rabbit (omnivore). Gunnison sage grouse are about the same size as a rabbit, and their home range size is at least ten times larger, therefore risks from ingestion of retardant are not expected (wildlife screen 4).

Aerially applied retardant can also be beneficial to Gunnison sage-grouse habitat. Retardant can be used as a firefighting tool to help slow the spread of fire, and to protect specific areas, thereby preserving available sagebrush habitat.

Anticipated effects to Gunnison sage grouse would be discountable based on:

- limited retardant application in occupied habitat with only moderate application potential in areas where sage grouse may be present,
- limited amount of habitat on National Forest Service lands,
- implementation of 0.6 mile avoidance areas around leks, and
- no expected risks from ingested retardant due to body size and home range size

Therefore, aerially applied fire retardant **may affect but is not likely to adversely Gunnison sage grouse** in National Forest System lands.

Coastal California gnatcatcher – *Polioptila californica californica*

The coastal California gnatcatcher was listed as threatened on 30 March 1993 (58 FR 16742) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This species occurs in coastal sage scrub plant communities found in dry coastal slopes, washes, and mesas with areas of low plant growth in southern California. This species is included in many habitat conservation plans. The gnatcatcher is only known to occur on the Cleveland National Forest; and occurs within 1 mile of the San Bernardino National Forest in Mentone, California (G. Hund, personal communication 2014). It has the potential to occur on the San Bernardino National Forest. All of these National Forests have high retardant application potential.

Critical habitat for coastal California gnatcatcher was designated on 9 December 2007 (72 FR 72009). It occurs in the form of coastal sage scrub communities, and includes areas on the Angeles and Cleveland National Forests where it occurs mainly in the wildland-urban interface on the edges of the forest. The primary constituent elements for the coastal California gnatcatcher are:

- Space for individual and population growth, normal behavior
- Food, water, air, light, minerals or other nutritional of physiological requirements
- Cover or shelter
- Sites for breeding, reproduction, or rearing (or development) of offspring, and
- Habitats that are protected from disturbance or are representative of the historic, geographical, and ecological distributions of a species

These elements are found in dynamic and successional sage scrub habitats that include: Venturan coastal sage scrub, Diegan coastal sage scrub, Riversidean sage scrub, maritime succulent scrub, Riversidean alluvial fan scrub, southern coastal bluff scrub, and coastal sage-chaparral scrub in Ventura, Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties. Other; non-sage scrub habitats, such as chaparral, grassland, and riparian areas in proximity to sage scrub habitats as described that provide space for dispersal, foraging, and nesting also contribute to the primary constituent elements.

There is a high probability of aerial retardant application in this volatile fuel type that make up the primary constituent elements.

Aerial application of fire retardant can impact critical habitat by acting as a fertilizer. In low amounts it can promote growth of plant species, including both native species and non-native invasive species where they are present. In higher amounts it can result in over-fertilization, which can kill some vegetation. A study on the effect of retardant in the Great Basin shrub steppe ecosystem showed declines in species richness in the first year, and no difference among treatments after a year. (Larsen et al. 1999).

Avoidance Area Mapping of critical habitat for coastal California gnatcatcher is not recommended due to the large, wide ranging habitat type for this species (Krueger 2011). Although retardant will impact the primary constituent elements, it can also limit impacts of fire to coastal sage scrub communities and to non-sage scrub habitats such as chaparral, grassland, and riparian areas. Retardant would be applied in only a small portion of the critical habitat at any given time, and the changes to the habitat would be limited in time, therefore the effects are discountable. Therefore, **aerially delivered retardant may affect but is not likely to adversely affect coastal California gnatcatcher critical habitat**.

On the Angeles and San Bernardino National Forests peak fire occurs from July to October, whereas on the Cleveland National Forest most fires have occurred in October (USDA Forest Service 2020d). Gnatcatchers breed from February to mid-July with most breeding occurring from mid-March to early April. Peak fire season does not happen during peak breeding season, so the potential for retardant application during breeding is low. Outside of breeding season gnatcatchers are highly mobile species that can escape from areas with wildland fire activities and avoid direct drops of retardant (wildlife screen 2).

Low flying aircraft may cause disturbance to perching or roosting birds; disturbance is expected to be long-term because retardant application potential on these units is high (wildlife screen 3).

Gnatcatchers eat insects. The ecological risk assessment (Auxilio Management Services 2021) has determined that threatened and endangered songbirds are at risk to effects from ingestion of retardant. (wildlife screen 4).

Low numbers of gnatcatchers occur on Forest Service lands in southern California. The Forest Service estimates about 692 acres of occupied habitat occur on the Cleveland National Forest, although only 5 to 8 pairs were found there in previous surveys (USDI Fish and Wildlife Service 2005a). This species is non-migratory. Habitat occurs primarily in the wildland-urban interface, were use of retardant is more prevalent and avoidance area mapping is not recommended. Because of the potential for retardant application in habitat and the expected effects, aerially applied retardant **may affect and is likely to affect coastal California coastal gnatcatchers**.

Florida scrub jay – *Aphelocoma coerulescens*

The Florida scrub-jay was listed as threatened on 3 June 1987 (52 FR 20715) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). It occurs in oak scrub habitat with no canopy, sand pine scrub, scrubby flatwoods, and coastal scrub on well drained sand in open areas without dense canopies. It is rarely round in areas with greater than 50 percent canopy over 10 feet. Nesting habitat on the Ocala National Forest typically consists of scrub between 3 and 12 years of age. Fire helps to maintain availability of this habitat. This species feeds on lizards, arthropods, and acorns.

The National Forests of Florida have very low aerial retardant application potential. Fire season occurs from September to July, with a peak from October to November, and a second peak from March to May. The second peak coincides with Florida scrub jay breeding from March to June.

Birds, including Florida scrub jays, are highly mobile species that can escape from areas with wildland fire activities. The likelihood of a direct application from aerial application is extremely low (wildlife screen 2), although nesting birds could be impacted by retardant drops. Because Florida scrub jays prefer habitat in an early successional stage, use of retardant to control fire could indirectly result in loss of habitat.

Low flying aircraft may cause disturbance to birds (wildlife screen 3). Because the retardant application potential is very low, disturbance is anticipated to be short term.

The risk assessment (Auxilio Management Services 2021) indicated that retardant application could result in risk to Florida scrub jay from ingestion of retardant (wildlife screen 4).

Due to the limited number of known populations on National Forest System lands, and because the species is non-migratory, ***avoidance area mapping (300-foot buffer) is required for the small, isolated resident populations***. The effects as described above are considered discountable because of the very low application potential and the avoidance area mapping. Therefore, **aerially applied fire retardant may affect but is not likely to adversely affect Florida scrub jay.**

Marbled murrelet – *Brachyramphus marmoratus*

The marbled murrelet was listed as threatened on 1 October 1992 (57 FR 45328). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The marbled murrelet is a robin-size species that nests in coastal old-growth forests. This species ranges from Alaska to the central coast of California and is considered a pelagic or open ocean bird. It travels back and forth daily from the ocean to feed on small fish (sandlance, capelin, herring, etc.). Murrelets occupy closed-canopy stands within old-growth redwood, Douglas fir or western cedar/hemlock forests that are within 35 miles of the ocean. Most nesting occurs in large stands of old growth and nest sites generally have good overhead protection.

The marbled murrelet is found on the following National Forests:

- Olympic, Mt-Baker-Snoqualmie and Siuslaw National Forests, which do not use aerial retardant;
- Gifford Pinchot National Forest, which has low retardant application potential
- Siskiyou National Forest, Los Padres and Six Rivers National Forests, which have high retardant application potential.

Marbled murrelets were known to occur historically on the Shasta-Trinity National Forest.

Critical habitat was designated on 4 August 2016 (81 FR 51348) and consists of 3,698,100 acres of mature and old-growth stands across the Pacific Northwest from Washington through coastal

Oregon and coastal northwest California, including lands on the Mt. Baker-Snoqualmie, Gifford-Pinchot, Olympic, Siuslaw, Siskiyou, Klamath and Six Rivers National Forests. Primary constituent elements specific to the marbled murrelet are individual trees with potential nesting platforms and forested areas within 0.5 mile of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site potential tree height.

Most use of aerial retardant is along ridges or open areas, or younger tree stands where it can penetrate to the ground and is more effective at stopping the fire spread. Aerial retardant may not be effective in old-growth forest conditions since the retardant does not penetrate the multi-canopy structure of mature and old growth forests. Because of this retardant is not likely to be used in the mature/old growth stands preferred for nesting by marbled murrelet. Retardant may be used in forested areas within 0.5 mile of nesting trees.

On rare occasions, aerially applied fire retardant can damage treetops or branches from the force of drop impact. Because retardant is not effective in old growth and mature forest, retardant drops will not affect trees with potential nest platforms. Damage to forested areas within 0.5 mile of nesting trees could occur. On average, the maximum acres affected by retardant each year on the Gifford Pinchot National Forest is 45 acres; on the Six Rivers National Forest it is 311 acres; on the Siskiyou National Forest it is 443 acres; and on the Klamath National Forest it is 907 acres. Although aerial retardant can damage individual trees within forested areas (wildlife screen 1), the effects are discountable based on the limited area impacted by retardant in a given year and would not alter the value of the forested area as critical habitat. The direct application of fire retardant from aircraft is not expected to change the structural characteristics of murrelet nest sites: depressions in limbs, moss covering, canopy closure, etc.

Note that the critical habitat for marbled murrelet is confined to the 35 mile distance along the Pacific Ocean coast, mainly on the Mt. Baker-Snoqualmie, Olympic and Siuslaw National Forests, which do not use retardant, and on the Siskiyou and Six Rivers National Forests, which have high retardant application potential. However, given the moist conditions in the coastal zone, actual use is expected to be less in the areas where nesting occurs.

As previously described, fire retardant is an effective tool in the control and management of wildland fire. Retardant use can protect mature and old growth forests from loss due to wildfire, therefore, use of retardant can protect murrelet critical habitat. Based on the above discussion, aerial application of fire **retardant may affect but is not likely to adversely affect marbled murrelet critical habitat**.

Murrelets are most active in forested areas of California and Oregon from mid-April through late July during nesting. In Washington they nest primarily from early May through early August (NatureServe 2021). This corresponds to the peak of fire season, June to August in California and July to August in Oregon and Washington. In general, murrelets are highly mobile species that can escape from areas with wildland fire activities. However, since fire season occurs during nesting there is a chance of retardant drops occurring. This possibility is reduced to a discountable level because use of retardant in old growth and mature nesting habitat is unlikely (wildlife screen 2).

Low flying aircraft may cause disturbance to perching or roosting birds. Disturbance from a single retardant drop would last for several minutes, while multiple drops in the same area would result in longer disturbance. Because several of the Forests where murrelet occur have high retardant application potential, disturbance effects are considered to last more than a couple days (long-term) (wildlife screen 3).

In 2011 the Fish and Wildlife Service determined that noise and activity associated with aerial application of fire retardant is likely to result in incidental take of murrelets nesting in close proximity to retardant drops on National Forest System lands in California and Oregon (USDI Fish and Wildlife Service 2011). A term and condition of the Biological Opinion (USDI Fish and Wildlife Service 2011) directed the Forest Service to "compile the number and approximate locations (pre-drop geographic positioning system coordinates of fire) of each aerial application of fire retardant drops by Forest" to "determine that (1) the number of retardant drops within the range for marbled murrelet for each National Forest, and (2) the estimated acres of suitable habitat exposed directly to retardant and aircraft noise has not exceeded the incidental take level for a given forest." The Northwest Region of the Forest Service submitted reports from 2014 to 2016 and again in 2018 (Table 20). This term and condition has been difficult to follow, as pre-drop global positioning system coordinates of retardant drops are not available to the Forest Service and mapping of drop locations is not consistently available. The data in Table 20 is based on estimates from the amount of retardant used by Forests each year and the amount of available murrelet habitat on those forests.

Table 20. Summary of Northwest Region Marbled Murrelet Term and Condition Reporting

Forest	Year	Estimated drops in murrelet range	Acres exposed to direct retardant	Acres exposed to aircraft noise disturbance	Nesting habitat exposed to direct retardant	Acres nesting habitat exposed to aircraft noise disturbance
Okanagon - Wenatchee	2014	189.2	261.0	39346.4	6.1	924.6
Rogue River - Siskiyou	2015	3	4.1	624.0	1.0	154.2
Rogue River-Siskiyou	2018	224.5	309.8	46690.0	76.5	11537.1

In April 2017, the Forest Service and the Fish and Wildlife Service held a Technical Conference meeting to discuss the difficulties associated with the monitoring Term and Condition and the need to revise or drop this requirement. The Service's analysis for disturbance in the 2011 Biological Opinion assumed that all retardant is delivered by Type 1 helicopters at canopy height, thus creating excessive noise disturbance. Data from 2012 to 2019 shows that on the Forests that have marbled murrelet, on average retardant was delivered by helicopter 19 percent of the time, while airtankers account for 81 percent of deliveries. The proportion delivered by airtanker or helicopter varies from year to year and unit to unit (USDA Forest Service 2021). Data is not available to determine what type helicopter was used. Because of their greater maneuverability helicopters can drop retardant at or near vegetation height. Standards for aerial supervision (https://www.nwcg.gov/sites/default/files/publications/pms505.pdf) indicate that helicopter drop height is critical in terms of accuracy, effectiveness, and effect of rotor wash on fire behavior. The standards also provide minimum heights for drops from airtankers. The minimum height above the top of vegetation for airtankers is 60 feet for single engine airtankers, 150 feet for large airtankers, and 250 feet for very large airtankers. Generally, drop heights should increase when using higher retardant coverage levels.

In addition to the assumption regarding helicopter use, the Service assumed that breakage of treetops is reasonably likely to occur and to degrade habitat. This occurs on a very limited basis and would depend on the stand conditions where drops are occurring. Since use of retardant in mature and old growth stands is unlikely, the potential for breakage and damage in these stands is also unlikely.

After the April 2017 meeting the Fish and Wildlife Service was to provide a Technical Assistance letter to modify this Term and Condition; however, the letter was never received. Based on that discussion and the information presented above, the Forest Service is requesting that tracking aircraft flight paths and drop locations not be required.

Because murrelet forages in the ocean, effects to it prey species is not anticipated (wildlife screen 4). Disruption of nestling feeding may occur if retardant activity interrupts adult behavior. Most feeding occurs near dawn and dusk. Although retardant flights are allowed from 30 minutes before sunrise to 30 minutes after sunset, the majority occur during the heat of the day when burning activity is highest. In addition, there is less incidence of fire in coastal areas (between nesting and foraging habitat) because those areas are generally wetter forest types. Based on low likelihood of fire and retardant used during primary nestling feeding times, the incidence of disturbance to nestling feeding would be relatively low.

Although the potential for effects to marbled murrelet are limited based on lack of retardant use on many forests with the species, no use in nesting habitat, limited use in other habitat, and asynchronous timing of retardant flights and feeding, there is still a small potential to affect some murrelets. Therefore, aerially applied fire **retardant may affect and is likely to adversely affect marbled murrelet.** ***Avoidance area mapping is not recommended for marbled murrelet due to its wide distribution and high mobility.***

Red-cockaded woodpecker -*Picoides borealis*

The red-cockaded woodpecker was listed as endangered on 13 October 1970 (35 FR 16047). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This woodpecker is a medium-sized bird adapted to the historic, fire-maintained mature pine forest ecosystems of the southeastern United States. The range of the red-cockaded woodpecker has been reduced to approximately one percent of its historic range. It is currently listed as endangered throughout its range. Red-cockaded woodpeckers are found on National Forest Service lands in the Southern Region (Region 8). Units with red-cockaded woodpeckers that do not use retardant include the Francis Marion and Sumter, Kisatchie, and Ouachita National Forests and the National Forests in Alabama and National Forests in Mississippi. This species is also found on the Chattahoochee-Oconee National Forest, National Forests in Florida, and National Forests in North Carolina that have very low retardant application potential.

This species requires large areas of mature pine forest with open understories to meet both foraging and nesting requirements. They excavate nesting and roosting cavities in live mature pines, 60 years old or older, and forage mainly in pines greater than 30 years of age within a half mile of the colony site and contiguous to the colony.

On the National Forests in Mississippi the Fish and Wildlife Service and Forest Service identified four districts as support units for this species. Two are primary core populations, acknowledged to harbor at least 350 potential breeding groups at the time of and after delisting: the Bienville National Forest and the Chickasawhay Ranger District of the De Soto National Forest. Two others are secondary core populations that will hold at least 250 potential breeding groups at the time of and after delisting: the Homochitto National Forest and the De Soto Ranger District of the De Soto National Forest. Avoidance areas with a 300-foot buffer were mapped surrounding all active red-cockaded woodpecker clusters on National Forests in Mississippi (Williamson 2011).

Red-cockaded woodpecker are highly mobile species that can escape from areas with wildland fire activities. The likelihood of a direct application from aerial application is extremely low (wildlife screen 2), although nesting birds could be impacted by retardant drops. Egg laying occurs in April and early May, with fledging occurring from early May to mid-June. The fire season in Region 8 peaks twice, once from March to May and again in October to November. Therefore, retardant use can occur during the early portion of nesting.

Low flying aircraft may cause disturbance to birds (wildlife screen 3). Because the retardant application potential is very low, disturbance is anticipated to be short term. The risk assessment (Auxilio Management Services 2021) indicated that retardant application could result in risk to red-cockaded woodpecker from ingestion of retardant (wildlife screen 4).

The effects as described above are considered discountable because of the very low application potential is some portions of the range and no use in others, the avoidance area mapping in Mississippi, and the limited overlap of fire season and nesting season. Therefore, aerially applied fire retardant **may affect but is not likely to adversely affect red-cockaded woodpecker**. ***Avoidance Area Mapping is not recommended for this species due to the wide-ranging distribution, except for the State of Mississippi, in which mapping of core areas has already been implemented***.

5.4.5.4 Invertebrates: Arachnids, Insects, and Terrestrial Mollusks

These species will be discussed in the following four subgroups: spiders, beetles and bees, moths and butterflies, and some terrestrial mollusks and aquatic invertebrates (stoneflies). Aquatic crustaceans and aquatic mollusks will be covered under the Aquatic Species and Habitats portion of the BA.

The following species were covered under No Effect: Taylor’s checkerspot butterfly (*Euphydryas editha taylori*), Uncompahgre fritillary butterfly (*Boloria acrocnema*), Mitchell's satyr (*Neonympha mitchellii*), Oregon silverspot butterfly (*Speyeria zerene hippolyta*), Karner blue butterfly (*Lycaeides melissa samuelis*) and Hungerford’s crawling water beetle (*Brychius hungerfordi*).

Effects Common to All Invertebrates

The effects of aerial application of fire retardant on all invertebrate species are influenced by the season of use and associated life cycle of the species, canopy cover at the retardant drop site, retardant application rates, and population densities.

Retardant impacts to vegetation used by invertebrate species in areas where retardant is applied may include the following:

- fertilization that results in growth of or increases in species used for foraging or other life history needs
- growth of or increases in other species and changes to species composition
- growth of or increased presence of invasive non-native plant species that may be present in the area
- direct physical effects (leaf loss, plants physically knocked down)
- effects on plant growth and health as a result of over-fertilization or toxicity

Unless effects are known or require specific discussion relative to an individual species, the above summary serves to describe the potential impacts of retardant on vegetation used by invertebrate species addressed in the following sections.

Impacts of direct retardant application to individual arachnids or insects in areas where retardant is applied may include impairment of ability to walk or fly, impairment of ability to breathe and potential suffocation, or direct mortality from physical impact. Whether or to what degree these outcomes may occur depend on the mobility of the species (addressed in wildlife screen 2), as well as its size, morphology, physiology, point in its life cycle, location (including vegetative cover) when retardant is applied, amount of retardant applied, and the degree to which the individual is covered by retardant. Unless effects are known or require specific discussion relative to an individual species, this summary serves to describe the potential impacts of direct application of retardant on individuals of the arachnid and insect species addressed in the following sections.

For some species, information is lacking about the potential likelihood or consequences of ingesting retardant or vegetation affected by retardant, making it difficult to screen these species using wildlife screen 4. In those cases, the analysis focuses on the potential for impacts to vegetation needed by the species in question for forage or other life history need.

Arachnids – Spiders

Table 21: Summary of determinations for spider species

Scientific Name	Common Name	Status[1]	Critical habitat Determination[2]	Species Determination[2]
Microhexura montivaga	Spruce-fir moss spider	E, CH	NLAA	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Spruce-fir moss spider – Microhexura montivaga

The spruce-fir moss spider was listed as endangered on 6 February 1995 (60 FR 6968). It was analyzed in the previous consultation (USDA Forest Service 2011a, USDI Fish and Wildlife Service 2011).

The spruce-fir moss spider is difficult to detect, but the most recent available information indicates that there are up to 20 occurrences (only 11 of which have been documented within the past 20 years) in high mountains across several counties in northwestern North Carolina, eastern Tennessee, and western Virginia. This species is found on the Pisgah (National Forests in North Carolina), Cherokee, and Jefferson National Forests. The Jefferson National Forest does not use aerially delivered retardant and the National Forests in North Carolina and Cherokee National Forest have very low retardant application potential. The typical microhabitat of the spruce-fir moss spider appears to be associated with moderately thick and humid, but well-drained, moss and liverwort mats growing in sheltered spots on surfaces of rock outcrops and boulders in mature high-elevation forests dominated by the Fraser fir (*Abies fraseri*).

Critical habitat was designated for this species on 6 July 2001 (66 FR 35547); Unit 3 is located on the Pisgah National Forest in North Carolina and the Cherokee National Forest in Tennessee. The primary constituent elements consist of Fraser fir or fir-dominated spruce-fir forests at and above 5,400 feet in elevation, and moderately thick and humid, but not wet, moss (species in the genus Dicranodontium, and possibly Polytrichum) and/or liverwort mats on rock surfaces that are adequately sheltered from the sun and rain (by overhang and aspect) and that include a thin layer of humid soil and/or humus between the moss and rock surface.

Critical habitat occupied by the spruce-fir moss spider is not typically vulnerable to wildfires. If retardant were to be applied to the moss or liverwort mats it could result in physical damage or changes such as browning. However, because of the very low retardant use on the forests with critical habitat, and that the moss mats occur in locations sheltered from rain and sun, it is unlikely retardant would reach the moss habitat. Nonetheless***, avoidance mapping is required to minimize or avoid impacts to the critical habitat*** (wildlife screen 1, Figure 10). Aerially applied fire retardant **may affect but is not likely to adversely affect spruce-fir moss spider critical habitat.**

The habitats occupied by the species are dependent on high moisture regimes; moss mats cannot become too dry as the species is sensitive to desiccation. Therefore, the effects of a fire in these areas would likely be devastating to the species. On the Cherokee, Nantahala and Pisgah National Forests, most fires are very small and of short duration, but it is possible that the use of fire retardant could be recommended to protect known and suitable habitats for the spruce-fir moss spider to avoid catastrophic loss of either species and/or their habitat. As noted above, the Cherokee National Forest and the National Forests in North Carolina have very low retardant application potential.

The primary direct effects of retardant use on the spruce-fir moss spider could include physical injury to or death of spiders resulting from the force of the retardant hitting them, as well as impacts from physical changes in its habitat (force of retardant hitting the moss and rock) and chemical changes in the environment (pH, phosphorous, nitrogen, etc.). The likelihood of spiders being killed by the force of retardant hitting them, or of physical damage to their habitat is minimal because of low likelihood of retardant use in the area and the location of habitats in sheltered locations.

While there could be adverse effects to the species from the use of fire retardant (though effects on arachnids have not been studied), the use of retardant, which would only affect a portion of the occupied habitat for a short duration of time, would be justified to protect remaining habitat from the known detrimental effects of fire.

Due to the low probability of fires occurring in the occupied habitat, and the low likelihood of use of aerial application of fire retardant for the area (wildlife screen 2, Figure 11) aerially applied fire retardant **may affect but is not likely to adversely affect spruce-fir moss spider**.

Due to the very limited distribution and non-mobility of these species ***an avoidance area with a 300-foot buffer is required***.

Bees

Table 22. Summary of determinations for bee species.

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Bombas affinis	rusty patched bumble bee	E	n/a	NLAA
Bombas franklini	Franklin's bumble bee	E	n/a	LAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Rusty-patched bumble bee – *Bombus affinis*

The rusty patched bumble bee was listed as endangered, effective on 21 March 2017 (82 FR 3186, 82 FR 10285). No critical habitat has been designated. Historically, this species was broadly distributed in the northeastern United States and adjacent Canada, in the eastern temperate and boreal forest regions, north to southern Quebec, Ontario, and Maine, south in a narrow band along the Appalachian Mountains to the northeast corner of Georgia, and west to the margin of the Great Plains in eastern North Dakota, South Dakota, Minnesota, and Iowa. Known records are at elevations from sea level to around 6,000 feet. This bumble bee was widespread and relatively common, and occurred in a variety of habitats. The majority of recent observations of *Bombus affini* are from the Midwest, where the species is often found in urban and suburban habitats, which may function as refugia now, and in proximity to intensive row crop agriculture. It is usually found close to or within woodlands, urban parks and gardens.

Rusty patched bumble bee occurs on the Midewin National Tallgrass Prairie and on the Monongahela and George Washington-Jefferson National Forests, none of which use aerial fire retardant. It also occurs on the Chippewa National Forest, which has very low retardant application potential. From 2012 to 2019, the Chippewa National Forest has only used aerial retardant in three years for a total of approximately 11,000 gallons.

This bumble bee nests underground in deserted mammal burrows. In early spring (mid-March through April/May), a solitary queen initiates a colony one to four feet below ground, although occasionally nests are observed above ground. Female worker bees are produced by the queen throughout the summer, with males and potential queens produced mid to late summer and early fall. Workers forage within 0.6 miles of the nest. From September through mid-October the males and new queens disperse to mate. The founding queen and workers die, and the new queens hibernate (diapause) in small chambers in loose soil or leaf litter. (Rusty Patched Bumble Bee https://www.fws.gov/pollinators/features/rusty_patched_bumble_bee.html).

Rusty patched bumble bee individuals have limited mobility, and foraging individuals may not be able to avoid areas where retardant is applied (wildlife screen 2). Data on the potential toxicity of fire retardants to invertebrates are lacking (wildlife screen 4). Potential direct effects of retardant application on bees or on the vegetation they use are described at the beginning of this section.

Because there is no aerial retardant use on the Midewin National Tallgrass Prairie or on the Monongahela, and George Washington and Jefferson National Forests, and very low application potential on the Chippewa National Forest, the potential for affects to the bumble bee are discountable. Aerial application of fire retardant **may affect, but is not likely to adversely affect, rusty patched bumble bee.**

Franklin's bumble bee – *Bombus franklini*

Franklin's bumble bee was listed as endangered, effective on 24 August 2021 (86 FR 47221). No critical habitat has been designated. This bumble bee has the most limited distribution of all bumble bees. It occurred historically in northern California and southern Oregon, although it was last observed in Oregon in 2006. Franklin's bumble bee is found from 540 feet to 7,800 feet in elevation and nests in abandoned rodent burrows or other cavities, although it may occasionally nest on the ground or in rock piles. The life history of this species is similar to that of the rusty patched bumble bee. The flight season is mid-May to the end of September. The species may forage up to 6.2 miles from the nest, but the typical dispersal distance is 1.9 miles.

The historic range of Franklin's bumble bee includes the Umpqua and Winema National Forests, which have moderate retardant application potential, and the Klamath, Shasta-Trinity, Six Rivers, and Rogue River-Siskiyou National Forests, all of which have high application potential.

Franklin's bumble bee has moderate mobility, however foraging individuals may not be able to avoid areas where retardant is applied (wildlife screen 2). Data on the potential toxicity of fire retardants to invertebrates are lacking (wildlife screen 4). Potential direct effects of retardant application on bees or on the vegetation they use are described at the beginning of this section.

Because of the very limited distribution of Franklin's bumble bee and the moderate to high application potential in the range of the species, aerial application of fire retardant **may affect, and is likely to adversely affect, Franklin's bumble bee**.

Beetles and Stoneflies

Table 23. Summary of determinations for beetle and stonefly species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	T	n/a	NLAA
Nicrophorus americanus	American burying beetle	T	n/a	NLAA
Lednia tumana	meltwater lednian stonefly	T	n/a	LAA
Zapada glacier	western glacier stonefly	T	n/a	LAA

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Somatachlora hineana	Hine's emerald dragonfly	E, CH	NLAA	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Valley elderberry longhorn beetle – *Desmocerus californicus dimporphus*

The valley elderberry longhorn beetle was listed as threatened on 8 August 1980 (45 FR 52803) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Critical habitat is designated for this species but does not occur on National Forest System lands. The valley elderberry longhorn beetle occurs in moist valley oak woodlands along margins of rivers and streams in the lower Sacramento and San Joaquin Valleys where its food plant, elderberry (Sambucus sp.), grows. Range of the species is the Central Valley of California at low elevations of under 3,500 feet. This is a riparian associated species and most habitat is included within 300 feet wide avoidance areas on waterways.

Known populations have been found on the Eldorado, Mendocino, Plumas, Sierra and Sequoia National Forests; all of which have a high retardant application potential. Individuals of this species spend most of their life as larvae within the stems of elderberry shrubs. Because of their limited mobility, larvae are not able to avoid retardant drops (wildlife screen 2), however they would not be exposed to retardant on the exterior of the plant. Adult beetles emerge from shrubs between mid-March and June, with adult activity spanning just a few weeks. The adult life stage coincides with the early portion of fire season in California. As adults eat elderberry leaves, they could consume any retardant that was dropped on elderberry (wildlife screen 4).

Only a small portion of valley elderberry longhorn beetle habitat occurs on National Forest Service lands, and occurrences are spread across five national forests. Because larvae would not be exposed to retardant on plants, the overlap of the adult life stage is only during the early portion of the fires season, and habitat is within avoidance areas, the potential effects to adults would be discountable as they are unlikely to occur. Aerially applied retardant therefore **may affect but is not likely to adversely affect valley elderberry longhorn beetle**.

Additional avoidance area mapping is not recommended for valley elderberry longhorn beetle due to the moderate to wide distribution of this species in northern and central California, and existing protection by waterway avoidance areas buffers.

American burying beetle – *Nicrophorus americanus*

The American burying beetle was listed as endangered on 13 July 1989 (54 FR 29652) and was re-classified as threatened on 15 October 2020 (85 FR 65241). There is a non-essential experimental population in southwest Missouri that does not occur in or near any National Forest System lands. This species was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Historically the American burying beetle ranged from the south central Midwest (Texas, Oklahoma) northeast to New England. The species currently occurs in the western edge of its former range from Nebraska to northeast Texas and three localities in Massachusetts and Rhode Island (NatureServe 2021).

American burying beetles reproduce from late April through mid-August; they bury a carcass, build a chamber, and lay eggs adjacent to the buried carcass. One or both parents then feed, tend and guard the larvae for 48 to 60 days. Larvae emerge as recently molted adults in July and August and spend the winter dormant. Adults live primarily above ground and are active at night from April through September. Adults die in the fall or winter following reproduction. This beetle is a strong flier and can travel moderate distances. They are found in a variety of vegetation types. The ability to bury carrion in the soil is an important habitat component (NatureServe 2021).

Populations are known to exist on National Forest System lands, including the Nebraska and Samuel R McKelvie National Forests in Nebraska, the Ouachita and Ozark National Forests in Arkansas and Oklahoma, and the Wayne National Forest in Ohio. This species is not known or suspected to occur on the Black Hills National Forest in South Dakota, but it may occur on adjacent lands and is therefore considered for indirect effects. The only units that use retardant are the Black Hills, Nebraska, and Samuel R. McKelvie, all of which have very low application potential.

Adult American burying beetles may be affected by the aerial application of fire retardant on the Nebraska and Samuel R. McKelvie National Forests. However, these forests use very little retardant; from 2012 to 2019 these forests applied aerial retardant in 3 years for a total of just under 12,000 gallons. This would have impacted 20 acres of land at most.

Beetles that are above ground and on vegetation could be impacted by retardant drops (wildlife screen 2). Potential direct effects of retardant application on this species are described at the beginning of this section.

The American burying beetle could be indirectly affected by consumption of food contaminated with fire retardant either by being coated with it or from ingestion. The toxicity to insects through the ingestion of contaminated carcasses has not been researched (wildlife screen 4).

Because American burying beetles occupy National Forest System lands with very little or no retardant application potential, and retardant drops impact a very small portion of those forest lands in any year, the potential effects of retardant to this species are discountable. Aerially applied fire retardant **may affect but is not likely to adversely affect American burying beetle**.

Avoidance Area Mapping is not recommended for the American burying beetle due to moderate to wide range of distribution of this species.

Meltwater lednian stonefly -*Lednia tumana* and Western glacier stonefly – *Zapada glacier*

The meltwater lednian stonefly and the western glacier stonefly were both listed as threatened on 23 December 2019 (84 FR 64211). These species were listed after previous consultations were completed.

According to the Recovery Plan Outline (USDI Fish and Wildlife Service 2019), the meltwater lednian and western glacier stoneflies are small insects that begin life as eggs and hatch into juveniles (nymphs) in aquatic environments with flowing water. Mature stonefly nymphs emerge from the water and complete their development in the terrestrial environment. The short-lived, winged adults are found on and around streamside vegetation or other streamside structures before reproducing and dying.

The meltwater lednian stonefly and western glacier stonefly are found in high-elevation, fishless, alpine streams originating from meltwater sources, including glaciers and small icefields, perennial and seasonal snowpack, alpine springs, and glacial lake outlets. Meltwater lednian stoneflies are known to occur in 113 streams in and around Glacier National Park, with only two on National Forest System lands, on the Flathead National Forest in the Great Bear and Bob Marshall Wilderness areas (other known occurrences include 109 in Glacier National Park, one south of the park on tribal land, and one north of the park in Waterton Lake National Park). Western glacier stoneflies are known to occur in 16 streams in Montana and Wyoming with six on National Forest land in the Absaroka/Beartooth Wilderness of the Custer Gallatin National Forest (other known occurrences include six in Glacier National Park, four in Grand Teton National Park). The Flathead National Forest has very low retardant application potential, while the Custer-Gallatin has low application potential.

Adult stoneflies generally stay close to the channel of their source stream. Lateral movement into neighboring uplands is confined to less than 262 feet from the stream (USDI Fish and Wildlife Service 2019). The primary threats to these stonefly species are loss of habitat due to climate change and risks from stochastic events due to their restricted range. Use of retardant will not impact habitat loss. Because of their limited range, individuals or possibly an entire stream occurrence could be lost due to retardant use.

The risk assessment (Auxilio Management Service 2021) indicated a risk in three ecoregions for threatened and endangered invertebrates, represented by daphnia, during an intrusion into small streams at higher retardant coverage levels. These species do not occur in those ecoregions, but the risks reported in the assessment indicate potential for toxic effects to the aquatic life cycle of these stoneflies (wildlife screen 4). The probability of retardant use anywhere near these stoneflies' habitat is extremely low. All eight streams where these species occur on National Forest System lands are in alpine habitat where retardant use is not likely as it occurs above tree line. Wilderness areas are also less likely to receive retardant use. Habitat is described as generally rocky, a type not likely to have retardant use. Habitat is all within avoidance areas, further limiting the probability of retardant entering habitat. These conditions all indicate that the potential for retardant use is extremely low.

Although there is a very low likelihood of retardant entering this species habitat, both species have very limited distribution and limited dispersal capabilities, therefore aerially applied fire retardant **may affect and is likely to adversely affect meltwater lednian and western glacier stoneflies**.

Avoidance area mapping (300 foot buffer) is required for the aquatic habitat in which these species are found.

Hine's emerald dragonfly – *Somatachlora hineana*

The Hine's emerald dragonfly was listed as endangered on 26 January 1995 (60 FR 5267). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This species occupies marshes and sedge meadows that are characterized by the presence of slow flowing water and nearby or adjacent forest edges. Currently this species is known only from the lower Des Plaines River valley in Illinois including on the Midewin National Tallgrass Prairie, northeastern Door County and Cedarburg Bog in Wisconsin, three areas on the Hiawatha National Forest in the upper peninsula of Michigan, three areas in the lower peninsula of Michigan, and three fens on the Mark Twain National Forest in Missouri.

The Hiawatha National Forest and the Midewin National Tallgrass Prairie have no retardant use. The Mark Twain National Forest has low retardant application potential.

Critical habitat was designated on 23 April 2010 (75 FR 21394). The primary constituent elements of critical habitat for the Hine's emerald dragonfly are:

- For egg deposition and larval growth and development:
    - ♦ Organic soils (histosols, or with organic surface horizon) overlying calcareous substrate predominantly dolomite and limestone bedrock),
    - ♦ Calcareous water from intermittent seeps and springs and associated shallow, small, slow-flowing streamlet channels, rivulets, and/or sheet flow within fens,
    - ♦ Emergent herbaceous and woody vegetation for emergence facilitation and refugia,
    - ♦ Occupied burrows maintained by crayfish for refugia, and
    - ♦ Prey base of aquatic macroinvertebrates, including mayflies, aquatic isopods, caddisflies, midge larvae, and aquatic worms.
- For adult foraging, reproduction, dispersal, and refugia necessary for roosting, for resting, for adult females to escape from male harassment, and for predator avoidance (especially during the vulnerable teneral stage):
    - ♦ Natural plant communities near the breeding/larval habitat which may include fen, marsh, sedge meadow, dolomite prairie, and the fringe (up to 328 feet) of bordering shrubby and forested areas with open corridors for movement and dispersal; and
    - ♦ Prey base of small, flying insect species (e.g., dipterans).

Aerially delivered retardant will not impact the presence of organic soils and calcareous water. The fertilizing properties of retardant can impact the vegetation within critical habitat by improving growth, or at higher levels could cause plant death. Retardant can also cause changes in the aquatic prey base if it enters the water, or the flying insect prey base if it covers the vegetation.

There is no retardant use on the Hiawatha, therefore retardant would not affect critical habitat on that forest. Designated critical habitat on the Mark Twain National Forest has been protected by avoidance area mapping (Marquardt 2011) with at least a 1/2-mile buffer. Because of the very low application potential on the Mark Twain, and the large avoidance area around habitat, there is a very low probability of retardant entering the critical habitat. This results in discountable effects to critical habitat (wildlife screen 1). Aerial retardant delivery **may affect, but is not likely to adversely affect critical habitat for Hine's emerald dragonfly.**

Data on the potential toxicity of fire retardants to sensitive invertebrates are lacking. The risk assessment (Auxilio Management Service 2021) indicated a risk in three ecoregions for threatened and endangered invertebrates, represented by daphnia, during an intrusion into small streams at higher retardant coverage levels. Potential direct effects of retardant application on individuals of this species are described at the beginning of this section (wildlife screen 2).

The Mark Twain National Forest has only used aerial application of fire retardant in two years from 2012 through 2019. That use is estimated to have impacted a maximum of 32 acres, or 0.0021 percent of the forest. Therefore, there is a very low potential for direct application to occur. The Hiawatha National Forest and the Midewin National Tallgrass Prairie do not currently use aerially applied retardant.

The Mark Twain National Forest mapped avoidance areas to include the entire area between ridgetops that parallel occupied fens. There is low probability of retardant entering Hine's emerald dragonfly habitat, because of limited use and large avoidance areas. Therefore, aerial application of fire retardant **may affect but is not likely to adversely affect Hine's emerald dragonfly**.

Butterflies and Skippers

Table 24. Summary of determinations for butterfly and skipper species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Euphydryas editha quino	Quino checkerspot butterfly	E, CH	LAA	LAA
Pyrgus ruralis lagunae	Laguna Mountains skipper	E, CH	LAA	LAA
Hesperia leonardus montana	Pawnee montane skipper	T, PCH	LAA	LAA
Euphilotes enoptes smithi	Smith's blue butterfly	E, PCH	LAA	LAA
Euproserpinus euterpe	Kern primrose sphinx moth	T	n/a	LAA
Hermelycaena (Lycaena) hermes	Hermes copper butterfly	PT, PCH	LAA	LAA
Icaricia (Plebejus) shasta charlestonensis	Mt Charleston blue butterfly	E, CH	LAA	LAA
Hesperia dacotae	Dakota skipper butterfly	T, CH	NLAA	NLAA
Oarisma powesheik	Poweshiek skipperling	E, CH	NLAA	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Quino checkerspot butterfly – *Euphydryas editha quino*

The Quino checkerspot butterfly was listed as endangered on 16 January 1997 (62 FR 2313). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The Quino checkerspot butterfly occurs in San Diego and Riverside Counties, California. The Recovery Plan (68 FR 54485) identifies six recovery units that would support a large, resilient metapopulation. Two of these recovery units are within or near the Cleveland and the San Bernardino National Forests.

Vegetation types that support the Quino checkerspot butterfly include coastal sage scrub, open chaparral, juniper woodland, and native grassland. Soil and climatic conditions, as well as other ecological and physical factors, affect the suitability of habitat within the species' range.

Critical habitat for this species was designated on 17 June 2009 (74 FR 28776). It occurs on both the Cleveland and San Bernardino National Forests, both of which have high retardant application potential. Designated critical habitat occurs throughout southern California, in the form of coastal sage scrub communities. The primary constituent elements of Quino checkerspot butterfly critical habitat are:

- Open areas within scrublands at least 21.5 square feet in size that contain:
  - no woody canopy cover
  - one or more of the host plants used for growth, reproduction, and feeding (*Plantago erecta, Plantago atagonica, Antirrhinum coulterianum*, or *Collinsia concolor*)
  - one or more of the host plants (*Cordylanthus rigidus* or *Castilleja exserta*) that are within 328 feet of the host plants previously listed, or
  - flowering plants with a corolla tube less than or equal to 0.43 inches used for Quino checkerspot butterfly feeding
- Open scrubland areas and vegetation within 656 feet of the open canopy areas used for movement and basking; and
- Hilltops or ridges within scrublands that contain an open, woody-canopy area at least 21.5 square feet in size used for Quino checkerspot butterfly mating (hill topping behavior) and are contiguous with (but not otherwise included in) open areas and natural vegetation described in the first two bullets.

Quino checkerspot butterfly habitat is a volatile fuel type, and it occurs on national forests with high retardant application potential. As such, there is a high probability of retardant application. Potential direct effects of retardant application on individuals of this species and on the vegetation they use are described at the beginning of this section.

Retardant can protect vegetation from wildfires by helping to control the spread of fire. Previous consultations included a resource protection measure to prioritize hazardous fuels reduction projects near Quino checkerspot butterfly populations. There are several hazardous fuels reduction projects occurring in the Thomas Mountain, Bonita Vista, and Garner Valley area on the San Bernardino National Forest to reduce the potential for damage due to a catastrophic fire event happening adjacent to or within designated Quino critical habitat and known occupied sites.

A second resource protection measure included in previous consultations requires Quino checkerspot butterfly critical habitat to be mapped as a key avoidance area. Beginning in 2008 critical habitat has been mapped as an avoidance area with a 1 kilometer (0.6 mile) buffer.

The 2013 Mountain Fire on the San Jacinto Ranger District of the San Bernardino National Forest resulted in several intrusions into the 1 kilometer buffers of occupied sites. Monitoring for invasive species was conducted for three years post fire, per the terms and conditions of the 2011 biological opinion (USDI Fish and Wildlife Service 2011). Results indicate that in the intrusion areas, invasive species increased in growth over the monitoring period, but growth increased in some of the host plants for the butterfly, as well. There was no pre-fire inventory, however, with which to gauge the degree of change.

Similar monitoring is currently being implemented for the 2019 Bautista Fire occurred within designated critical habitat for Quino checkerspot butterfly. As of March 2020, no invasive plant species were present in the monitoring area (D. Austin, personal observation/knowledge of this area; surveys in progress).

Because of the high retardant application potential of retardant on forests with critical habitat, the potential impacts to the vegetation from the retardant (wildlife screen 1), and past intrusions into avoidance areas; aerial application of fire retardant **may affect and is likely to adversely affect Quino checkerspot butterfly designated critical habitat**. ***Avoidance area mapping of critical habitat is required, due to the high probability retardant application by the San Bernardino and Cleveland National Forests and the potential impacts to critical habitat***.

Data on the potential toxicity of fire retardants to larvae of sensitive invertebrates are lacking. The ecological risk assessment (Auxilio Management Services 2021) indicates some risk to aquatic invertebrate is present at high application rates near small stream in some ecoregions; those ecoregions do not include California. However, direct effects from aerial retardant drops could potentially kill adults, larvae, and pupae of the Quino checkerspot butterfly if the retardant covered an individual. Refer also to the discussion at the beginning of this section regarding impacts of direct application on individuals an on the vegetation they us. Based on past intrusions and the potential for direct impacts to individuals and vegetation, the two known populations that occur on National Forest System lands would be vulnerable to effects from aerial fire retardant applications.

The population occurring on the San Bernardino National Forest is critical to the recovery and distribution of the species. Surveys have resulted in expanding the known range of this species farther to the north than what was previously known (San Bernardino National Forest unpublished reports 2015 to 2019); this population occurs further north and higher in elevation than previously known occurrences, and is farther away from areas experiencing the most development and onto National Forest System lands where there are some protections from certain threats.

Because of the high application potential of retardant and the potential effects to individuals, aerially applied fire retardant **may affect and is likely to adversely affect Quino checkerspot butterfly.**

The 2011 Biological Opinion required a 1 kilometer avoidance area around all known occurrences. This large avoidance area buffer is difficult to implement because of the proximity of occupied habitat to the communities of Idyllwild, Mountain Center and private lands in

Garner Valley. Several intrusions have occurred on the San Bernardino National Forest since 2012. These intrusions have occurred using the exception for human life and fire fighter safety and protection of critical infrastructure (powerlines and State highways) during the Mountain Fire of 2013, the Cranston Fire of 2018 and the Bautista Fire of 2019 (Austin, personal observation as the Lead Resource Advisor for these incidents). In these intrusions, the retardant drops were in the outer part of the 1 kilometer buffer and landed within occupied Quino checkerspot butterfly habitat. A summary of these intrusions is provided in the 2013, 2018 and 2019 required monitoring reports submitted to the Fish and Wildlife Service, and these intrusions were reported to the Fish and Wildlife Service Ventura Office.

The San Bernardino National Forest has conducted post-fire monitoring for each of these intrusions; as described in the discussion above on critical habitat, host plants were reoccurring after each new spring season, as were nonnatives that were present in the area of the drops. The San Bernardino National Forest has also conducted extensive habitat suitability surveys in the range of the Quino checkerspot butterfly on the San Jacinto Ranger District.

The Forest Service recommends use of 600-foot buffers for known occurrence locations and designated critical habitat. This smaller avoidance area will provide adequate protection for the species while allowing the option of using retardant in a larger area of this volatile fuel type in the urban interface.

Laguna Mountains skipper – *Pyrgus ruralis lagunae*

The Laguna Mountains skipper was listed as endangered on 16 January 1997 (62 FR 2313). It was analyzed for the 2011 consultation (USDA Forest Service 2011B, USDI Fish and Wildlife Service 2011). This species is a small butterfly found in montane meadow habitat of southern California mountains. The Laguna Mountains skipper is a subspecies of the rural skipper (*Pyrgus ruralis*) that is restricted to the Laguna Mountains and Mount Palomar in San Diego County. Little is known regarding the subspecies' population status anywhere, including the five locations known at the time of listing. Surveys conducted on Palomar Mountain in 2007 found fewer than 100 individuals distributed in seven montane meadow systems, primarily along drier forest-meadow edges. The subspecies has been associated with its primary host plant, *Horkelia clevelandii*. This host plant is a rare species within the range of the butterfly and has a restricted range in Laguna, Cuyamaca, and San Jacinto Mountains of southwestern California.

Habitat destruction and degradation from overgrazing and trampling by cattle are considered to be the reasons for the decline of host plants; however, this plant has not been listed at either the federal or state level. Changes in hydrology, invasion of exotic species, and forest encroachment caused by cattle grazing also affect the host plant.

Critical habitat for this species was designated on 12 December 2006 (71 FR 74592). The designated critical habitat for this species occurs throughout the southern California area in the form of coastal sage scrub communities. The primary constituent elements of Laguna Mountains skipper's critical habitat are:

- the hostplants, *Horkelia clevelandii* or *Potentilla glandulosa*, in meadows or forest openings needed for reproduction,
- nectar sources suitable for feeding by adult Laguna Mountains skippers, including *Lasthenia* spp., *Pentachaeta aurea*, *Ranunculus* spp., and *Sidalcea* spp. found in woodlands or meadows, and

- wet soil or standing water associated with features such as seeps, springs, or creeks where water and minerals are obtained during the adult flight season.

Aerially applied retardant can impact the reproductive host plants and nectar sources for feeding through the fertilizing properties of the retardants. Thus, a flush of new growth can be expected to occur in the short term after application. If non-native invasive plant species are present, they may out compete native species that make up the primary constituent elements.

Past consultations for aerially delivered retardant have resulted in reasonable and prudent measures to focus fuels reduction projects in this species' habitat, and to map critical habitat in a retardant avoidance area. The forests on Palomar Mountain have been subject to fire suppression practices for many decades. The Cleveland National Forest has focused fuels reduction program to thin forests on the mountain as part of compliance with the reasonable and prudent measure. On the Cleveland National Forest, all Laguna mountain skipper designated critical habitat has been mapped in critical avoidance areas since 2008 (Winter 2010).

Aerially applied fire retardant has a high probability of being used because this habitat is the most volatile fuel type and the Cleveland National Forest has high retardant application potential. Although the critical habitat is avoidance area mapped, there is still a potential for effects if intrusions occur. Because critical habitat occurs only on one National Forest, aerial application of fire retardant **may affect and is likely to adversely affect Laguna Mountains skipper critical habitat**.

Effects to Laguna Mountains Skipper are the same as those described for Quino checkerspot butterfly. Because of the small isolated population, the high application potential of retardant and the potential effects to individuals, aerially applied fire retardant **may affect and is likely to adversely affect Laguna Mountains butterfly.**

Avoidance area mapping is required for all Laguna Mountain skipper known population sites due to the very limited distribution and low number of occupied sites for this species. The Cleveland National Forest has requested the buffer for occupied habitat sites be 600 feet (K. Winter, Cleveland Forest Biologist, personal conversation with D. Austin, July 6, 2020).

Pawnee montane skipper – *Hesperia leonardus montana*

The Pawnee montane skipper was listed as threatened on 25 September 1987 (52 FR 36176). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This species is known from one population; it has a very restricted range of approximately 38 square miles, occurring within an area roughly 23 miles long and 5 miles wide, along the South Platte River drainage in central Colorado. Seventy percent of the species' range is on the Pike-San Isabel National Forest, which has moderate retardant application potential.

The Pawnee montane skipper inhabits dry, open ponderosa pine woodlands with sparse understory in elevations from 6,000 to 7,500 feet. Adult butterflies fly in late summer, as early as late July into mid-September or later. Prairie gayfeather (*Liatiris punctata*) is the primary nectar plant for the adult skipper, which also feeds on nectar from thistles. The host plant for larvae is blue grama grass (*Bouteloua gracilis*). Individuals of this species hibernate as young larvae among dry grass blades near the base of the plant.

This species' range is within the Southern Rocky Mountain Eco-Region, which has a fire season from June to September. Past fire history within skipper habitat indicates a peak fire season from May through August, with larger fires occurring in the early summer months.

Critical habitat was proposed on 3 July 1978 (43 FR 28938). The area proposed as critical habitat contains the only known population of this butterfly species. The proposed critical habitat rule did not identify primary constituent elements.

Potential direct effects of retardant application on individuals of this species and on the vegetation they rely on are described at the beginning of this section. Specifically, fertilizing effects of retardant could cause a short-term increase in blue grama biomass that would increase food resources for the skipper larvae, but could also result in the increase of plants that may compete with the blue grama. If retardant covers the flowering plant, the nectar source would be temporarily unavailable (wildlife screen 4). Prairie gayfeather flowers sequentially down its flowering spike, so it is likely that new flowers would continue to open and provide continued nectar sources.

Aerial retardant application **may affect and is likely to adversely affect Pawnee montane skipper and its proposed critical habitat** due to the skipper's restricted range and possible exposure to aerial fire retardant

Avoidance area mapping is not recommended for the Pawnee montane skipper due to the isolated habitat type.

The Pike-San Isabel National Forest and the Fish and Wildlife Service Ecological Services Office in Colorado believe that the risk of wildfire to this species is far greater than the potential for negative impacts from retardant use (McDonald 2011).

Smith's blue butterfly – *Euphilotes enoptes smithi*

The Smith blue butterfly was listed as endangered on 1 June 1976 (41 FR 22041). It was analyzed in the 2011 consultation (USDA Forest Service 201b, USDI Fish and Wildlife Service 2011). Habitat consists of coastal sand dune hills or serpentine grasslands with buckwheat species as host plants. The historic range for this species is Monterey and San Mateo Counties, California. There are currently two occurrences (metapopulations): the northern metapopulation north of the town of Santa Cruz, and the southern metapopulation including Carmel Valley and Big Sur coastal habitat. The disjunct range covers an 80 mile stretch of coast and in a few places extends up to 10 miles inland (NatureServe 2021). The species is found on the Los Padres National Forest, which has high potential for aerial retardant application.

Smith's blue butterfly flight season is from mid-June to early September, and ranges from four to ten weeks long. The egg stage is from four to eight days and the larval stage lasts about a month (NatureServe 2021). Most of the year is spent as a diapausing pupa. Home range size varies between 2.2 and 8.3 acres. All stages of Smith's blue butterfly are entirely dependent upon seacliff buckwheat (*Erioginum parvifolium*) and coast buckwheat (*Erioginum latifolium*). Invasive plants are a primary threat for the species.

Critical habitat was proposed on 8 February 1977 (42 FR 7972). It consists of an elongate strip of coastal sand dunes, extending one kilometer inland in a westward direction from the Pacific Ocean, bounded by Del Rey Creek on the south and the Salinas River on the north. Primary constituent elements have not been identified.

Potential direct effects of retardant application on individuals of this species and on the vegetation they rely on are described at the beginning of this section. More specifically, the fertilizing effects of retardants could cause a short-term increase in buckwheat biomass that would increase food resources for the butterfly, but could also result in the increase of nonnative plants that are a threat to buckwheat.

Aerially applied fire retardant **may affect and is likely to adversely affect Smith's blue butterfly and its proposed critical habitat** based on direct and potential indirect impacts to the species and its habitat and due to its isolated populations and limited range. ***Avoidance area mapping (300-foot buffer) is required for all Smith's blue butterfly critical habitat and known population sites*** due to the very limited distribution and low number of known occupancy sites for this species.

Kern primrose sphinx moth – *Euproserpinus euterpe*

The Kern primrose sphinx moth was listed as threatened on 8 April 1980 (45 FR 24088) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). It is known only from one small area in the Walker Basin in Kern County, California. This moth is restricted to areas that contain the evening primrose, which supplies the food source for both adults and larvae. The flight season for this moth is late February to early April. The evening primrose is known to grow only in sparsely vegetated sandy washes (seasonally dry waterways), where the fuel continuity is not enough to support the spread of a wildfire.

This species may occur on the Los Padres National Forest which has a high application potential of aerial retardant.

Forest Service Region 5 removed all dry intermittent streams and washes from mapped avoidance areas in 2014 (USDA Forest Service Region 5 2014). A retardant drop in this habitat area may cause direct effects as described at the beginning of this section (wildlife screen 2). More specifically, fertilizing effects of retardant could promote growth of primrose species, but also could promote growth of nonnative species in primrose habitat. The latter has a high potential to occur given the high amount of disturbance within and adjacent to primrose habitat.

In recent years the Los Padres National Forest has potential to have fires at any time of year (e.g., the Thomas Fire December 2017, Soboranes Fire 2016). The use of aerial retardant occurs in all areas at any time of year regardless of elevations, and in sandy washes when dry. The limited distribution, limited mobility, and isolated populations of the Kern primrose sphinx moth, along with the potential effects as described above, results in the determination that aerial application of fire retardant **may affect and is likely to adversely affect the Kern primrose sphinx moth**.

Avoidance area mapping is required (300-foot buffers) for Kern primrose sphinx moth due to very limited distribution of this species.

Hermes copper butterfly – *Lycaena hermes*

The Hermes copper butterfly was proposed as a threatened species, with proposed critical habitat, on 8 January 2020 (85 FR 1018). The Hermes copper butterfly is a small-sized butterfly historically found in San Diego County, California, and northwestern Baja California, Mexico.

There are 95 known historical or extant Hermes copper butterfly occurrences in the United States and northwestern Baja California, Mexico: 45 are extant or presumed extant (all in the United

States), 40 are presumed extirpated, and 10 are permanently extirpated. Hermes copper butterflies need connectivity within habitat patches - an unfragmented habitat patch where reproduction occurs. Habitat patches are a collection of host plants and host plant patches among which adult butterflies readily and randomly move during a flight season. Butterflies must be free to move among individual host plants and patches of host plants within a habitat patch. They also require dispersal corridor-connectivity areas; those are undeveloped wildlands with suitable vegetation structure that occur between habitat patches, close enough to allow recolonization of a formerly occupied habitat patch. Hermes copper butterflies are periodically extirpated from host plants by wildfire, and therefore require the ability to recolonize from other patches.

The Hermes copper butterfly occurs on the Cleveland National Forest, which has a high retardant application potential.

The physical or biological features essential to the conservation of the Hermes copper butterfly consist of the following components, when they are found between 100 feet and 4,400 feet above sea level and in appropriate quality, quantity, and spatial and temporal arrangement:

- spiny redberry (*Rhamnus crocea*) host plants, including post-fire stumps that can re-sprout, and
- nectar sources for adult butterflies.

Significant nectar sources include California buckwheat (E*riogonum fasciculatum*) and golden yarrow (*Eriophylum confirtiflorum*), although nectar from plants associated with these species may be used, also.

The Cleveland National Forest contains part of Critical Habitat Unit 3: Southeast San Diego. This unit consists of 27,709 acres within the geographical area currently occupied by the species and contains all of the essential physical or biological features. The physical or biological features may require special management to protect them from land use change and wildfire, although wildfire will be challenging to manage in this unit because of its size and risk of megafire.

A retardant drop in this habitat area may cause direct effects as described at the beginning of this section (wildlife screen 2). More specifically, fertilizing effects of retardant could promote growth of spiny redberry and some nectar-producing species, but also could promote growth of nonnative species as well.

The Cleveland National Forest has high retardant application potential, which likely means high potential for the effects as described above. Aerial application of fire retardant **may affect and is likely to adversely affect the Hermes copper butterfly and its proposed critical habitat**.

Avoidance area mapping is required for all Hermes copper butterfly known population sites and proposed critical habitat for this species due to the very limited distribution and low number of known occupancy sites for this species. he Cleveland National Forest proposes a 600-foot buffer on occupied sites (Winter 2020).

Mount Charleston blue butterfly – *Icaricia (Plebejus) shasta charlestonensis*

The Mount Charleston blue butterfly was listed as endangered effective 21 October 2013 (78 FR 57749). The Mount Charleston blue butterfly is a subspecies of the wider ranging Shasta blue butterfly; individuals of this subspecies likely complete their entire life cycle within a single patch of habitat. The typical flight, feeding, and breeding period for the adult Mount Charleston blue butterfly is early July to mid-August with a peak in late July, although the subspecies has been observed as early as mid-June and as late as mid-September. During this time female Mount Charleston blue butterflies oviposit a single egg per host plant.

Eggs may hatch into larva that will feed on the host plant during the summer and enter diapause as larva; alternately eggs may diapause over winter and hatch the next spring. The Mount Charleston blue butterfly thus completes its life cycle in two or more years if it enters diapause multiple times.

There are no population estimates of the Mount Charleston blue butterfly because not all areas have been surveyed, different survey methodologies have been used in the past, and early life stages, which may diapause one or more years, are also difficult to detect. Further, the Mount Charleston blue butterfly can be present in an area of habitat and difficult to observe even after repeated visits during appropriate times and conditions.

The declining trend of the Mount Charleston blue butterfly was determined based on an increasing number of locations where adult butterflies had been previously observed but that have had fewer or no subsequent detections. There are 17 locations where populations of the Mount Charleston blue butterfly have been known to occur historically. Of the 17 locations, five are extirpated, 11 are presumed occupied, and three are known occupied. While Mount Charleston blue butterflies have been observed at presumed and known occupied locations, the latter have had consistent observations in successive years. All Mount Charleston blue butterfly presumed and known occupied locations are within the critical habitat units.

The Mount Charleston blue butterfly occurs only on the Toiyabe National Forest, which has high potential for aerial fire retardant application.

Critical habitat was designated on 30 June 2015 (80 FR 37403). Three critical habitat units totaling approximately 5,214 acres (2,110 hectares) were designated for the Mount Charleston blue butterfly: Unit 1 South Loop is 2,228 acres (902 hectares), Unit 2 Lee Canyon 2,569 acres (1,040 hectares), and Unit 3 North Loop is 413 acres (167 hectares). All three critical habitat units are occupied. Primary constituent elements identified for critical habitat include:

- Areas of dynamic habitat between (8,200 feet and 11,500 feet elevation with openings or where disturbance provides openings in the canopy that have no more than 50 percent tree cover (allowing sunlight to reach the ground), widely spaced low (less than 0.5 feet forbs and grasses, and exposed soil and rock substrates.
- The presence of one or more species of host plants required by larvae of the Mount Charleston blue butterfly for feeding and growth. Known larval host plants are *Astragalus calycosus* var. *calycosus*, *Oxytropis oreophila* var. *oreophila*, and *Astragalus platytropis*.
- The presence of one or more species of nectar plants required by adult Mount Charleston blue butterflies for reproduction, feeding, and growth. Common nectar plants include *Erigeron clokeyi, Hymenoxys lemmonii, Hymenoxys cooperi* and *Eriogonum umbellatum* var. *versicolor*.

Aerial use of fire retardant will not alter openings or tree cover. Potential direct effects of retardant application on individuals of this species or on the vegetation they use are described at the beginning of this section. Specifically, retardant can cause a short-term increase in host plant biomass but could also result in the increase of nonnative plants that may outcompete host plants (wildlife screen 1). Because the Humboldt-Toiyabe National Forest has high retardant application potential, the proposed action **may affect and is likely to adversely affect Mount Charleston blue butterfly critical habitat due** to the potential effects to the primary constituent elements. ***Avoidance area mapping is required (300-foot buffer) for critical habitat to reduce the likelihood of retardant application***.

Data on the potential toxicity of fire retardants to larvae of sensitive invertebrates are lacking. Potential direct effects of retardant application on individuals of this species or on the vegetation they use are described at the beginning of this section (wildlife screen 2). As described for critical habitat, retardants can also impact the vegetation. Aerial application of fire retardant **may affect and is likely to adversely affect Mount Charleston blue butterfly**. ***Because of its limited distribution and low number of occupied sites, a voidance area mapping (300-foot buffers) is required for all Mount Charleston blue butterfly known population sites***.

Dakota skipper butterfly – *Hesperia dacotae* and Poweshiek skipperling -*Oarisma powesheik*

These two species co-exist where they occur. The Dakota skipper was listed as threatened and the Poweshiek skipperling was listed as endangered on 24 November 2014 (79 FR 63671) Dakota skippers and Poweshiek skipperlings may move between patches of prairie habitat separated by structurally similar habitats (for example, perennial grasslands, but not necessarily native prairie). Small populations need immigration corridors for dispersal from nearby populations, to prevent genetic drift and to reestablish a population after local extirpation. These species occur on the Dakota Prairie National Grasslands, which has very low retardant application potential.

Critical habitat was designated on 1 October 2015 (80 FR 59247. The primary constituent elements specific to the Dakota skipper and powesheik skipperling are:

- wet-mesic tallgrass or mixed-grass remnant untilled prairie that occurs on near-shore glacial lake soil deposits or high-quality dry-mesic remnant untilled prairie on rolling terrain consisting of gravelly glacial moraine soil deposits,
- native grasses and native flowering forbs for larval and adult food and shelter, that includes
  - ♦ at least one of the following food and shelter sources for larval development: *Sporoborus heterolepis* or *Schizachyrium scoparium* and
  - ♦ one or more of the following for food and nectar for adults: *Echinacea angustifolia, Campanula rotundifolia, Dalea candida, Ratibida columnifera, Erigeron* spp., *Gaillardia* spp., *Rudbeckia hirta, Calylophus serrulatus, Astragalus adsurgens,* or *Gaillardia aristate*.
- dispersal grassland habitat that is within 0.6 mi of native high quality remnant prairie that connects high-quality wet-mesic to dry tallgrass prairies or moist meadow habitats. Dispersal grassland habitat consists of undeveloped open areas dominated by perennial grassland with limited or no barriers to dispersal including tree or shrub cover less than 25 percent of the area and no row crops such as corn, beans, potatoes, or sunflowers.

Avoidance area mapping (300-foot buffers) are required on critical habitat for these species. Although retardant can impact prairie vegetation as previously described, implementation of avoidance areas and very low application potential reduces the likelihood of retardant entering the area reducing the potential for effects to a discountable level (wildlife screen 1). Therefore, aerial application of fire retardant **may affect but is not likely to adversely affect Dakota skipper and powesheik skipperling critical habitat**.

Data on the potential toxicity of fire retardants to larvae of sensitive invertebrates are lacking. Potential direct effects of retardant application on individuals of this species or on the vegetation they use are described at the beginning of this section. Dakota skippers are not known to disperse widely and lave low mobility (wildlife screen 2).

Dakota Prairie National Grassland has very low retardant application, thus there is very low potential for retardant to enter habitat. ***Required avoidance area mapping (300-foot buffers) of known population sites further reduces the potential to discountable levels***. Aerial application of fire retardant **may affect but is not likely to adversely affect Dakota skipper and Poweshiek skipperling**.

Terrestrial Gastropod

Table 25. Summary of determinations for terrestrial gastropod species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Helminthoglypta walkeriana	Morro shoulderband (banded dune) snail	E, (CH)	na	LAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Morro shoulderband (banded dune) snail – *Helminthoglypta walkeriana*

The Morro shoulderband dune snail was listed as endangered on 15 December 1994 (59 FR 64613) and was proposed for reclassification to threatened 24 July 2020 (85 FR 44821). This species was not analyzed previously. It occurs in coastal dune and scrub communities and maritime chaparral with dominant shrub of mock heather and buckwheats. No National Forest System land is designated as critical habitat (66 FR 9233). The species potentially occurs on the Los Padres National Forest, which has high application potential for aerial fire retardant.

Potential impacts of retardant on aquatic mussels and gastropods have been identified, but those effects are based on chemical presence in water. Potential impacts to terrestrial mollusk species are unknown but, given the salts used in aerial retardants, there is a possibility of direct toxic or physical effects to terrestrial mollusk species. This species has very limited distribution to only one area in San Luis Obispo County, CA, and has very limited mobility.

Based on the high potential for retardant use and the likely effects if snails are directly impacted (wildlife screen 2), aerial application of fire retardant **may affect and is likely to adversely affect morro shoulderband dune snail**. ***If the species is found on the Los Padres National Forest avoidance area mapping (300-foot buffers) of occupied habitat is recommended***.

5.4.5.5 Mammals

Aerially applied retardant was found to have no effect on Florida panther (*Puma concolor coryi*). A summary of the rationale for each species in found in appendix F.

Small Rodents – Mice and Kangaroo Rats

Table 26. Summary of determinations for mouse and kangaroo rat species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Zapus hudsonius luteus	New Mexico meadow jumping mouse	E, CH	NLAA	LAA
Zapus hudsonius preblei	Preble's Meadow jumping mouse	T, CH	NLAA	LAA
Dipodomys merriami parvus	San Bernardino Merriam’s Kangaroo Rat	E, CH	NLAA	LAA
Dipodomys stephensi	Stephens’ kangaroo rat	E	na	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. ‘P’ preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Because of similarities in the discussions about potential impacts to, and determinations for the mouse and kangaroo rat species included in this analysis, the discussion of determinations for critical habitats and for species are grouped into two sections that are placed after the individual species discussions below.

New Mexico meadow jumping mouse – *Zapus hudsonius luteus*

The New Mexico meadow jumping mouse was listed as endangered on 10 July 2014 (79 FR 33119). Forest Service Region 3 conducted consultation for the Santa Fe, Lincoln, and Apache-Sitgreaves National Forests (USDA Forest Service Santa Fe National Forest 2013, USDI Fish and Wildlife Service 2013, USDI Fish and Wildlife Service 2017). The New Mexico meadow jumping mouse is found on the Rio Grande National Forest in Colorado, which has very low retardant application potential, the Apache-Sitgreaves National Forest in Arizona, which has low retardant application potential, and the Gila, Lincoln, San Juan and Santa Fe National Forests in Arizona and New Mexico, all of which have moderate retardant application potential.

The New Mexico meadow jumping mouse is a habitat specialist that nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet. The jumping mouse appears to use only two riparian community types: 1) persistent emergent herbaceous wetlands; and 2) scrub-shrub wetlands. In particular, this species uses microhabitats of patches or stringers of tall dense sedges on moist soil along the edge of permanent water. The jumping mouse is generally nocturnal, but occasionally diurnal. It is active only during the growing season of the grasses and forbs on which it depends. This is a primarily solitary species with home range sizes of about 2.5 acres for males and smaller for females. Individuals weigh about 1 ounce. Individuals hibernate from September-October to April-May (NatureServe 2021).

There are 7,713 acres of critical habitat designated for this species on National Forest System lands (81 FR 14263). This includes two subunits in New Mexico (3,042 acres): Unit 3 on the Santa Fe National Forest in the Jemez Mountains (2,056 acres), and Unit 4 on the Lincoln National Forest in the Sacramento Mountains (986 acres); and one subunit in Arizona on the Apache-Sitgreaves National Forest in the White Mountains (4,671 acres). There is no critical habitat designated on National Forest System lands in Colorado. Because critical habitat occurs in wet areas within 330 feet of bankfull, most of the critical habitat is included within waterway avoidance areas. ***In order to avoid impacts to critical habitat avoidance areas are required to be expanded to 300 feet from the edge of critical habitat (630-foot buffers from bankfull)***.

Four primary constituent elements of critical habitat were identified:

- Riparian communities along rivers and streams, springs and wetlands, or canals and ditches that contain persistent emergent herbaceous wetlands especially characterized by presence of primarily forbs and sedges (*Carex* spp. or *Schoenoplectus pungens*); or scrub-shrub riparian areas that are dominated by willows (*Salix* spp.) or alders (*Alnus* spp.) with an understory of primarily forbs and sedges.
- Flowing water that provides saturated soils throughout the jumping mouse's active season that supports tall (average stubble height of herbaceous vegetation of at least 24 inches) and dense herbaceous riparian vegetation composed primarily of sedges (*Carex* spp. or *Schoenoplectus pungens*) and forbs, including, but not limited to, one or more of the following associated species: Spikerush (*Eleocharis macrostachya*), beaked sedge (*Carex rostrata*), rushes (*Juncus* spp. and *Scirpus* spp.), and numerous species of grasses such as bluegrass (*Poa* spp.), slender wheatgrass (*Elymus trachycaulus*), brome (*Bromus* spp.), foxtail barley (*Hordeum jubatum*), or Japanese brome (*Bromus japonicas*), and forbs such as water hemlock (*Circuta douglasii*), field mint (*Mentha arvense*), asters (*Aster* spp.), or cutleaf coneflower (*Rudbeckia laciniata*).
- Sufficient areas of 5.6 to 15 miles along a stream, ditch, or canal that contain suitable or restorable habitat to support movements of individual New Mexico meadow jumping mice.
- Adjacent floodplain and upland areas extending approximately 330 feet outward from the boundary between the active water channel and the floodplain (as defined by the bankfull stage of streams) or from the top edge of the ditch or canal.

Preble's meadow jumping mouse – *Zapus hudonius preblei*

The Preble's meadow jumping mouse was listed as threatened on 13 May 1998 (63 FR 26517) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). It occurs on the Arapahoe-Roosevelt National Forest, which has low retardant application potential, and on the Medicine Bow-Routt and Pike-San Isabel National Forests, which have moderate retardant application potential.

The Preble's meadow jumping mouse lives primarily in heavily vegetated, shrub-dominated riparian (streamside) habitats and immediately adjacent upland habitats along the foothills of southeastern Laramie, Wyoming south to Colorado Springs along the eastern edge of the Front Range of the Rocky Mountains in Colorado. This species is nocturnal. Subadults hibernate from mid-October to mid-May, and adults hibernate from late August through mid-May.

There are 12,431 acres of critical habitat designated for the Preble's meadow jumping mouse on National Forest System lands (75 FR 78430), all in Colorado. The Arapahoe-Roosevelt National Forest contains Unit 1 North Fork Cache la Poudre River (1,244 acres), Unit 2 Cache Poudre River (4,702 acres), Unit 3 Buckhorn Creek (1,346 acres) and Unit 4 Cedar Creek (510 acres), all within Larimer County. The Pike-San Isabel National Forest contains Unit 6 Rocky Flats Site (1,094 acres) in Jefferson County; Unit 9 West Plum Creek (802 acres) and Unit Upper South Platte River (2,674 acres) both in Douglas Counties; and Unit 11 Monument Creek (59 acres) in El Paso County.

The primary constituent elements specific to Preble's meadow jumping mouse are:

- riparian corridors:
  - ♦ formed and maintained by normal, dynamic, geomorphological, and hydrological processes that create and maintain river and stream channels, floodplains, and floodplain benches and that promote patterns of vegetation favorable to the Preble's meadow jumping mouse;
  - ♦ containing dense, riparian vegetation consisting of grasses, forbs, or shrubs, or any combination thereof, in areas along rivers and streams that normally provide open water through the mouse's active season; and
  - ♦ including specific movement corridors that provide connectivity between and within populations. This may include river and stream reaches with minimal vegetative cover or that are armored for erosion control; travel ways beneath bridges, through culverts, along canals and ditches; and other areas that have experienced substantial human alteration or disturbance, and
- additional adjacent floodplain and upland habitat with limited human disturbance (including hayed fields, grazed pasture, other agricultural lands that are not plowed or disked regularly, areas that have been restored after past aggregate extraction, areas supporting recreational trails, and urban–wildland interfaces).

San Bernardino Merriam's kangaroo rat – *Dipodomys merriami parvus*

The San Bernardino Merriam's kangaroo rat was listed as endangered on 27 January 1998 (63 FR 3835) and was analyzed in the 2011 (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011) consultation. The San Bernardino Merriam's kangaroo rat occurs in several small, isolated populations on the San Bernardino National Forest: the Lytle, Cajon, and Cable Creek area, and the upper reaches of the Santa Ana River, in San Bernardino County and in the San Jacinto River and Bautista Creek area, both in Riverside County. The San Bernardino National Forest has high retardant application potential.

Kangaroo rats live individually in a maze of underground burrows. They are nocturnal, but limit their time above ground defending their territory, searching for mates or collecting food. They eat primarily plant seeds that they cache in their burrow system.

Critical habitat for the San Bernardino kangaroo rat was designated 17 October 2008 (73 FR 61936) in San Bernardino and Riverside Counties, California. There are 190 acres of critical habitat designated for this species on National Forest System lands: Unit 2 Lytle Creek/Cajon Wash (89 acres) in San Bernardino County; and Unit 5 Bautista Creek (101 acres) in Riverside

County. The Fish and Wildlife Service determined that the primary constituent elements specific to the San Bernardino kangaroo rat are:

- Alluvial fans, washes, and associated floodplain areas containing soils consisting predominately of sand, loamy sand, sandy loam, and loam, which provide burrowing habitat necessary for sheltering and rearing offspring, storing food in surface caches, and movement between occupied patches;
- Upland areas adjacent to alluvial fans, washes, and associated floodplain areas containing alluvial sage scrub habitat and associated vegetation, such as coastal sage scrub and chamise chaparral, with up to approximately 50 percent canopy cover providing protection from predators, while leaving bare ground and open areas necessary for foraging and movement of this subspecies; and
- Upland areas adjacent to alluvial fans, washes, and associated floodplain areas, which may include marginal habitat such as alluvial sage scrub with greater than 50 percent canopy cover with patches of suitable soils that support individuals for repopulation of wash areas following flood events. These areas may include agricultural lands, areas of inactive aggregate mining activities, and urban/wildland interfaces

Stephens' kangaroo rat – *Dipodomys stephensi*

The Stephen's kangaroo rat was listed as endangered on 30 September 1988 (53 FR 38465). This species was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Habitats for this species includes annual grassland and coastal sage scrub with sparse shrub cover, commonly in association with *Eriogonum fasciculatum*, *Artemisia californica*, and *Erodium cicutarium*. Typical habitat includes sparsely vegetated areas (perennial cover less than 30%) with loose, friable, well-drained soil (generally at least 20 inches deep) and flat or gently rolling terrain (NatureServe 2021). The Stephen's kangaroo rat occurs is three geographically distinct regions: western Riverside County, western San Diego County, and central San Diego County. It is known to occur within one mile of both the Cleveland and San Bernardino National Forests, but not known to occur on Forest Service lands. The Cleveland and San Bernardino National Forests have high aerial retardant application potential.

Stephens kangaroo rat is a small species at only 2.4 ounces. They are a keystone species that promote the growth of native plants and reduce the spread of invasive ones with their burrowing habits and caching of seeds. Like the San Bernardino Merriam's kangaroo rat they are nocturnal and periods of inactivity are spent in underground burrows.

Analysis and determinations for Small Rodent (mouse and kangaroo rat species) Designated Critical Habitats

Aerially delivered retardant will not affect the presence of flowing water, movement areas, or adjacent floodplain areas. As previously described, retardant can affect the vegetative components of critical habitat. Retardant impacts to vegetation may include fertilization that results in growth of species used for foraging or other life history needs, growth of other species and changes to species composition in the affected area, and growth of or increased presence of invasive non-native plant species that may out-compete native species that make up the primary constituent elements (wildlife screen 1). Other impacts may include direct physical effects (leaf loss, plants physically knocked down), or effects on plant growth and health as a result of over-fertilization or toxicity.

Although retardant has the potential to impact the vegetation, the critical habitat for these three species is centered around waterways. Existing waterway avoidance areas will greatly reduce the probability of retardant entering critical habitat. In 2008, the San Bernardino National Forest included San Bernardino Merriam's kangaroo rat critical habitat in avoidance areas with 300-foot buffers on the edge of the critical habitat. ***Avoidance area mapping of New Mexico meadow jumping mouse, Preble's meadow jumping mouse, and San Bernardino Merriam's kangaroo rat critical habitat, with 300-foot buffers, is required to further reduce impacts to a discountable level***.

Therefore, aerial application of fire retardant **may affect but is not likely to adversely affect New Mexico meadow jumping mouse, Preble's meadow jumping mouse, and San Bernardino Merriam's kangaroo rat critical habitat**.

Analysis and Determinations for Small Rodent (mouse and kangaroo rat) Species

Retardant use occurs within the range of all four small rodent species. Because the species are nocturnal and retardant is aerially applied during the day, individuals would avoid direct application. However, because of their small home range sizes (2.5 acres or less), individuals would not be able to avoid retardant if it is applied in their home range (wildlife screen 2).

Retardant use occurs during each species' active periods, however disturbance to the species is not expected due to their nocturnal nature (wildlife screen 3).

As described for critical habitat, retardant can impact vegetation by improving growth. This could increase or decrease seed availability for these species, depending on the response of native plants or competing plants to the fertilizing effects of retardant chemicals. The ecological risk assessment (Auxilio Management Services 2021) indicated that threatened and endangered omnivores, as represented by deer mice, that reenter an area after firefighting activities have subsided have risk of effects to survival, growth, and reproduction of individuals from ingestion of retardant. This risk was present at all application rates (wildlife screen 4). Deer mice have similar size and home ranges to the four species analyzed here.

Use of retardant can have beneficial effects to small rodent habitat by helping to control wildfires and limiting loss of habitat.

Based on their small population size, limited occurrences, limited mobility, and potential for effects as described above, aerially delivered fire retardant **may affect and is likely to adversely affect Preble's meadow jumping mouse and New Mexico meadow jumping mouse**. San Bernardino Merriam's kangaroo rat and Stephen's kangaroo rat have the same factors and the jumping mice, and also occur in or near forests with high application potential. Aerial fire retardant **may affect and is likely to adversely affect San Bernardino Merriam's kangaroo rat**. ***Avoidance area mapping of known occurrences, with 300-foot buffers, is required to minimize impacts.*** There are no known occurrences of Stephen's kangaroo rat on the Cleveland or San Bernardino National Forests at this time. Aerial application of fire retardant **may affect but is not likely to adversely affect Stephen's kangaroo rat**. If found on National Forest System lands in the future avoidance area mapping will be determined by the local forest.

Larger Rodents: Squirrels

Table 27. Summary of determinations for squirrel species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Tamiasciurus hudsonicus grahamensis	Mount Graham red squirrel	E, CH	NE	NLAA
Glaucomys sabrinus coloratus	Carolina northern flying squirrel	E	na	NLAA
Cynomys parvidens	Utah prairie dog	T	na	LAA
Urocitellus bruenneus	Northern Idaho ground squirrel	T	na	LAA
Neotamias minimus atristriatus	Peñasco least chipmunk	PE, PCH	NLAA	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Mount Graham red squirrel – *Tamiasciurus hudsonicus grahamensis*

The Mount Graham red squirrel was listed as endangered on 3 June 1987 (52 FR 20994) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). It occurs only in the Pinaleno Mountains on the Safford Ranger District of the Coronado National Forest, which has high aerial retardant application potential.

The Mount Graham red squirrel is closely associated with mature and old-growth stands of mixed conifer and spruce-fir forests generally above 8000 feet elevation. These squirrels prefer to nest in tree cavities but may also construct leaf nests or use ground burrows. Red squirrels are most active two hours after sunrise and before sunset. Their diet consists of seeds, conifer cones, nuts, and fruits. They occasionally feed on invertebrates and small vertebrates. Mount Graham red squirrels cache conifer cones for food.

Population estimates ranged from 199 to 583 individuals from 1991 to 2006 (USDI Fish and Wildlife Service 2008). Since 1993 habitat losses have occurred. A four-species insect outbreak has eliminated most of the spruce-fir forest in their range. Three wildfires have also reduced the amount of suitable habitat. These include the 1996 Clark Peak Fire that burned approximately 7,400 acres of red squirrel habitat, the 2004 Nuttall-Gibson Complex that burned approximately 9,400 acres of habitat, and the 2017 Frye Fire that burned 48,000 acres, with about 15 percent of the fire burning at high or moderate severity (i.e., stand-altering or stand-replacing). After the 2017 Frye Fire, surveys estimated 35 individuals in 2017, 67 individuals in 2018, and at least 109 individuals in 2020.

Critical habitat was designated and became effective on 5 February 1990 (55 FR 425). The area designated is composed of three large areas covering about 2,000 acres on Mount Graham; they are identified as the Hawk Peak/Mount Graham, Heliograph Peak, and Webb Peak Critical Habitat blocks. Primary constituent elements are not identified in the listing, the listing indicated that the major constituent element of critical habitat is dense stands of mature spruce-fir forest. The listing also indicated that winter survival of the red squirrel depends primarily on the availability of cone seeds stored in middens; therefore, an environment in which the midden-cached cones will stay cool and moist, and be prevented from opening and losing their seeds, is of critical importance.

Dense stands of mature spruce-fir forest can benefit from aerial retardant use; retardant can decrease fire intensity and slow the advance of the fire, thereby allowing firefighters to protect habitat. Because retardant is most effective when applied to the ground vegetation, it is not used in multi-storied mature or old growth stands where retardant would not penetrate the canopy. Therefore, it is unlikely retardant would be directly applied to Mount Graham red squirrel critical habitat (wildlife screen 1). Use of retardant would not alter the cool, moist environment around middens. Because aerially delivered **retardant would not impact the components of Mount Graham red squirrel critical habitat, there will be no effect**.

Aerial application of fire retardant has very low likelihood of direct effects, since this species occupies mature and old growth forests where retardant is generally not used. Mount Graham red squirrel has limited mobility, due to their small size and small home range (wildlife screen 2). It is possible that foraging red squirrels could be disturbed by retardant drops occurring near their habitat, such as on nearby openings or ridges. Although fire season occurs during the nesting season, nests are in tree cavities and it is unlikely nesting squirrels would leave the nest due to noise disturbance (wildlife screen 3).

The ecological risk assessment (Auxilio Management Services 2021) indicated that threatened and endangered omnivores, as represented by deer mice, that reenter an area after firefighting activities have subsided have risk of effects to survival, growth, and reproduction of individuals from ingestion of retardant; this risk was present at all application rates (wildlife screen 4). Deer mice are much smaller and have smaller home ranges than red squirrels, so the risk to squirrels is expected to be less. Because this species occurs in areas with high retardant application potential, we assume there may be negative indirect effects of toxicity caused by eating seeds or vegetation covered with retardant (wildlife screen 4); however, because retardant use is unlikely in red squirrel habitat, any effects from ingestion of retardant are discountable. Aerial applied fire retardant **may affect but is not likely to adversely affect Mount Graham red squirrel**.

The greatest threat to this species is habitat loss due to catastrophic wildfires (NatureServe 2021). The risk to the species and its habitat from wildfire far out weights any benefits from avoiding the use of fire retardant in occupied or designated critical habitat. ***Therefore, avoidance area mapping is not required or recommended for Mount Graham red squirrel populations or critical habitat.***

Carolina northern flying squirrel – *Glaucomys sabrinus coloratus*

The Carolina northern flying squirrel was listed as endangered on 1 July 1985 (50 FR 26999). It was analyzed in the 2017 consultation (USDA Forest Service 2017, USDI Fish and Wildlife Service 2018). This species occurs in high elevation forests in the southern Appalachians, typically in cool, moist mature forests of spruce–fir that have an abundance of standing snags with large cavities. The squirrel's diet consists of insects, nuts, lichens, fungi, birds, seeds, and fruit.

The Carolina northern flying squirrel occurs in North Carolina in isolated localities in 13 counties, including on the National Forests of North Carolina, which have very low aerial retardant application potential. In Tennessee there are six extant occurrences in four counties, including on the Cherokee National Forest, which also has very low retardant application potential. In Virginia it occurs in only three counties, including on the George Washington-Jefferson National Forest, which does not use aerial retardant.

As previously discussed, retardant application is unlikely in mature stands as it is not effective unless is reaches the ground vegetation, but there is still some potential risk from ingestion of retardant (wildlife screen 4). Because there is a very low application potential, the species has moderate distribution and high mobility (wildlife screen 2), and disturbance would not be expected to this nocturnal species (wildlife screen 3), these affects are considered discountable and aerially delivered fire retardant **may affect and is not likely to adversely affect Carolina northern flying squirrel.**

Utah prairie dog – *Cynomys parvidens* and Northern Idaho ground squirrel – *Urocitellus bruenneus*

The Utah prairie dog was added to the United States List of Endangered Native Fish and Wildlife on 4 June 1973 (38 FR 14678) and was reclassified as threatened 29 May 1984 (49 FR 22330). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This species occupies approximately 10 square miles in southern Utah in swale-type formations where grass and forbs are available year-round. There are an estimated 2 dozen subpopulations, with 68 percent of Utah prairie dogs occurring on private and non-federal lands (NatureServe 2021). This species occurs on the Fishlake National Forests, which have high retardant application potential, and the Dixie National Forest, which has low retardant application potential.

Utah prairie dogs live in colonies. Adults emerge from their underground burrow system and begin foraging mid-March to early April. Young are born late April to early May and emerge above ground from late May to early June. Adults enter dormancy from mid-July to mid-August, with juveniles following in early October to mid-November. The Utah prairie dog is an herbivore, feeding on grasses, alfalfa, flowers and seed. Their home ranges are small (3 to 20 acres).

The northern Idaho ground squirrel was listed as threatened on 5 May 2000 and was analyzed in the 2011 consultation (USDA Forest Service 2011b. USDI Fish and Wildlife Service 2011). It occurs in dry meadows surrounded by ponderosa pine and Douglas-fir forests at 3,500 to 7,500 foot elevations. One-third of the total population occurs on the Payette National Forest, which has high retardant application potential. The Boise National Forest contains substantial potential habitat for this species based on habitat modeling, and the Final Recovery Plan for the northern Idaho ground squirrel identifies these areas as important for recovery (USDI Fish and Wildlife Service 2008).

Northern Idaho ground squirrels are active above ground from late March or early April until late July or early August (NatureServe 2021). They hibernate up to eight months a year. This ground squirrel is active during the day, feeding on green vegetation and seeds. The primary threat to the species is meadow invasion by conifer/woody encroachment (NatureServe 2021).

Both the Utah prairie dog and northern Idaho ground squirrel occur on units with high retardant application potential and are active above ground during the fire season. Their fossorial nature minimizes their likelihood of being hit by a retardant drop because they retreat to burrows underground (wildlife screen 2), although this represents a form of disturbance (wildlife screen

3). they will continue to be active above ground after retardant is applied. The ecological risk assessment (Auxilio Management Services 2021) identifies a risk to omnivores, as represented by deer mice, when reentering areas of retardant use after a fire. Deer mice are much smaller and have smaller home ranges than red squirrels, so the risk to squirrels is expected to be less. This risk can be assumed for these species as they are small in size and have limited ranges (wildlife screen 4). Retardant impacts to vegetation used by these species may include fertilization that results in growth of species used for foraging, or growth of other species resulting in changes to species composition and subsequent effects to foraging resources.

Because of the high retardant application potential of the National Forests on which these species occur, their limited distribution, and the potential for ingestion of chemicals on the food source, aerially applied fire retardant **may affect and is likely to adversely affect Utah prairie dog and northern Idaho ground squirrel**.

Avoidance area mapping is recommended for the Utah prairie dog and northern Idaho ground squirrel to minimize the impacts of aerially applied fire retardant. The forests with these populations will determine the avoidance area mapping requirements. This is consistent with the Payette National Forest's Biological Assessment for fire management activities, which includes a ground application buffer for retardant (Richards 2021).

Peñasco least chipmunk – *Neotamias minimus atristriatus*

The Fish and Wildlife Service proposed to list the Peñasco least chipmunk as endangered, and proposed to designate critical habitat on 28 September 2021 (86 FR 53583). This subspecies has extremely limited range and is highly threatened by multiple factors affecting habitat suitability, including recreational activities, grazing, logging, wildfires, and climate change, and potentially by competition with gray-footed chipmunks. This chipmunk is currently known from only three localities, all in the Lincoln National Forest: Lookout Peak, Ice Spring, and Nogal Peak. The Lincoln National Forest has moderate retardant application potential. Habitat at Ice Spring and Lookout Mountain consist of subalpine Thurber's fescue meadow where deciduous shrubs and rocks are present. At Nogal Peak, and formerly occupied sites in the Sacramento Mountains, occupied habitat is upper montane coniferous forest (NatureServe 2021).

Peñasco least chipmunks in the White Mountains likely forage primarily on the seeds and flowers of forbs, such as sunflower (*Helianthus* spp.) seeds along fence lines and on wheat (*Triticum* sp.) and oats (*Avena sativa*) at the edges of agricultural fields in the Sacramento Mountains. The diet also includes flowers and fruits of gooseberry (*Ribes* spp.) and wild strawberry (*Fragaria* spp.), pinyon (*Pinus edulis*) nuts, Gambel oak (*Quercus gambelii*) acorns, insects, and other items. Like other least chipmunks, the Peñasco least chipmunk likely has relatively low water requirements, which may allow it to exploit the drier conditions of open subalpine meadows (NatureServe 2021).

This chipmunk may be active throughout the day but prefers the sunny midday hours. It begins semi-hibernation in late October and is fully active again by mid-March. This species does not build fat reserves prior to hibernation; it wakes during the winter to feed on cached food. Least chipmunk breeding takes place soon after emergence from the hibernation chambers. For Peñasco least chipmunks, young are thought to be born in mid- to late-summer.

The Fish and Wildlife Service determined that the following physical or biological features are essential to the conservation of the Peñasco least chipmunk:

- Areas within the White Mountains:
  - Between elevations of 8,200 to 11,800 feet,
  - That contain rock outcrops or talus, and
  - That are subalpine Thurber's fescue meadow/grassland communities found within openings of spruce-fir forest, above tree line in the glacial cirque, containing tall bunchgrasses, including Thurber's fescue, sedges, flowering forbs, and shrubs.
- Forage, including species of Asteraceae, flowers and fruits of gooseberry *(Ribes* spp), wild strawberry (*Fragaria* spp.), pinyon (*Pinus edulis*) nuts, Gambel oak (*Quercus gambelii*) acorns, and insects.

Retardant impacts to vegetation may include fertilization of meadow grassland communities, resulting in growth of species used for foraging, changes to species composition in the affected area, and growth of or increased presence of invasive non-native plant species that may be present in the area (wildlife screen 1). Retardant is unlikely to be used in subalpine habitats used by this species. Although aerial application of fire retardant has the potential to impact vegetation, beneficial impacts may also occur through fertilization of forage species or protection of areas from impacts of fire.

This species is small and occurs only in limited, localized areas (wildlife screen 2). Individuals tend to be active during the time of day when retardant applications may occur, but it is likely able to move to shelter in vegetation or other habitat features and minimize potential disturbance effects (wildlife screen 3).

The ecological risk assessment (Auxilio Management Services 2021) indicated that threatened and endangered omnivores, as represented by deer mice, that reenter an area after firefighting activities have subsided have risk of effects to survival, growth, and reproduction of individuals from ingestion of retardant; this risk was present at all application rates (wildlife screen 4). Deer mice are smaller and have smaller home ranges than chipmunks, so the risk to chipmunks is expected to be less. This species occurs in areas with moderate retardant application potential, but retardant is unlikely to be used in subalpine habitats used by this species. There may be negative indirect effects of toxicity caused by eating seeds or vegetation covered with retardant (wildlife screen 4); however, any effects from ingestion of retardant are discountable.

Aerially applied fire retardant **is not likely to adversely affect Peñasco least chipmunk or its critical habitat.** If this species becomes listed, aerially applied retardant may affect but is not likely to adversely the species or its designated critical habitat***. Avoidance areas are not recommended because of the threat wildfire has on this species habitat***.

Bat species

Table 28. Summary of determinations for bat species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Myotis septentrionalis	Northern long-eared bat	T	na	NLAA
Leptonycteris nivalis	Mexican long-nosed bat	E	na	NLAA
Corynorthinus towsendii ingens	Ozark big-eared bat	E	na	NLAA

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Corynorhinus townsendii virginianus	Virginia big-eared bat	E, CH	NE	NLAA
Myotis grisescens	Gray bat	E	na	NLAA
Myotis sodalis	Indiana bat	E, CH	NE	NLAA

[2] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Avoidance area mapping is not commonly used for bat species, but avoidance area mapping of occupied roost and hibernacula sites may be done if determined necessary by local units.

For the analyses of all bat species, the following assumptions were used:

- Direct effects are not expected to occur from aerial retardant application because bat species are highly mobile and able to avoid or flee areas where wildland fires and firefighting activity are occurring. Bats remaining in areas where application occurs are likely to be protected inside trees, snags, under bark, or within structure or caves.
- Bats roosting in caves or under bark or inside trees or snags are unlikely to be disturbed by flights associated with aerial retardant application

Northern long-eared bat – *Myotis septentrionalis*

The northern long-eared bat was listed as threatened on 2 April 2015 (80 FR 17973). It was analyzed as a Forest Service sensitive species in the Biological Evaluation (USDA Forest Service 2011e) and under the 2017 Supplemental Biological Assessment for wide-ranging newly listed species (USDA Forest Service 2017, USDI Fish and Wildlife Service 2018). The Fish and Wildlife Service determined that critical habitat designation was not prudent (81 FR 24707).

During summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. The northern long-eared bat spends winter hibernating in caves and mines, called hibernacula. They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. This species does not form large colonies.

The northern long-eared bat is found in Forest Service Regions 1, 2, 8 and 9. Occupied forests with no retardant use include the Daniel Boone, Francis Marion and Sumter, Kisatchie, George Washington and Jefferson, Ouachita, Ozark, Allegheny, Chequamegon-Nicolet, Green Mountain and Finger Lakes, Hiawatha, Hoosier, Huron-Manistee, Monongahela, Midewin, Ottawa, Shawnee, Wayne and White Mountain National Forests, National Forests in Alabama, National Forests in Mississippi, and Land Between the Lakes National Recreation Area. Occupied forests with very low retardant application potential include the Black Hills, Nebraska, Samuel R. McKelvie, Chatahoochee-Oconee, Chippewa, Mark Twain, and Superior National Forests, National Forests in North Carolina, and the Dakota Prairie Grasslands. It is also found on the Custer-Gallatin National Forest, which has low retardant application potential and the Medicine Bow-Routt National Forest, which has moderate application potential.

The northern long-eared bat is highly mobile and wide ranging. There is potential for retardant use on one-third of the forests where the species occurs. Because northern long-eared bats are active primarily one to two hours after sunset and again seven to eight hours after sunset (NatureServe 2021), they would not be active when retardant drops occur. Nursery colonies and day roosting occurs in cavities beneath loose bark in trees or snags. Because a low, fast retardant drop has the ability to break the tops off trees or knock weak snags over, there is a very limited chance of a retardant drop causing physical damage to roost or colony trees. The low and very low retardant potential on most units where the species occurs greatly reduces the possibility of damage occurring to occupied trees (wildlife screen 2).

Disturbance to roosting bats and maternity colonies is possible if drops occur near occupied sites. Because of the low levels of use on most occupied forests the probability of this occurring is low. Disturbance during the summer period is less likely to have negative impact than disturbance occurring during hibernation. Although retardant use can occur during the hibernation period in Regions 8 and 9, aircraft use would not result in disturbance to bats in caves (wildlife screen 3).

Aerial retardant can impact availability of prey in very localized areas of retardant drops by killing insects occurring in the drop area. Bats may also ingest retardant found on insects, which may result in a risk to this species (Auxilio Management Services 2021). Because of the limited retardant use across the species range, the large area available to forage in relation to the small area impacted by retardant drops each year, and avoidance areas around water bodies where much of bat foraging occurs, the effects are expected to be discountable (wildlife screen 4).

Although aerial retardant can impact the northern long-eared bat and its forest habitat, the expected impacts are limited in scale and discountable. Therefore, aerially delivered fire retardant **may affect and is not likely to adversely affect northern log-eared bat**.

On the Black Hills National Forest (Region 2), this species uses some caves and mines with vertical openings. A retardant drop at the surface of these vertical openings could be washed by rain into the mine. This can affect the water quality within the mine, possibly affecting northern long-eared bat habitat (McDonald 2015). In these situations, the local unit may choose to include these vertical mine shafts in avoidance areas.

Mexican long-nosed bat – *Leptonycteris nivalis*

The Mexican long-nosed bat was listed as endangered on 30 September 1988 (53 FR 38456). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Critical habitat is not designated for the Mexican long-nosed bat.

This species uses caves and mines for roost sites and eats nectar and pollen from agave and cacti flowers. It occurs in mid- to high-elevation (1,500 to 9,300 feet) in desert scrub, open conifer-oak woodland, and pine forest. It has been recorded in the United States from June to August, on the Coronado National Forest in New Mexico, which has high retardant application potential. The majority (80 percent) of acres burned on the Coronado National Forest occur in May and June (USDA Forest Service 2020d), therefore Mexican long-nosed bat can occur on the Coronado during fire season.

This species is nocturnal, with nighttime emergence occurring relatively late in the evening. Because the species occurs in caves during the day when retardant is dropped it would avoid direct contact with retardant drops (wildlife screen 2). Aircraft are not expected to disturb bats when they are in caves (wildlife screen 3). The fertilizing properties of retardant can impact the cactus food of Mexican long-nosed bat. In limited amounts fertilizer can increase the growth of cacti. Too much fertilizer can lead to slow development, or poor root growth or root rot (wildlife screen 4). Although these effects can reduce the foraging opportunities for this species, retardant impacts less than 500 acres on average each year on the Coronado, or less than 0.03 percent of the land base. Based on the foraging distances for this species, the potential effects are discountable. Aerial retardant application **may affect but is not likely to adversely affect Mexican long-nosed bat**.

Ozark big-eared bat – *Corynorhinus townsendii ingens*

The Ozark big-eared bat was listed as endangered effective 31 December 1979 and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The Ozark big-eared bat is a cave obligate species that requires limestone and sandstone talus caves surrounded by oak-hickory hardwood forest (NatureServe 2021). It occurs on the Ozark National Forest, which has no retardant use, and on the Mark Twain National Forest, Cassville Unit (USDI Fish and Wildlife Service Information for Planning and Consultation accessed September 21, 2021), which has very low retardant application potential. Critical habitat is not designated for the Ozark big-eared bat.

This species has high site fidelity and moves among caves both during the maternity period and during the hibernating period. This species mates in fall with fertilization occurring in spring when hibernation ends. A single young is born in June and weaned within 6 weeks. Adults feed almost exclusively on moths.

As previously described for other bat species, this cave dwelling, nocturnal species is not expected to have direct contact with retardant (wildlife screen 2) or be disturbed by retardant use (wildlife screen 3). As described for the northern long-eared bat, retardant use may reduce the moth prey in localized areas on the Mark Twain. Because retardant application potential is very low on the Mark Twain, and no retardant is used on the Ozark, these effects are discountable. Aerially applied retardant **may affect but is not likely to adversely affect Ozark big-eared bat**.

Virginia big-eared bat – *Corynorhinus townsendii virginianus*

The Virginia big-eared bat was listed as endangered effective 31 December 1979 (44 FR 69206), along with critical habitat. It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011).

This species occurs in caves in limestone karst regions dominated by mature hardwood forests of hickory, beech, maple and hemlock.

This species occurs on the Daniel Boone, George Washington and Jefferson, and Monongahela National Forests that do not use aerially applied retardant. It is also found on the Cherokee National Forest and National Forests in North Carolina that have very low retardant application potential. Males and females hibernate together.

Females form nursery colonies after hibernation, while males roost separately. A single pup is born in May or June. Young are on their own within 2 months; at the end of July/early August. Activity for this species begins well into the night. It principally feeds on moths. Forest insects are a substantial part of the diet. Individuals can travel up to 3.5 miles to a foraging area. Outbuildings and bridges are sometimes used as night roosts between bouts of feeding.

Critical habitat includes five caves on the Monongahela National Forest with no retardant use. Because there is no retardant use there will be **no effect to Virginia big-eared bat critical habitat**.

Effects to Virginia big-eared bat are the same as those described for Ozark bat. Aerially applied fire retardant **may affect but is not likely to adversely affect Virginia big-eared bat.**

Gray bat – *Myotis grisescens*

The gray bat was listed as endangered on 28 April 1976 and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). No critical habitat has been designated. This species occurs in caves in 14 states in the southeast and Midwest (Forest Service Regions 8 and 9). Gray bats feed mostly on flying insects over water. Individuals may travel up to 21 miles between prime feeding areas over lakes or rivers and occupied sites (NatureServe 2021). The population is estimated at over a million individuals, 95 percent of which hibernates in only 8 to 9 caves, with over half hibernating in one cave.

Gray bats occur on most forests in Forest Service Regions 8 and 9 This includes the Daniel Boone, George Washington and Jefferson, Ozark, Hoosier, and Shawnee National Forests, National Forests in Alabama, and Land Between the Lakes National Recreation Area, all of which have no retardant use. It is also found on the Chattahoochee-Oconee, Cherokee, and Mark Twain National Forests, National Forests in Florida, and National Forests in North Carolina, all of which have very low retardant application potential.

Effects to gray bat are the same as those described for Ozark and Virginia big-eared bat. Because retardant is not used or has very low application potential on the forests where this species occurs, aerially applied fire retardant **may affect but is not likely to adversely affect gray bat.**

Indiana bat – *Myotis sodalis*

The Indiana bat was listed as endangered under the Endangered Species Preservation Act on 24 February 1967 (32 FR 4001) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The Indiana bat is an insectivorous, migratory bat of temperate areas, that hibernates colonially in caves and mines in the winter. In spring, reproductive females migrate to maternity sites behind loose bark of dead or dying trees or in tree cavities. Summer habitat consists of wooded or semi-wooded areas, often near streams. Maternity colonies are much smaller than colonies in winter hibernacula and the occupied summer area is much larger.

Males and non-reproductive females typically do not roost in colonies and may stay close to their hibernaculum or migrate to summer habitat. Summer roosts are typically behind exfoliating bark of large, often dead, trees. Both males and females return to hibernacula in late summer or early fall to mate and enter hibernation.

Indiana bat is found on many forests in Forest Service Regions 8 and 9. Forests with no retardant use include the Daniel Boone, George Washington and Jefferson, Ouachita, Ozark, Green

Mountain and Finger Lakes, Hoosier, Huron-Manistee, Monongahela, Shawnee, and Wayne National Forests, National Forests in Alabama (Talladega and William B. Bankhead National Forests), National Forests in Mississippi (Holly Springs National Forest), and Land Between the Lakes National Recreation Area. Forests with very low retardant application potential include the Chattahoochee, Cherokee, and Mark Twain National Forests and National Forests in North Carolina (Pisgah and Nantahala National Forests).

Critical for the Indiana bat was designated 24 September 1976 (41 FR 41914) with a final correction published 22 September 1977 (42 FR 47840). Thirteen hibernacula, consisting of 11 caves and 2 mines, were designated. Primary constituent elements were not identified. Indiana bat designated critical habitat is found on the George Washington, Cherokee, Hoosier, Monongahela, Wayne, and Mark Twain National Forests and the National Forests in North Carolina (Pisgah and Nantahala National Forests). The Cherokee, Pisgah, Nantahala, and Mark Twain National Forests all have very low retardant application potential.

Indiana bats hibernate for approximately 6 months; arriving at the hibernacula from late August to early September and exiting the hibernacula from late March to early April. The fire season in Regions 8 and 9 is bimodal, with peaks from March to May and again from October to November. Retardant use can occur when bats are in the winter hibernacula. Threats to hibernacula include disturbance or vandalism, quarrying or mining, and changes in temperature and humidity. Aerially applied retardant will not alter temperature or humidity in the caves or contribute to the other threats to hibernacula. **Aerial retardant would not affect Indiana bat designated critical habitat**.

Effects to Indiana bat are the same as those described to northern long-eared bat. Because retardant is not used or has very low application potential on the forests where this species occurs, aerially applied fire retardant **may affect but is not likely to adversely affect Indiana bat**.

Carnivores

This section describes the characteristics and affected environment for each Carnivore species considered, as well as descriptions of and effects and determinations for critical habitat where that has been designated. The analysis of effects and determinations for each species considered is found in a separate section that is placed after all of the species descriptions.

Table 29. Summary of determinations for Carnivore species

Scientific Name	Common Name	Status	Critical Habitat Determination	Species Determination
Panthera onca	Jaguar	E, CH	NE	NLAA
Leoparadus paradalis	Ocelot	E	na	NLAA
Vulpes macrotis mutica	San Joaquin kit fox	E	na	NLAA
Martes caurina	Pacific marten (coastal distinct population segment)	T	na	NLAA
Mustela nigripes	Black-footed ferret	E	na	NLAA

Scientific Name	Common Name	Status	Critical Habitat Determination	Species Determination
Vulpes vulpes necator	Sierra Nevada red fox	E	na	NLAA
Pekania pennanti	Fisher – west coast distinct population segment	E	na	NLAA
Lynx canadensis	Canada lynx	T, CH	NE	NLAA
Ursus arctos horribilis	Grizzly Bear (Lower 48 states)	T	na	NLAA
Canis lupus baileyi	Mexican wolf	E, XN	na	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Jaguar – *Panthera onca*

The Jaguar was listed as endangered on 22 July 1997. Effects to the species were analyzed in the 2011 consultation (USDA Forest Service 2011b, USDA Forest Service 2011). This species' range extends from the southwestern United States to northern Argentina. At the northern extreme of its range habitat consists of chaparral and timbered areas. Jaguars are active throughout the year, hunting primarily at night although they may be active day or night (NatureServe 2021). Jaguar feed opportunistically on small and large mammals, reptiles and ground-nesting birds. They are known to feed on peccaries, capybaras, tapirs, agoutis, deer, small crocodilians, and turtles. They hunt mostly on the ground (NatureServe 2021).

The jaguar occurs in Forest Service Region 3 on the Coronado National Forest, which has high arial retardant application potential.

Critical habitat for the jaguar was designated 5 March 2014 (79 FR 12571) and was revised by court order 22 July 2021 (86 FR 38570). The primary constituent element specific to jaguars is expansive open spaces (at least 38.6 square miles) in the southwestern United States, which:

- provide connectivity to Mexico;
- contain adequate levels of native prey species, including deer and javelina, as well as medium-sized prey such as coatis, skunks, raccoons, or jackrabbits;
- include surface water sources available within 12.4 miles of each other;
- contain greater than 1 to 50 percent canopy cover of trees and ground vegetation;
- are characterized by intermediately, moderately, or highly rugged terrain;
- are below 6,562 feet in elevation; and
- are characterized by minimal to no human population density, no major roads, or no stable nighttime lighting over any 0.4 square mile area.

Aerial retardant application will not alter the expansive open spaces, or the components of those open spaces identified as the jaguar primary constituent element. Therefore, there will be **no effects to jaguar critical habitat from aerially applied fire retardant**.

Ocelot – *Leoparadus paradalis*

The ocelot was listed as endangered on 21 July 1982 (47 FR 31670) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011. Critical habitat has not been designated for this species. The ocelot is widely distributed from Texas to South America. In the United States, the ocelot is currently found regularly only in Southern Texas. Ocelots may be found in Arizona on the Coronado National Forest, based on a few old records (NatureServe 2021).

Primary habitat is areas with good cover. In Texas this species inhabits dense chaparral thickets. Brushland and riverine scrub in deserts is available on the Coronado National Forest, which has high retardant application potential.

The ocelot is mainly terrestrial, but climbs, jumps, and swims well. Dens are in caves, hollow trees, thickets, or the spaces between the closed buttress roots of large trees; ocelots may sometimes sleep on tree branches. In Texas this species breeds in late summer, with births occurring in the fall and winter. The home range in Texas is approximately 500 acres.

Ocelots are primarily nocturnal, although they can be active at dawn and dusk, or during the day. This carnivore feeds on small to moderate-sized vertebrates including rodents, rabbits, other small mammals, young deer and peccaries, birds, snakes, lizards, and fishes. It hunts and captures prey on the ground (NatureServe 2021).

San Joaquin kit fox – *Vulpes macrotis mutica*

The San Joaquin kit fox was listed as endangered on 11 March 1967 under the Endangered Species Preservation Act (32 FR 4001). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Critical habitat has not been designated for this species. Habitat includes alkali sinks, valley grassland, and woodland, in valleys and adjacent gentle foothills. These foxes hunt in areas with low sparse vegetation that allows good visibility and mobility. Their primary food item is the most abundant rodent, usually kangaroo rats, mice or ground squirrels. Multiple underground dens in dry soils are used throughout the year (NatureServe 2021). Young are born in an underground den that usually have multiple entrances. Most activity for this species is nocturnal, although young may be found playing outside the den mouth in the afternoon. Adult home ranges averaged between 988 and 5,782 acres.

The San Joaquin kit fox occurs in California. It is found on National Forest System lands on the Sequoia National Forest, which has high retardant application potential

Pacific marten (Coastal Distinct Population Segment)– *Martes caurina*

The Fish and Wildlife Service listed the coastal distinct population segment of Pacific marten as a threatened species, effective on 9 November 2020 85 FR 63806). Critical habitat has not been designated for this species.

In northwestern California, martens favor old-growth, conifer-dominated forests with dense shrub cover in large, contiguous patches. In general, the species usually occurs in dense deciduous, mixed, or especially coniferous upland and lowland forest. When inactive they occupy holes in live or dead trees or stumps, abandoned squirrel nests, rock piles, burrows or snow cavities. The species is active year-round, using under the snow areas in winter associated with abundant coarse woody debris.

Marten are solitary by nature. The home range sizes are variable and usually average less than 3.9 square miles. Young may disperse up to 25 miles or more. Daily activity peaks at dusk or dawn, although foraging activity may occur at times of day when prey species are active.

The coastal distinct population segment of marten occurs in Forest Service Region 6 on the Siuslaw National Forest, which does not use retardant, and on the Rogue River-Siskiyou National Forest, which has a high retardant application potential. In Forest Service Region 5 it is located on the Six Rivers National Forest, which has high retardant potential. It is suspected on the Klamath, Shasta-Trinity, and Mendocino National Forests, which have high retardant application potential

Black-footed ferret – *Mustela nigripes*

Black-footed ferret was listed as endangered on 11 March 11, 1967 under the Endangered Species Preservation Act (32 FR 4001). This species is endangered throughout its range, except in certain areas of Wyoming, Montana, South Dakota, Arizona, Colorado, and Utah, where some populations are listed as nonessential experimental. Black-footed ferret was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This species is limited to open habitat used by prairie dogs, which includes grasslands, steppe, and shrub steppe. Resting and birthing sites are found in underground burrows generally made by prairie dogs. The species is secretive, rarely seen except at night (NatureServe 2021).

The black footed ferret occurs on the Dakota Prairie National Grasslands and Nebraska and Samuel R. McKelvie National Forests, which have very low retardant application potential; and on the Medicine Bow-Routt National Forest/Thunder Basin National Grasslands and the Pike-San Isabel National Forest, which have moderate retardant application potential. The Bridger-Teton and Wasatch-Cache National Forests, which have high retardant application potential, consider potential offsite (downstream) impacts to black-footed ferret populations.

Sierra Nevada red fox (Sierra Nevada Distinct Population Segment) – *Vulpes vulpes necator*

The Sierra Nevada red fox distinct population segment was listed as endangered 3 August 2021 (86 FR 41743). Critical habitat has not been designated for this species. This distinct population segment occurs along the highest elevations of the Sierra Nevada mountain range in California, from 8100 to 11,608 feet. This fox occurs in various habitats (forest openings, meadows, and barren rocky areas) in alpine and subalpine zones. Preferred habitat in California appears to be red fir and lodgepole pine forests and alpine fell-fields (NatureServe 2021).

The Sierra Nevada red fox occurs on the Humboldt-Toiyabe, Inyo, and Stanislaus National Forests, which have high retardant application potential.

Fisher (southern Sierra Nevada Distinct Population segment) – *Pekania pennanti*

The southern Sierra Nevada distinct population segment of fisher was listed as endangered effective 15 June 2020 (85 FR 29532). Critical habitat has not been designated for this species. Habitat in the Sierra Nevada consists of forest stands with late successional characteristics including high canopy closure, large trees and snags, large woody debris, large hardwoods, and multiple canopies. Late successional forests provide abundant potential den sites and the preferred prey species (NatureServe 2021). Fisher are also associated with riparian areas that provide the forest structure fishers prefer.

Fishers are active night and day. During the summer they are mainly nocturnal, or active at dawn and dusk. During winter they are more diurnal. This carnivore's diet consists primarily of mammals, including small rodents, shrews, squirrels, hares, muskrats, beaver, porcupine, raccoon and deer carrion. The also eat birds and fruit.

The southern Sierra Nevada distinct population segment of fisher occurs on the Sierra, Sequoia, and Stanislaus National Forests, all of which have high aerial retardant application potential.

Canada lynx – *Lynx canadensis*

The Canada lynx was listed as threatened on 24 March 2000 (65 FR 16053) and was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011) In 2017 additional analysis was completed for new occurrences in Forest Service Region 3 (USDA Forest Service 2017, USDA Fish and Wildlife Service 2018). Lynx generally occur in boreal and montane regions dominated by coniferous or mixed forest with thick undergrowth, but also sometimes enter open forest, rocky areas, and tundra to forage for abundant prey. When inactive or birthing, Canada lynx occupy dens typically in hollow trees, under stumps, or in thick brush. Den sites tend to be in mature or old growth stands with a high density of logs.

Canada lynx occur in six Forest Service regions on 37 National Forests. This species occurs on the following forests, organized by retardant application potential:

- No retardant use - Hiawatha, White Mountain, and Mount Baker National Forests, with no retardant use.
- Very low retardant application potential - Flathead, Bighorn, Grand Mesa Uncompahgre Gunnison, Rio Grande, Carson, Ashley, Targhee, Chippewa, and Superior National Forests
- Low retardant application forests with lynx include the Custer-Gallatin, Arapahoe-Roosevelt, and Colville National Forests.
- Moderate retardant application potential - Beaverhead-Deerlodge, Bitterroot, Helena-Lewis and Clark, Idaho-Panhandle, Kootenai, Medicine Bow-Routt, Pike-San Isabel, San Juan, Shoshone, White River, Santa Fe, Sawtooth, and Umatilla National Forests.
- High retardant application potential - Lolo, Nez Perce-Clearwater, Boise, Bridger-Teton, Payette, Uinta-Wasatch-Cache, Malheur, Okanogan-Wenatchee, and Wallowa-Whitman National Forests.

A revised designated critical habitat rule was published on 12 September 2014 (79 FR 54781).

Designated critical habitat occurs in Forest Service Region 1 on the Flathead, Kootenai, Lolo, Custer-Gallatin and Helena-Lewis and Clark National Forests; in Forest Service Region 2 on the Shoshone National Forest; in Region 4 on Bridger Teton National Forest; in Region 6 on the Okanogan-Wenatchee and Mount Baker National Forests: and in Region 9 on the Superior National Forest. The primary constituent element specific to lynx in the contiguous United States is boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

- Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface;
- Winter conditions that provide and maintain deep fluffy snow for extended periods of time;
- Sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and
- Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

Aerially delivered fire retardant would not alter the components of the primary constituent element (wildlife screen 1) and therefore would have **no effect on Canada lynx designated critical habitat**. ***Avoidance Area Mapping is not required or recommended for lynx critical habitat.***

Grizzly bear – *Ursus arctos horribilis*

The grizzly bear was listed as threatened in the 48 conterminous States 28 July 1975 (40 FR 31734). The Fish and Wildlife Service established a nonessential experimental population area in the Bitterroot Mountains of Idaho and Montana (17 November 2000 65 FR 69624). No bears have been introduced, and in January 2020 the Fish and Wildlife Service clarified that bears moving into this area naturally are considered part of the threatened population (NatureServe 2021). Grizzly bears were analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). The Greater Yellowstone Ecosystem Distinct Population Segment (Wyoming and Montana) has recovered; it was delisted in 2007 and again in 2017, but on both occasions court rulings have subsequently re-listed the population.

Grizzly bears are large, long-lived, solitary mammals that were distributed historically throughout most of the western United States, southward into northern Mexico, and northward throughout western Canada. Currently, they occur in a variety of habitat types in portions of Idaho, Montana, Washington, and Wyoming. They are opportunistic and feed on a wide variety of foods. Grizzly bears hibernate in winter, typically in excavated dens on steep, north-facing slopes where snow accumulates (NatureServe 2021). They require large, intact blocks of land in which to breed, forage, shelter, den, and disperse, (USDI Fish and Wildlife Service 2021), and in which to find seclusion from humans. The grizzly bear ranges widely at the landscape level, and may be found in a wide variety of habitat types, including open prairie, brushlands, riparian woodlands, and, historically, semidesert scrub.

Critical habitat for the grizzly bear in the lower 48 states was proposed in 1976 (41 FR 48757), but was never finalized or withdrawn. The Fish and Wildlife Service Information for Planning and Consultation (iPaC) system does not identify proposed critical habitat in any ecosystem. Critical habitat is therefore not analyzed here.

Six recovery ecosystems have been identified for grizzly bears in the lower 48 states, although not all of them are currently occupied. Occupied areas include the Northern Continental Divide Ecosystem in Montana; the Greater Yellowstone Ecosystem in Montana, Wyoming and Idaho; the Cabinet-Yaak Ecosystem in Montana and Idaho; and the Selkirk Mountains Ecosystem in

Idaho, Washington and Canada. The currently unoccupied areas are the North Cascades Ecosystem in Washington, and the Bitterroot Ecosystem in Montana and Idaho (USDI Fish and Wildlife Service 2021). The grizzly bear is analyzed on the following National Forests in Forest Service Region 1, organized by retardant application potential:

- No retardant use – Mount Baker-Snoqualmie National Forest
- Very low retardant application potential – Flathead, and Targhee National Forests
- Low retardant application potential - Custer-Gallatin, Colville, and Gifford Pinchot National Forests
- Moderate retardant application potential - Beaverhead-Deerlodge, Bitterroot, Helena-Lewis and Clark, Idaho Panhandle, Kootenai, and Shoshone National Forests
- High retardant application potential – Lolo, Nez Perce-Clearwater, Bridger-Teton, Okanagan-Wenatchee, National Forests.

The Bitterroot non-essential experimental population area is much larger than the Bitterroot recovery ecosystem, and includes portions of the Boise, Salmon-Challis, Payette, Bitterroot, Nez-Perce Clearwater, Idaho Panhandle, and Lolo National Forests. This analysis addresses only the established recovery areas or areas known to be occupied by grizzly bears.

Mexican wolf – *Canis lupus baileyi*

The Mexican wolf was listed as endangered on 21 April 1975 (40 FR 17590). In 2015, the Fish and Wildlife Service finalized endangered status for the Mexican wolf based on its status as a subspecies, effective on 17 February 2015 (80 FR 2488). The endangered population occurs on the Apache National Forest, which has low retardant application potential, and on the Gila National Forest, which has moderate retardant application potential. Critical habitat has not been designated for this species.

In 1998 the Fish and Wildlife Service established a nonessential experimental population of the Mexican Wolf in Arizona and New Mexico (63 FR 1752). In 2015 revisions to the regulations for the nonessential experimental population were published (80 FR 2512).The nonessential experimental population includes 3 zones; Zone 1 where wolves may initially be released or translocated, Zone 2 where initial releases of Mexican wolves limited to pups less than five months old and translocated females with pups born in captivity, and Zone 3 where neither initial releases nor translocations will occur, but wolves are allowed to disperse and will be more actively managed. The nonessential experimental population occurs across the southern portions of Arizona and New Mexico except where the endangered population occurs. This nonessential experimental population area includes the Kaibab National Forest, which has very low retardant application potential, the Sitgreaves National Forest, which has low retardant application potential, the Cibola, Coconino, and Lincoln National Forests, which have moderate application potential, and the Coronado, Prescott, and Tonto National Forests, which have high retardant application potential.

This species is not limited to a particular habitat type. Viable populations occur only where the human population density and human-caused mortalities are low and prey densities are high. Elk are the predominant prey in Arizona and New Mexico, with deer, rabbits, rodents and carrion as alternate prey items. Young are born in a den in March to early April. The parents and young leave the den when the pups are about 3 months old. Mexican wolves are mainly nocturnal, and have home ranges of approximately 100 square miles (NatureServe 2021).

Effects Analysis and Determinations for Carnivore Species

The carnivore species considered here all occur on units where retardant is used. Because the species are highly mobile with large home ranges, they can escape from areas with fire activities; they are able to avoid direct retardant application and areas where retardant is applied within their home ranges (wildlife screen 2). Each of the species occurs on forests with moderate to high retardant use, so there is a potential for disturbance from aerially delivered retardant to be long-term, lasting several days (wildlife screen 3). Except for the grizzly bear, these species are primarily nocturnal or crepuscular during the summer; grizzly bears can be active at any time of day, although they tend to be more crepuscular/nocturnal when temperatures are high. Since retardant is not delivered during nighttime hours, the potential for disturbance is minimal for most carnivore species. Although the fire season overlaps the birthing and rearing periods for all these species, they all use dens for those activities, minimizing the potential for disturbance effects. Many of the species are known to move young between dens if disturbed.

The ecological risk assessment (Auxilio Management Services 2021) identified that threatened and endangered species, represented by deer mice (omnivores), American kestrel (birds of prey), and red-winged blackbirds (songbirds) that re-enter an area after firefighting activities have subsided have a risk of effects to survival, growth, and reproduction of individuals from ingestion of retardant. This risk was present at all application rates. Risks were not identified for rabbit (small herbivore), deer (large herbivore), coyote (carnivore), cow (ruminant) or bobwhite quail (ground nester). Because the two omnivore species considered here (Sierra Nevada red fox and grizzly bear) are bigger and have much larger home ranges than deer mice, and therefore a smaller percentage of their home range would be impacted, no risks are anticipated. Retardant could result in changes to food resources for ocelot, kit fox, marten, red fox, fisher, and grizzly bear by potentially reducing availability of small rodent or plant resources in very localized areas. Because this would impact a small percentage of the home range of each species the effect would be discountable. Therefore, are no anticipated risks related to ingestion of retardant for the carnivore species considered here (wildlife screen 4).

Use of retardant can have beneficial effects by helping to control wildfires and limiting loss of habitat. This is particularly important for marten, fisher and lynx, which rely on late successional habitats that would take many generations to re-establish after a wildfire. ***Because of the large home ranges for these species, avoidance area mapping is not recommended***.

Based on the above discussion, aerially applied retardant **may affect but is not likely to adversely affect jaguar, ocelot, San Joaquin kit fox, Pacific marten (Coastal Distinct Population Segment), black-footed ferret, Sierra Nevada red fox (Sierra Nevada Distinct Population Segment), fisher (Southern Sierra Nevada Distinct Population Segment), Canada lynx, grizzly bear, and Mexican wolf**.

Ungulates

This section describes the characteristics and affected environment for each Ungulate species considered, as well as descriptions of and effects and determinations for critical habitat where that has been designated. The analysis of effects and determinations for each species considered is found in a separate section that is placed after all of the species descriptions.

Table 30. Summary of determinations for ungulate species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Ovis canadensis nelsoni	Peninsular bighorn sheep	E, (CH)	n/a	NLAA
Ovis canadensis sierra	Sierra Nevada bighorn sheep	E, CH	NE	NLAA
Rangifer tarandus caribou	Woodland caribou	E, CH	NE	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Peninsular bighorn sheep – *Ovis canadensis nelsoni* (Population 2)

The Peninsular bighorn sheep was listed as endangered on 18 March 1998. It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). These sheep are found on the steep east-facing lower elevations of the Peninsular Range along the northwestern edge of the Sonoran Desert in California in Imperial, San Diego, and Riverside counties. This species needs steep open topography for lambing/rearing sites and open habitat for predator avoidance. This species occurs only on the San Bernardino National Forest, which has high aerial retardant application potential. The San Bernardino National Forest contains essential habitat for rearing and winter use. Critical habitat was designated in 2009 (74 FR 17288), but none of it occurs on National Forest System lands; therefore, it is not analyzed.

Sierra Nevada bighorn sheep – *Ovis canadensis sierrae*

The Sierra Nevada bighorn sheep was emergency listed as endangered on 20 April 1999 (64 FR 19300) and a final rule was published 3 January 2000 (65 FR 2030). The species was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This species inhabits the eastern portion of the southern Sierra Nevada Range. Habitat for the Sierra Nevada bighorn sheep ranges from alpine on the Sierra Nevada crest down to Great Basin sagebrush scrub. It inhabits open areas that are rocky, sparsely vegetated, and characterized by steep slopes and canyons (NatureServe 2021). This species occurs in Fresno, Inyo, and Mono Counties of California.

Sierra Nevada bighorn sheep occur on the Inyo, Sequoia, and Sierra National Forests in Forest Service Region 5 and on the Humboldt-Toiyabe National Forest in Forest Service Region 4; all these forests have high retardant application potential. Sierra Nevada bighorn sheep were historically located on the Stanislaus National Forest as well.

Critical habitat was designated on 5 August 2008; (73 FR 45534). It includes National Forest lands on the Humboldt-Toiyabe National Forest (Unit 1), Inyo National Forest (Units 2, 3, 4, 5, 6, 7, 8, and 12), Sierra National Forest (Units 3 and 4), and Sequoia National Forest (Unit 11). The primary constituent elements of critical habitat for the Sierra Nevada bighorn sheep are:

- Non-forested habitats or forest openings within the Sierra Nevada Range, from 4,000 feet to 14,500 feet in elevation with steep (greater than or equal to 60 percent slope), rocky slopes that provide for foraging, mating, lambing, predator avoidance, and bedding and that allow for seasonal elevational movements between these areas.

- Presence of a variety of forage plants as indicated by the presence of grasses and browse in winter, and grasses, browse, sedges and forbs in summer.
- Presence of granite outcroppings containing minerals such as sodium, calcium, iron, and phosphorus that could be used as mineral licks in order to meet nutritional needs.

Critical habitat occurs in areas that are open, steep and high elevation areas where retardant use is unlikely. Although retardant can have impacts to vegetation as described elsewhere in this document, effects to the primary constituent elements for this species are unlikely because of the low probability of retardant use in those areas (wildlife screen 1). Therefore, aerially applied retardant would have **no effect on Sierra Nevada bighorn sheep critical habitat**.

Woodland caribou – *Rangifer tarandus caribou*

On 14 January 1983, the Fish and Wildlife Service published an emergency rule listing the population of woodland caribou (also referred to as the southern Selkirk Mountain herd) in Washington and Idaho, as endangered (48 FR 1722). A final rule was published 29 February 1984 (49 FR 7390). In 2019 the Fish and Wildlife Service published a final rule designating the southern mountain caribou distinct population segment of woodland caribou (2 October 2019, 84 FR 52598) as endangered. This determination amended the current listing of the southern Selkirk Mountains population of woodland caribou by defining the southern mountain caribou distinct population segment. The southern mountain caribou distinct population segment includes 17 subpopulations, including the currently listed southern Selkirk Mountains population. Woodland caribou was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011).

Caribou in this population (referred to as southern mountain caribou) use steep, high-elevation (typically over 4,000 feet elevation), mountainous habitats with deep snowfall, and substantial arboreal (tree) lichens. This distinct population segment stays within the same general latitude year-round, making as many as four altitudinal migrations per year. They winter at high elevations, and move to lower elevations where snow has melted to forage on new green vegetation. During the calving season (June through July), the need to avoid predators influences habitat selection. Calving areas are typically high elevation, alpine and non-forested and in close proximity to old-growth forest ridge tops, as well as high-elevation basins. During calving, arboreal lichens become the primary food source for pregnant females because other types of forage are largely unavailable in these secluded, old growth conifer habitats. During summer months, southern mountain caribou move to upper elevation spruce/alpine fir forests.

Southern mountain caribou rely heavily on arboreal (tree) lichens, which are a critical food source in the winter months and for females during the calving season. The two kinds of arboreal lichens commonly eaten are Bryoria spp. and Alectoria sarmentosa. Both are extremely slow-growing lichens found in high-elevation, old-growth conifer forests that are greater than 250 years old. Summer diets include grasses, flowering plants, horsetails, willow and dwarf birch leaves and tips, sedges, lichens, and huckleberry leaves. Fall and early winter diets consist largely of dried grasses, sedges, willow and dwarf birch tips, and arboreal lichens.

This species is found in the Selkirk Mountain range of Washington in Pend Oreille County, and in Idaho in Bonner and Boundary counties. It occurs in Forest Service Region 6 on the Colville National Forest, which has low retardant application potential, and Forest Service Region 1 on the Idaho Panhandle National Forests, which have moderate retardant application potential.

Critical habitat was designated in 2012 (72 FR 71041). Region 6 conducted a supplemental consultation in 2014 to analyze the newly designated critical (USDA Forest Service 2014, USDI Fish and Wildlife Service 2015). The 2019 listing document (84 FR 52598) reaffirmed the existing critical habitat for the distinct population segment. In total, 30,010 acres are designated on the Idaho Panhandle National Forests and Colville National Forest. Primary constituent elements identified in the final rule for woodland caribou critical habitat include:

- Mature to old-growth western hemlock / western red cedar climax forest, and subalpine fir / Engelmann spruce climax forest at least 5,000 feet (1,520 meters) in elevation; these habitats typically have 26-50 percent or greater canopy closure.
- Ridge tops and high-elevation basins that are generally 6,000 feet (1,830 meters) in elevation or higher, associated with mature to old stands of subalpine fir / Engelmann spruce climax forest, with relatively open (approximately 50 percent) canopy.
- Presence of arboreal hair lichens.
- High-elevation benches and shallow slopes, secondary stream bottoms, riparian areas, and seeps, and subalpine meadows with succulent forbs and grasses, flowering plants, horsetails, willow, huckleberry, dwarf birch, sedges and lichens. The southern Selkirk Mountains population of woodland caribou, including pregnant females, use these areas for feeding during the spring and summer seasons.
- Corridors / Transition zones that connect the habitats described above. If human activities occur, they are such that they do not impair the ability of caribou to use these areas.

The primary constituent elements for this species occur in areas where retardant application is unlikely (mature/old growth forest and alpine/subalpine). If retardant is applied in these areas, it would not alter the primary constituent elements as described above (wildlife screen 1). Use of retardant in areas adjacent to the primary constituent elements could benefit the critical habitat by protecting the primary constituent elements from loss due to wildfire. Therefore, aerial application of retardant would have **no effect on woodland caribou critical habitat**.

Effects Analysis and Determinations for Ungulate Species

These species all occur on units where retardant application potential is high. However, retardant use is unlikely in the steep, rocky open habitat used by bighorn sheep, or in the high elevation, old growth habitat used by caribou. The Sierra Nevada bighorn sheep may be in lowland areas in winter, but fires are unlikely during that time of year. All three ungulate species considered here are highly mobile, have large home ranges, and can therefore avoid direct retardant application and areas where retardant is applied if it were to be used in their habitats (wildlife screen 2). Individuals in the vicinity of a retardant drop could be displaced or experience disturbance due to aircraft, but the mobility of these species would make any disturbance effect short term and discountable (wildlife screen 3).

The ecological risk assessment (Auxilio Management Services 2021) identified that herbivore species, represented by rabbit (small herbivore), deer (large herbivore), and cow (ruminant) would not experience risk related to ingestion of retardant; risk is related to length and quantity of exposure. Use of retardant is unlikely in the habitats used by these three ungulate species, and if retardant were to be used, they are likely able to avoid feeding on plants coated with fire retardant (wildlife screen 4). The fertilizing effects of aerial retardant can result in changes to plant communities but use of retardant is unlikely in habitats used by these species; therefore, effects to food resources are not expected.

Based on the above discussion, aerially applied retardant **may affect but is not likely to adversely affect Peninsular bighorn sheep, Sierra Nevada bighorn sheep, or woodland caribou**, based on the limited potential for disturbance. ***Avoidance area mapping is not required due to all these species being highly mobile and wide ranging in distribution***.

Marine Mammals

This section includes listed mammals within the marine environment that are under the jurisdiction of the Fish and Wildlife Service; the species analyzed here are also protected by the Marine Mammal Protection Act of 1972.

Table 31. Summary of determinations for marine mammal species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Enhydra lutris nereis	Southern sea otter	T	na	NLAA
Trichechus manatus	West Indian Manatee	E, CH	NE	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Southern Sea otter – *Enhydra lutris nereis*

The southern sea otter was listed as threatened on 14 January 1977 (42 FR 2965). A nonessential experimental population was also designated that does not occur on National Forest System lands. This subspecies was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011).

Southern sea otters inhabit coastal waters within 1.2 miles of shore, especially shallows with kelp beds and abundant shellfish. In rough weather, they take refuge among kelp, or in coves and inlets and rarely come ashore. Young are born from December to March in the water or on land.

This species occurs on National Forest System lands on the Monterey Ranger District of the Los Padres National Forest. The Forest Service acquired Bixby Creek and beach for the protection of the southern sea otter (Krueger 2020). The Los Padres National Forest has a high retardant application potential, and on some fires has been known to anchor to shoreline areas (Krueger 2020).

Because southern sea otters rarely come ashore and, when they do, occur on a beach where retardant would not be used, it is unlikely that otters would come into contact with aerially applied fire retardant (wildlife screen 2). However, disturbance from low-flying aircraft noise associated with retardant drops in the vicinity of the beach may cause sea otters to leave the haul out area and return to the ocean (wildlife screen 3). ***The Bixby Creek beach area is included in an avoidance area with a 300-foot buffer to minimize noise related disturbance***.

Based on this discussion aerially applied fire retardant **may affect but is not likely to adversely affect southern sea otter**.

West Indian manatee – *Trichechus manatus*

The West Indian manatee, including the Florida manatee subspecies (Trichechus manatus latirostris) was listed as endangered on 11 March 1967 (32 FR 4001). The species was reclassified as threatened on 5 April 2017 (82 FR 16668). The West Indian manatee was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Critical Habitat was designated on 22 September 1977 (42 FR 47840) but no primary constituent elements were identified. Manatees may be found on the Apalachicola and Ocala National Forests in Florida, on the Francis Marion National Forest in South Carolina, and on the Croatan National Forest in North Carolina. Critical habitat is designated on the Ocala National Forest. The Francis Marion National Forest does not use aerially applied retardant. The National Forests of North Carolina and Florida have very low retardant application potential.

Manatee habitat includes shallow coastal waters, estuaries, bays, rivers, and lakes. Throughout most of their range, manatees appear to prefer rivers and estuaries over marine habitats. Manatees can be active day or night. Young are born in spring or early summer and are weaned in one or two years. This species is not highly social, although in the northern portions of their range they may congregate in winter. North of Florida, manatees are mainly a migrant or irregular visitor; long-distance migrations have also been observed. Manatees are herbivores; their diet is mainly submergent, emergent, and floating vegetation (NatureServe 2021).

Manatees' aquatic habitat is protected with avoidance areas (300-foot buffers). Avoidance areas in combination with the very low retardant application potential where they occur limits the probability of retardant entering their habitat, but does not eliminate the chance. Manatees are mobile and able to move away from areas where retardant drops might occur (wildlife screen 2). If retardant were to enter the habitat it has the potential to fertilize the water which could result in increased plant growth, or if enough retardant enters the water, to contribute to or result in an algal bloom in freshwater habitat. Because of the limited potential for retardant to enter habitat, and dilution as the retardant moves downstream into estuarine and marine environments, the amount of nutrient contributed by retardant drops would be negligibly small, and would not measurably add to the existing sources of nutrient loading (agriculture and industry) by the time the retardant reached the estuarine environment. Disturbance to manatee from aircraft delivering retardant is not expected because retardant use is a short term disturbance in Florida and North Carolina, and manatees spend nearly all of their time submerged (wildlife screen 3); habitat is protected by avoidance areas, minimizing the likelihood of disturbance by aircraft.

Based on the limited retardant use, the minimal anticipated effects, and the presence of avoidance areas, aerial application of retardant **may affect but is not likely to adversely affect West Indian Manatee or its designated critical habitat.**

5.4.5.6 Reptiles: Lizards, Snakes, Turtles, and Tortoises

Aerially applied retardant was found to have No Effect on American alligator (*Alligator mississippiensis*), bog turtle (*Clemmys muhlenbergii*), Puerto Rican boa (*Epicrates inornatus*), gopher tortoise (*Gopherus polyphemus*), yellow-blotched map turtle (*Graptemys flavimaculata*), black pinesnake (*Pituophis melanoleucus lodingi*), Louisiana pinesnake (*Pituophis ruthveni*), sand skink (*Plestiodon reynoldsi* or *Neoseps* r*eynoldsi*), eastern massassauga (*Sistrusus* *catenatus*), and flattened musk turtle (*Sternotherus depressus*). A summary of the rationale for each species is found in appendix F

Table 32. Summary of determinations for lizard, snake, turtle, and tortoise species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Gambelia sila	blunt-nosed leopard lizard	E	na	NLAA
Gopherus agassizii	desert tortoise	T, (CH)	na	NLAA
Crotalus willardi obscurus	New Mexican ridge-nosed rattlesnake	T	na	NLAA
Thamnophis eques megalops	Northern Mexican gartersnake	T, CH	NLAA	NLAA
Thamnophis rufipunctatus	narrow-headed gartersnake	T, PCH	NLAA	NLAA
Drymarchon couperi	eastern indigo snake	T, (CH)	na	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Blunt-nosed leopard lizard – *Gambelia sila*

The blunt-nosed leopard lizard was listed as endangered under the Endangered Species Preservation Act of 1966 on 11 March 1967 (32 FR 4001). It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). This lizard inhabits semi-arid grasslands, alkali flats, low foothills, canyon floors, large washes and arroyos. They are common where there are abundant rodent burrows and are rare or absent in dense vegetation or tall grass. Adults depend on deeper burrows for hibernation and egg laying. This lizard emerges from hibernation from late-March to mid-April. Adults are most active April through July and continue to be active through September to October. These lizards are most active in the morning and late afternoon, and return to burrows in hot weather. Males are territorial during the breeding season. Home range sizes average 5 acres for females and 10 acres for males. Blunt-nosed leopard lizards are opportunistic feeders, preying mostly on insects and spiders; they will also eat small lizards (NatureServe 2021).

There are four sites known on National Forest lands, on the Los Padres National Forest, although these may be hybrid individuals. The Los Padres National Forest has high retardant application potential.

Because this species has limited mobility and small home range size, individuals may not be able to avoid areas where retardant is applied (wildlife screen 2). ***Avoidance area mapping (300-foot buffer) of occupied sites is required to minimize potential effects to the species***. It is unlikely that aircraft would disturb this small, land dwelling lizard; however, if disturbed they would likely retreat to their burrows (wildlife screen 3). A retardant drop within the home range can reduce the amount of prey (insects and spiders) available to an individual. There is very little data on the potential toxicity of retardant to lizards, but there could be toxic effects if lizards eat prey species coated in retardant (wildlife screen 4).

The threats to blunt-nosed leopard lizard include conversion of natural lands to agriculture, land development, and habitat modification by non-native plants. The fertilizing effects of retardant could increase growth of non-native plants if present in the area. The use of avoidance areas would reduce these effects to a discountable level. Therefore, aerially applied fire retardant **may affect but is not likely to adversely affect blunt-nosed leopard lizard**.

Desert tortoise – *Gopherus agassizii*

The Mojave population of desert tortoise was emergency listed 4 August 1989 (54 FR 32326) and was listed as threatened under a final rule on 2 April 1990 (55FR 12178). Critical habitat has not been designated for this species. It was analyzed in the 2011 consultation (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011. The desert tortoise may occur in Forest Service Region 4 on the Humboldt-Toiyabe National Forest and in Forest Service Region 5 on the San Bernardino National Forest, both of which have high retardant application potential.

This tortoise is almost entirely confined to warm creosote bush vegetation characteristic of the Upper Sonoran life zones of the Mohave and Colorado deserts. Specific habitat associations vary geographically, as do substrate preferences. In the Mohave Desert, the tortoise occurs in creosote scrub, creosote bursage, shadscale scrub in Joshua Tree National Park, and, more rarely (in the northern periphery of their range), in mixed blackbush scrub between 3,500 to 5,000 feet elevation. In the warmer and lower Colorado Desert, tortoises generally are confined to creosote scrub and wash woodland habitats.

Tortoises are often subterranean when inactive, which is about 98 percent of their total life span. Typically, they use or excavate shelters of four different types: burrows, dens, pallets, and non-burrows.

The 2011 analysis of effects to desert tortoise was based on the assumption that aerially delivered retardant would not be used in their habitat. Since 2012, the San Bernardino National Forest has had four fires (Bowen Fire 2013, North Fire 2014, Pilot and Blue Cut Fires 2015) in which aerial retardant was used in desert tortoise suitable and occupied habitat (2015 D. Austin, personal observation). No desert tortoises were reported within the fire perimeters by Resource Advisors or by fire suppression personnel during suppression activities.

Aerial fire retardant may be used in tortoise habitat when structures in the urban interface are threatened. Because desert tortoises spend much of the time inactive in their burrows, and the use of retardant in their habitat is limited, the likelihood of individuals experiencing a direct application is extremely low (wildlife screen 1). The potential for disturbance is also limited because tortoises spend a significant amount of time in burrows or would retreat to their burrow if disturbed by firefighting activities (wildlife screen 3). Gopher tortoises are herbivores; annual grasses important in their diet are largely exotic species. Perennial grasses, largely native, are important contributors to shelter and soil retention. Retardant can fertilize plants, causing increases in growth of both native and nonnative vegetation. Overfertilization can also result in plant death, although this is not expected at the application rates in desert habitats. Because retardant is used in very localized areas, and can increase vegetative growth and thereby forage, the effects would be beneficial. Ingestion of retardant is not expected to affect desert tortoise because of their size and movements within their home ranges (wildlife screen 4).

Based on the limited use of retardant in localized areas of desert habitat, the species spending most of their time in burrows, and potential for increases in forage in areas of retardant application, aerially applied fire retardant **may affect, but is not likely to adversely affect desert tortoise**. ***Avoidance area mapping is not recommended for the desert tortoise due to the wide distribution of the species across the western desert region areas of California and Nevada.***

New Mexican ridge-nosed rattlesnake - *Crotalus willardi obscurus*

The New Mexican ridge-nosed rattlesnake was listed as threatened on 8 August 1978 and was analyzed in 2011 (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). Critical habitat was designated on 8 August 1978 (43 FR 34476) but does not occur on National Forest System lands. This rattlesnake is found at high elevations (5,600 to 9,000 feet) in pine-oak woodland and pine-fir forest, and in foothill canyons in pinyon juniper woodland. It uses the bottom of steep rocky canyons with intermittent streams or talus slopes. This species hides among rocks, bunchgrass and leaf litter and frequently climbs into trees and shrubs.

New Mexican ridge-nosed rattlesnake is inactive in cold temperatures and during extreme heat. It is mainly diurnal, although may be partially nocturnal during hot summer weather. In summer they are most active on warm humid mornings; in fall they are active mainly in the afternoon. This rattlesnake is active on the surface during the daylight hours as early as April and as late as October, with heightened activity from July to September. They birth live young in late July through August after a 13-month gestation. They prey on scorpion, centipedes, lizards, small mammals, and birds. They have limited dispersal ability and move only short distances. Current threats to the species include mortality associated with prescribed fire and wildfire, climate related habitat shifting, and illegal collection.

The New Mexican ridge-nosed rattlesnake is found in the Animas and Peloncillo Mountains of Hidalgo County in New Mexico. The subspecies also occurs in the Pelloncillo Mountains of Cochise County in Arizona. Population numbers are estimated at below 500 individuals. This species occurs on the Douglas Ranger District of the Coronado National Forest which has high potential for use of aerial retardant.

Fires on the Coronado National Forest primarily occur in May and June (USDA Forest Service 2020), which corresponds to the species' active period. From 2000 through 2019 only 6 percent of fires occurred in July. New Mexican ridge-nosed rattlesnake can avoid retardant drops by retreating into their burrows or under rocks. However, mobility for this species is limited due to their small size and small home range (wildlife screen 2) and individuals could be hit by a retardant drop. It is unlikely that aircraft would disturb this small, canyon dwelling snake; however, if disturbed they would retreat to their burrows (wildlife screen 3). Retardant application is unlikely to occur during the period when young are born or dispersing. A retardant drop within the home range can reduce the amount of prey (insects and spiders) available to an individual in very localized areas of their home range.

Use of retardant can have beneficial effects to rattlesnake habitat by helping to control wildfires and limiting loss of habitat and death. Barrera (2011) indicated that the threats of wildfire is greater than the potential effects of retardant use. Therefore, aerially applied fire retardant **may affect but is not likely to adversely affect New Mexican ridge-nosed rattlesnake**. ***Avoidance area mapping is not recommended for this species.***

Northern Mexican gartersnake – *Thamnophis eques megalops* and Narrow-headed gartersnake – *Thamnophis rufipunctatus*

Both the northern Mexican gartersnake and the narrow-headed gartersnake were listed as threatened on 8 July 2014 in Arizona and New Mexico. Both garter snakes occur in Region 3 on the Apache-Sitgreaves National Forest, which has low retardant application potential; on the Gila and Coconino National Forests, which have moderate application potential, and on the Prescott and Tonto National Forests, which have high retardant application potential. Northern Mexican gartersnakes also occur on the Coronado National Forest, which has high retardant application potential.

Northern Mexican gartersnakes occur up to about 8,500 feet in elevation but in the United States are most frequently found between 3,000 and 5,000 feet. They are found in both lotic and lentic habitats that include cienegas and stock ponds (in southern Arizona), as well as river habitat that includes pools and backwaters. They forage along the banks of waterbodies, feeding primarily on native fish and adult and larval leopard frogs. They may also supplement their diet with earthworms and leeches, and vertebrates such as lizards, small rodents, salamanders, treefrogs, and toads. In areas where the species co-occur, adult northern Mexican gartersnakes will prey on juvenile nonnative bullfrogs and/or bullfrog tadpoles. In the northern part of their range the species mates in April and May, and gives birth to live young in July and August; individuals may only reproduce every other year (USDI Fish and Wildlife Service July 2014).

Narrow-headed gartersnakes are strongly associated with clear, rocky streams, and use predominantly pool and riffle habitat that includes cobbles and boulders. They have also been observed using lake shoreline habitat in New Mexico. This species occurs at elevations from 2,300 – 8,000-feet and is surface-active between March and November. Narrow-headed gartersnakes specialize on fish as their primary prey item, including native fish such as suckers, dace, and chub, as well as native and nonnative trout. Unlike most species of gartersnakes that actively crawl about in search of prey, narrow-headed gartersnakes are ambush predators that often anchor to stream cobbles and wait for passing fish. Female narrow-headed gartersnakes breed annually and give birth from late July into early August (possibly earlier at lower elevations) (USDI Fish and Wildlife Service August 2014).

Both species may be inactive in cold temperatures or extreme heat. They are diurnal, and both species hibernate and aestivate. Both species are threatened by introduced predators (bullfrogs, fishes, crayfish); loss of habitat; and destruction of rivers and wetlands.

Critical habitat was proposed for both species on 10 July 2013 (78 FR 41549). The critical habitat proposal was revised 28 April 2020 (85 FR 23608). A final rule designating critical habitat for northern Mexican gartersnake published 28 April 2021 (86 FR 22518). The final rule for narrow-headed gartersnake is still pending.

Northern Mexican gartersnake designated critical habitat contains the follow physical and biological features:

- Perennial or spatially intermittent streams that provide both aquatic and terrestrial habitat that allows for immigration, emigration, and maintenance of population connectivity of northern Mexican gartersnakes and contain:
    - ♦ Slow-moving water (walking speed) with in-stream pools, off-channel pools, and backwater habitat;

- ♦ Organic and natural inorganic structural features (e.g., boulders, dense aquatic and wetland vegetation, leaf litter, logs, and debris jams) within the stream channel for thermoregulation, shelter, foraging opportunities, and protection from predators;
- ♦ Terrestrial habitat adjacent to the stream channel that includes riparian vegetation, small mammal burrows, boulder fields, rock crevices, and downed woody debris for thermoregulation, shelter, foraging opportunities, brumation, and protection from predators; and
- ♦ Water quality that meets or exceeds applicable State surface water quality standards.

- Hydrologic processes that maintain aquatic and terrestrial habitat through:
  - ♦ A natural flow regime that allows for periodic flooding, or if flows are modified or regulated, a flow regime that allows for the movement of water, sediment, nutrients, and debris through the stream network; and
  - ♦ Physical hydrologic and geomorphic connection between a stream channel and its adjacent riparian areas.
- A combination of amphibians, fishes, small mammals, lizards, and invertebrate prey species such that prey availability occurs across seasons and years.
- An absence of nonnative fish species, American bullfrogs, and/or crayfish, or occurrence of these nonnative species at low enough levels such that recruitment of northern Mexican gartersnakes is not inhibited and maintenance of viable prey populations is still occurring.
- Elevations from 130 to 8,497 feet
- Lentic wetlands including off channel springs, cienegas, and natural and constructed ponds with:
  - ♦ Organic and natural inorganic structural features (e.g., boulders, dense aquatic and wetland vegetation, leaf litter, logs, and debris jams) within the ordinary high water mark for thermoregulation, shelter, foraging opportunities, brumation, and protection from predators;
  - ♦ Riparian habitat adjacent to ordinary high water mark that includes riparian vegetation, small mammal burrows, boulder fields, rock crevices, and downed woody debris for thermoregulation, shelter, foraging opportunities, and protection from predators; and
  - ♦ Water quality that meets or exceeds applicable State surface water quality standards.
- Ephemeral channels that connect perennial or spatially intermittent perennial streams to lentic wetlands in southern Arizona where water resources are limited.

Aerially delivered retardant will not affect the majority of the physical and biological features of the designated and proposed critical habitat. Streams and waterbodies are protected with standard avoidance areas, but if retardant is delivered to the stream is could affect water quality as the retardant moves downstream. The spill calculator tool (United States Geological Survey 2019) helps to estimate the potential for downstream effects to aquatic species, and has shown that at any given location retardant is diluted /moved downstream within several hours of an intrusion. Therefore, effects to water quality are short-term. Retardant impacts to vegetation may include fertilization can result in changes to species composition in the affected area, and growth of or increased presence of invasive non-native plant species that may be present in the area. Designated and proposed critical habitat for these gartersnake species are within the 300 feet waterway buffer avoidance areas. This greatly reduces the potential for retardant to enter the area, and results in the effects as described being discountable. Therefore, aerially applied retardant **may affect but is not likely to adversely affect designated critical habitat for the northern Mexican gartersnake and proposed critical habitat for the narrow-headed gartersnake.**

Use of an ***avoidance area with a 600-foot buffer to include all critical habitat, instead of a 300-foot standard buffer, is recommended*** (Nelson 2020).

The use of aerial application of fire retardant has very low likelihood of direct effects since these species occur in aquatic habitat and riparian terrestrial areas protected by standard avoidance areas. Mobility for individuals of these species is limited due to their small size and small home ranges (wildlife screen 2), but direct impacts from a retardant drop are unlikely because of existing avoidance areas, and the ability of the species to shelter. As with other ground-dwelling reptiles, disturbance from aircraft is unlikely but if it were to occur these snakes would likely move to their burrows (wildlife screen 3). The ecological risk assessment (Auxilio Management Services 2021) did not analyze ingestion risk for reptile species. It is unlikely that these gartersnakes would consume retardant or prey contaminated with retardant because they eat primarily fish and frogs which would not be expected to be coated in retardant (wildlife screen 4), particularly given the presence of avoidance areas.

Because of the existing aquatic avoidance areas, the probability of retardant entering these species habitat is limited and the effects described above would be discountable. Therefore, aerially applied retardant **may affect but is not likely to adversely affect northern Mexican gartersnake and narrow-headed gartersnake**. ***Avoidance area mapping with a 600-foot buffers is recommended for known populations in order to further reduce the potential for retardant to enter their habitat***.

Eastern indigo snake – *Drymarchon couperi*

The eastern indigo snake was listed as threatened effective 3 March 1978 (43 FR 4026) and was analyzed in 2011 (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011). It is found on the National Forests in Florida, which have very low retardant application potential. This snake was found historically on the De Soto National Forest (National Forests of Mississippi) and the Conecuh National Forest (National Forests of Alabama), which do not use aerially applied retardant. Reintroduction efforts into these areas are planned. Critical habitat has not been designated.

Habitat for the eastern indigo snake includes sandhill regions dominated by mature longleaf pines, turkey oaks, and wiregrass; flatwoods; most types of hammocks; coastal scrub; dry glades; palmetto flats; prairie; brushy riparian and canal corridors; and wet fields. Occupied sites are often near wetlands and frequently are in association with gopher tortoise burrows. Pineland habitat is maintained by periodic fires. Viable populations of this species require relatively large tracts of suitable habitat. Refuges include tortoise burrows, stump holes, land crab burrows, armadillo burrows, or similar sites.

The eastern indigo snake is a diurnal species. They may move seasonally between upland and lowland habitats, particularly in northern portions of their range. Throughout their range, eastern indigo snakes use below-ground shelter sites for refuge, breeding, feeding, and nesting. They depend on gopher tortoise burrows in xeric sandhill habitats throughout the northern portion of the species' range for overwintering shelter sites. Adult eastern indigo snakes move long distances and have very large home ranges; from several hundred to several thousand acres. Eastern indigo snakes breed October through January. They consume a wide variety of animals, including other snakes (USDI Fish and Wildlife Service 2018). The primary negative factors influencing the viability of the species are habitat fragmentation and loss due to land use changes. Habitat loss for coastal populations due to sea level rise is also an increasing risk.

Eastern indigo snake is wide ranging in areas with very low retardant application potential and is a highly mobile species that can avoid areas where retardant is applied (wildlife screen 2). Any disturbance on the National Forests of Florida from aerially applied retardant would be short term. It is unlikely the noise of aircraft would disturb this snake species, although if they were disturbed, they would likely move out of the area (wildlife screen 3). Because they are so wide ranging and aerial retardant use is limited within their range, eastern indigo snakes would be able to avoid areas with retardant and find prey elsewhere (wildlife screen 4).

Eastern indigo snake can avoid areas with applied retardant, but may have to move to do so. Because retardant application potential is very low, the probability of retardant affecting this species is discountable. Aerially applied **retardant may affect but is not likely to adversely affect eastern indigo snake.**

Sea Turtles

In the United States, NOAA Fisheries leads the conservation and recovery of sea turtles in the marine environment, while the Fish and Wildlife Service has the lead for the conservation and recovery of these animal on nesting beaches. The discussion here is limited to potential effects when turtles are on land. Descriptions of status and habitat for each species are provided, followed by a discussion of effects to all sea turtles.

Table 33. Summary of determinations for sea turtles

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Caretta caretta	loggerhead sea turtle	E, T, (PCH)	n/a	NLAA
Chelonia mydas	green sea turtle	T, (CH)	n/a	NLAA
Dermochelys coriacea	leatherback sea turtle	E, (CH)	n/a	NLAA
Eretmochelys imbricata	Hawksbill sea turtle	E, (CH)	n/a	NLAA
Lepidochelys kempii	Kemp's ridley sea turtle	E, (PCH)	n/a	NLAA
Lepidochelys olivacea	olive ridley sea turtle	T	n/a	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

The individual discussions for each species of sea turtle considered in this analysis are followed by a discussion of effects to all critical habitats and species combined.

Loggerhead sea turtle – *Caretta caretta*

The loggerhead sea turtle was listed as threatened on 23 July 1978 (43 FR 32800). In 2011, nine distinct population segments of loggerhead sea turtle were listed as threatened or endangered (22 September 2011, 76 FR 58868). The North Pacific Ocean distinct population segment off the west coast was listed as endangered, the Northwest Atlantic Ocean distinct population segment off the east coast was listed as threatened. The North Pacific Ocean distinct population segment may be found on beaches of the Suislaw National Forest, which does not use retardant and the Siskiyou and Los Padres National Forests, which have high retardant application potential. The Northwest Atlantic Ocean distinct population segment may be found on beaches of the Francis Marion National Forest, which does not use retardant, and the Croatan National Forest (National Forests in North Carolina) and the Ocala National Forest (National Forests in Florida), all of which have very low retardant application potential.

This species nests mainly at night, at high tide, from late April through early September. It nests on open, sandy beaches above the high tide mark, seaward of well-developed dunes. The eggs hatch in 7 to 11 weeks (mid-June to mid-November), with hatchlings emerging a few days after hatching typically during darkness (NatureServe 2021).

Green sea turtle – *Chelonia mydas*

Green sea turtle was listed as threatened on 28 July 1978 (43 FR 32800), with the Florida breeding population listed as endangered. In 2016, 11 distinct population segments of green sea turtle were listed as threatened or endangered (6 April 2016, 81 FR 20058). The North Atlantic distinct population segment, which includes the Florida breeding population, and the East Pacific distinct population segment were listed as threatened. The East Pacific distinct population segment of green sea turtle may occur on the Los Padres National Forest, which has high retardant application potential. The North Atlantic distinct population segment may occur on the Francis Marion National Forest and the De Soto National Forest (National Forests in Mississippi), which do not use retardant, and on the Croatan National Forest (National Forests in North Carolina) and Ocala National Forest (National Forests in Florida), which have very low retardant application potential.

This species nests generally at night, from May through September. It nests on beaches, usually on islands but also on the mainland. A relatively small number nest in Florida, with rare nesting in Georgia, North Carolina, and Texas. Basking on beaches from mid-morning to mid-afternoon occurs in some areas (NatureServe 2021).

Leatherback sea turtle – *Dermochelys coriacea*

The leatherback sea turtle was listed as endangered on 2 June 1970 (35 FR 8491). It may occur on the Francis Marion and Siuslaw National Forests, which do not use retardant, on the Croatan National Forest (National Forests in North Carolina) and Ocala National Forest (National Forests in Florida), which have very low retardant application potential, and on the Los Padres and Siskiyou National Forests, which have high retardant application potential.

This species nests at night from March to August. They nest on sloping, sandy beaches backed up by vegetation, often near deep water and rough seas. The absence of a fringing reef appears to be important. Leatherback deposit eggs in moist sand and they hatch in 8 to 10 weeks. This species seldom approaches land except for nesting (NatureServe 2021).

Hawksbill sea turtle – *Eretmochelys imbricata*

Hawksbill sea turtle was listed as endangered on 2 June 1970 (35 FR 8491). It may occur on the Ocala National Forest (National Forests in Florida), which has very low retardant application potential.

This species nests at night from May to November in the West Indies. They nest in United Stated waters in the Virgin Islands and Puerto Rico, and infrequently on the Atlantic coast of central and southern Florida and the Florida Keys. They nest on undisturbed, deep sand, insular or mainland beaches. A typical site would be low energy sand beach with woody vegetation near the water line (NatureServe 2021).

Kemp's ridley sea turtle – *Lepidochelys kempii*

Kemp's ridley sea turtle was listed as endangered on 2 December 1970 (35 FR 12222). It may occur on the Francis Marion National Forest, which does not use retardant, and on the Croatan National Forest (National Forests in North Carolina), which has very low retardant application potential.

This species lays eggs during daylight hours from April to July. Nesting occurs on well-defined elevated dune areas, especially on beaches backed up by large swamps or bodies of open water having seasonal, narrow ocean connections. The eggs hatch in 45 to 58 days (mid-May to September). Sporadic nesting has occurred as far north as North Carolina; although adults are essentially limited to the Gulf of Mexico, with immature turtles inhabiting the Gulf and Atlantic coast north to Long Island Sound (NatureServe 2021).

Olive ridley sea turtle – *Lepidochelys olivacea*

Olive ridley sea turtle was listed as threatened on 28 July 1978 (43 FR 32800). It may occur on the Siuslaw National Forest, which does not use retardant, and on the Los Padres and Siskiyou National Forests, which have high retardant application potential.

This species exhibits synchronized nesting in some areas from June to September. Solitary nesting also occurs. Nesting occurs on upper beaches at night. When not nesting the species is nomadic in the eastern Pacific Ocean (NatureServe 2021).

Sea Turtle Critical Habitat

Designated and proposed critical habitat for sea turtles does not occur on National Forest System lands (43 FR 45905, 63 FR 46693, 44 FR 17710).

Effects to Sea Turtles

There is a potential for aerial retardant application on some of the units where sea turtles may occur (wildlife screen 2). In general, retardant would not be used on beaches although beaches may be used as an anchor point for retardant application in adjacent vegetation. These sea turtles rarely come ashore, and beach areas on National Forests are a very small percentage of the land base. The main impact of aerial retardant use would be disturbance to nesting or basking turtles (wildlife screen 3). Kemp's ridley is the only turtle that nests during daylight hours, when retardant is applied. Because of the limited land base of beaches on National Forest System lands, the limited use of these beaches as nesting or basking sites, the limited to no use on all forests except for the Los Padres and Siskiyou National Forests, disturbance to basking or nesting turtles would rarely occur. Therefore, aerially delivered fire retardant **may affect but is not likely to adversely affect the sea turtles**. ***Mapped avoidance areas are required for all beach-shoreline areas on the Los Padres National Forest,*** in order to mitigation any affects from the potential use of aerial retardant (Krueger 2020).

5.5 Aquatic Species and Habitats Analysis and Determinations

5.5.1 Introduction

This section addresses 146 species identified as proposed, threatened, or endangered under the Endangered Species Act listed and/or their designated or proposed critical habitat. Effects to those species and to critical habitat are analyzed on a nationwide, programmatic scale. Because the analysis is at such a large scale and addresses a nationwide program rather than a specific action (i.e., we cannot predict when, where, in what habitat type, or how large or long-lasting a wildfire event will happen, nor can we predict when, where, or how much aerial fire retardant may be used on a specific wildfire incident), the analysis is generally not quantitative. Local information is provided by individual national forests to Fish and Wildlife Service Field offices when more detailed or site-specific analysis is required.

5.5.2 Effects Analysis Process

As part of the analysis framework established for the 2011 biological assessments (USDA Forest Service 2011a), a National Effects Screening Process (as described in the 'Effects Analysis Process – Analysis Process Used', in section 4.2 of this document) was developed for all Endangered Species Act (ESA) listed threatened, endangered, proposed and candidate species, and designated or proposed critical habitat.

The analyses and effects determinations are based on species information including distribution and habitat requirements, the national screening process (refer to section 4 in this document) the risk assessment, any avoidance area mapping that would reduce effects, and information on past retardant use. Species information was obtained from current lists of species known and suspected to occur on or near National Forest System lands, as well as information found on the Fish and Wildlife Service endangered species website (https://www.fws.gov/endangered/), the Fish and Wildlife Service Environmental Conservation Online website (https://ecos.fws.gov/ecp/), NatureServe (https://www.natureserve.org/), federal register listing or status review documents, and other sources as needed.

The analyses and determinations here used the national screening process as an initial filter (refer specifically to Table 13, section on aquatic species), and also relied on available information regarding retardant impacts to similar species or habitats, or on information about general retardant effects to ecological systems or habitats, as described throughout this document, including in species discussions. This analysis also used information from the 2011 consultation (USDA Forest Service 2011a, USDI Fish and Wildlife Service 2011), updating information and adjusting determinations as appropriate.

Determinations of no effect were made for species that:

- occur on National Forests that do not use aerially applied retardant,
- occur in habitats where aerial fire retardant is extremely unlikely to be used (e.g., in large waterbodies or in estuaries or marine habitats)
- occur on National Forest with very low use of aerially applied fire retardant, are in habitat protected by avoidance areas, and where analysis has shown that there would be no changes to critical habitat

Refer to appendix F for the list of species and the analysis of No Effect determinations.

5.5.3 Effects Common to All Aquatic Species

Given the national programmatic nature of this consultation, and the fact that the Forest Service cannot predict when or where the aerial application of fire retardant will occur but can only estimate based on data from aerial retardant use in the last 20 years since 2000, the specific effects to individuals resulting from the proposed action cannot be described. The potential effects of the use of aerial fire retardant on all aquatic species is summarized here. The information in this section is applied to evaluation of individual species in the sections that discuss and provide determinations for those species.

5.5.3.1 Entry of retardant chemical into waterways

Aerial retardant drops are not allowed in mapped avoidance areas for threatened, endangered, proposed, candidate or sensitive species or in waterways. This national direction is mandatory and would be implemented except in cases where human life or public safety is threatened and retardant use within avoidance areas could be reasonably expected to alleviate that threat. (USDA Forest Service 2011b) (Forest Service Manual 5100-2020-1 Policy 5130.3; USDA Forest Service 2011). Between 2012 and 2019 there were 90 of 459 total intrusions (drops or retardant into avoidance areas) occurred as a result of using the exceptions.

Avoidance area maps help ensure that retardant drops on National Forest System lands are not made within waterways or threatened, endangered, proposed or candidate species habitat. Increased size of avoidance areas can further reduce the potential for retardant entry into waterways in areas where species distribution or habitat warrants a larger buffer or greater likelihood of protection.

Operations protocols reduce the potential for intrusions. For example, pilots fly “dry runs” over retardant drop areas prior to the application, to orient themselves with the location of avoidance areas relative to the target area. Implementation guidance included as part of aircraft operations protocols provide pilots with instructions about when to stop applying retardant when approaching and departing avoidance areas. Pilots adjust methods based on airspeed and weather to avoid application over avoidance areas.

Over time, multiple fires and repeated intrusions in the exact same location with the same ESA-listed species are unlikely, however, repeat intrusions into habitat of ESA-listed species do occur. The situation arose for Snake River spring/summer Chinook, Snake River Sockeye, and Snake River steelhead habitat, over the course of 8 years, where there were multiple intrusions into the overlapping critical habitat of these three species during six fires between 2012 and 2019.

Between 2012 and 2019 there were 459 reported intrusions in a total of 56,868 retardant drops, for an intrusion rate of 0.8 percent (Table 6). Maps showing the locations of intrusions into threatened, endangered, proposed and candidate species habitat are found as identified in appendix B. The rate of intrusion over the period analyzed has remained constant at 0.46 (range 0.28 to 0.61) percent of total fires experiencing one or more incidents of intrusions. Based on these intrusion rates, the probability of an intrusion in the future into aquatic threatened, endangered, proposed and candidate species will remain low (near one percent).

Thickeners in retardant mixtures are designed to increase viscosity (i.e., thickness) and thereby prevent breakup of the mixture into smaller droplets as it falls from the aircraft. Retardant mixtures on the Qualified Products List must meet requirements for minimum viscosity in order to optimize retardant delivery to the target area and improve its ability to stick to fuels (vegetation). This also reduces the potential for drift of the mixture outside of the target area.

Surface runoff can occur when retardant moves from an upslope area into a waterway. Thickeners and surfactants added to retardant mixtures increase adhesion of chemicals to vegetation and reduce the risk of runoff. None of the products evaluated in the ecological risk assessment (Auxilio Management Service 2021; see section below) demonstrate a risk of runoff.

Spills of retardant into threatened, endangered, proposed and candidate species habitat are unlikely. Air tanker bases are located generally off National Forest System lands and away from aquatic species habitat and operate with protocols for cleaning and containment that minimize risk of retardant reaching areas off the tanker base. Thus, there are no effects to threatened, endangered, proposed and candidate species from mixing and loading retardant at airtanker bases.

Mobile retardant bases (portable mixing system) are used to mix and load helicopters near the incident site and are often on National Forest System lands. To prevent accidental spill of concentrate or mixed product from a mobile retardant base into a waterbody, a spill containment system is required, and contracts include environmental controls such as:

The Mobile Retardant Base site will be located greater than 300-feet from any water source.

- The contractor and Agency Representative at the incident will jointly develop a Site Spill Containment Plan.
- The retardant contractor will be responsible for removal and disposal of chemical residue and chemical spills created in the retardant mixing area or due to accident or negligence of retardant personnel. All cleanup and disposal will be accomplished in accordance with state and federal environmental standards.
- All wash-down water generated from cleaning aircraft and ramp surfaces shall be the ordering Agency's responsibility for disposal.
- All chemical spills into waterways or other identified avoidance areas will be reported to the Incident Commander, through the on-site agency representative and to the Contracting Officer or representative within 24 hours of the time of the spill. Information regarding fire chemical intrusions can be found at https://www.fs.fed.us/managing-land/fire/chemicals.
- The Contractor shall possess an environmental plan. The plan will be approved by the Government and shall be maintained with the mobile retardant base at all times when operating.

Between 2012 and 2019, there was one spill at a mobile retardant base on the Sunrise incident (2017) on the Lolo National Forest. Improper procedure allowed retardant to flow over the ground into a mapped avoidance area adjacent to bull trout habitat, but retardant did not flow into the water. There were no documented effects from that intrusion. In another incident documented since 2000, retardant concentrate entered water during transport. Based on those two occurrences and on the number of drops by helicopters from mobile retardant bases (estimated at 14,216 drops) during the monitoring period, the expected frequency of intrusions from mobile retardant bases in the future is extremely low (0.01 percent). If any spills related to mobile retardant bases were to occur there would be effects to individual threatened, endangered, proposed and candidate species. The likelihood is so small, however, as to be discountable.

5.5.3.2 Risk Assessment

The Long-Term Retardant Specification (5100-304, USDA Forest Service 2020c) requires risk assessments prior to a retardant's placement on the Qualified Products List. An ecological risk assessment (Auxilio Management Services, 2020) was prepared for aerial fire retardants on the Qualified Products List as of August 5, 2020. This risk assessment evaluates the toxicological effects associated with chemical exposure. The risk assessment follows the United States Environmental Protection Agency's Guidelines for Ecological Risk Assessment (EPA 1998). This section summarizes the methodology and results of the assessment.

The risk assessment compares published toxicity data with anticipated environmental chemical concentrations. The assessment included all retardant formulations currently on the Qualified Products list. Each retardant formulation was screened for individual ingredients that were moderately toxic, as defined by the Environmental Protection Agency (2012), to representative aquatic species. Moderately toxic ingredients have toxicity greater than or equal to a lethal median concentration (LC50) of 10 mg/L for aquatic organisms. Representative aquatic species included rainbow trout (coldwater fish), water flea (aquatic invertebrate), and tadpoles of frogs or toads (aquatic stages of amphibians). Assessment was also made of the risk to freshwater mussels of ammonia exposure originating from aerial retardant runoff.

The assessment looked at the potential concentrations of the retardant ingredients described above that would result from contaminated runoff or as a result of a retardant drop or accidental spill directly into a stream. Concentrations of chemicals that could occur in streams because of these events were estimated by environmental fate and transport modelling, using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) (Leonard et al. 1987, Knisel and Davis 2000) model. Because inputs of the model vary based on geographic area, the model was run for fifteen ecoregions (Bailey 1995) representative of areas where retardants are applied (Auxilio Management Services 2021). In order to estimate a range of effects, estimates were made for two different stream sizes: a small (6,400-acre) drainage with a 12 cubic-feet-per-second streamflow and a larger (147,200-acre) drainage basin with a 350 cubic-feet-per-second streamflow.

Potential risks were assessed following the Environmental Protection Agency Office of Pesticides Program methodology, which characterizes risk as the ratio of the exposure level (chemical concentration in water) to the hazard level (chemical toxicity to representative species). Where risks are identified, they can be interpreted to mean the identified exposure level could be associated with risk of mortality to individual organisms. For this assessment, if the modeled concentration in water exceeds one twentieth of the median lethal concentration (LC50) for an individual aquatic species, then there is an assumed risk of effects to the survival, growth, or reproduction of individuals of that species. The risks of adverse effects vary by representative species, type of event (i.e., runoff or direct drop or spill into waterway), and bioregion, and are summarized here.

The risk assessment evaluated the potential for impacts from persistent aquatic exposure to ammonia from the retardant salts because some aquatic species could be limited to habitats, such as ponds, where water movement is limited and therefore exposure would be longer term. In water, the balance of un-ionized ammonia (NH_3) to ionized ammonia (NH_4^+) is dependent on pH. Using a conservative estimate that all ammonia would be present in the more toxic un-ionized form, the risk assessment determined that Phos-Chek® 259-Fx and Phos-Chek® LCE20-Fx pose potential risks of effects to bivalves resulting from long-term exposure.

In the case of an accidental spill of retardant concentrate or mixed tank directly to the stream, the risk assessment determined risk to all species groups from all retardant chemicals in both small and large drainages.

5.5.3.3 Potential Effects Associated with the Proposed Action

The previous sections discussed the potential for retardant to enter waterways, and the potential risk to aquatic organisms if that occurs. This section discusses what direct and indirect effects could occur to species that come in direct contact with retardant, consume vegetation or prey affected by retardant, or as a result of retardant aircraft flights or the physical impact of retardant drops. Sub-lethal effects of chemical toxicity are those effects that do not result in direct mortality, but that could impact the overall health and fitness of individuals within a population of aquatic species. These effects may include impacts to individual physiology or behavior that lead to impacts on individual survival, growth or reproduction. There are no studies that specifically address the impact of retardants in this manner, but in addition to the risk of direct mortality, effects may include such things as:

- Increases or decreases in growth, developmental abnormalities, or physical deformities
- Changes in reproductive behavior, number of eggs or offspring produced or hatched
- Reduced ability for osmoregulation or other physiological processes,
- Reduced ability to tolerate shifts in environmental variables (temperature, dissolved oxygen etc.),
- Increased susceptibility to disease or to predation,
- Changes in migratory behavior.
- Disturbance due to sight or sound of low-flying aircraft.

Effects may also include impacts to habitat. Studies have documented a short-term (one year) reduction in species richness in areas treated with retardant. This effect was more pronounced in riparian corridors than in other habitat types. Vegetation changes in the riparian corridor could contribute to changes in stream characteristics such as water temperature, sedimentation rates, or other factors that could alter the way aquatic species are able to use those habitats. Fire retardant chemicals could also impact algal populations through direct mortality or, alternately, through increased algal production due to fertilization or changes in solar radiation related to changes in riparian vegetation. Changes in vegetation could also contribute to changes in availability of prey species.

The integrity of the aquatic food chain is an essential biological requirement for salmonids, marine mammals, and reptiles, and the possibility exists that retardant applications could alter productivity and aquatic systems. Retardant chemicals could impact prey species through direct mortality of prey, changes in prey distribution and availability, or ingestion by aquatic species of prey that have been exposed to chemicals.

The risk assessment (Auxilio Management Services 2020) found that the analyzed retardants would have low toxicity to prey species. Of the means by which retardant could enter aquatic environments (direct application/intrusion, surface runoff, and accidental spills), an accidental spill would have the greatest potential to impact prey species because of the amount of chemical that a spill could introduce into the water. As discussed earlier, however, the absence of a spill between 2012 and 2019, and the low likelihood that a spill will occur in the future make the risk of spill effects on the food chain very low.

Overall, the risk of riparian vegetation and prey base changes and effects on threatened, endangered, proposed, and candidate species is low because, as described above, intrusions are rare and toxic conditions are of short duration. Multiple intrusions into the same waterbody would likely need to occur before long term effects to prey availability become apparent. As discussed previously, intrusions rarely occur in the same location. While the risk of spills and intrusions occurring is very low, studies indicate when they occur habitat characteristics could change and impacts to prey species could occur. Therefore, there is a low probability that aerial fire retardant would cause indirect effects to listed aquatic species by causing changes in riparian or aquatic habitat or prey availability.

A low, fast drop of a large load (2,500 gallons) of aerially applied fire retardant could negatively affect habitat by breaking off treetops or vegetation or cause direct mortality. Fire retardant drops could negatively affect components of species spawning activities and rearing habitat by direct hit. However, direct mortality did not occur from 2012 to 2019 and the probability of broken treetops and direct mortality occurring in the future, and taking individual listed aquatic species, or damaging habitat and making an area less productive is discountable.

Disturbance from low-flying aircraft is not a concern for most species addressed in this biological assessment because water mutes aircraft noise, and the amount of time an aircraft would spend directly over a waterway would be minuscule.

5.5.3.4 Potential Cumulative Effects to Aquatic Species

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State, local, tribal, or private activities, not involving federal activities that are reasonably certain to occur within the action area of the federal action subject to consultation." Effects from state, local, tribal, and private actions on or near public lands could affect fish and other aquatic organisms discussed in this biological assessment, although the size, magnitude and potential for adverse effects may differ due to differences in management practices and scale of actions. Because aquatic habitats that occur on public lands often extend onto land under other ownership, non-federal activities could occur within the action area for aquatic species and would have the potential to be additive to Forest Service aerial fire retardant activities. Non-federal, or state and private activities that could have impacts to Endangered Species Act listed aquatic species within the watersheds adjacent to National Forest System lands include aerial delivery of retardant, use of salt mixtures for deicing or dust abatement, and use of fertilizers for agriculture

States, local townships and tribes use aerial fire retardant and use may increase based on human population growth trends and the impacts of that trend (increasing amount of wildland-urban interface, climate change). Re-application of retardant to specific locations is unlikely because past fires tend to reduce fuel loads for some period of time. Where retardant is used on federal and non-federal land within the same watershed, greater distance between those areas could reduce the potential for cumulative impacts in any specific portion of the watershed used by an Endangered Species Act listed species for a specific portion of its life cycle. Risk of cumulative effects would be reduced when interagency coordination occurs on the use of aerial fire retardant, avoidance area mapping, establishing trigger points that restrict the use of retardants within watersheds where fire retardant has caused adverse effects, and annual coordination. Nevertheless, there remains the low likelihood of cumulative effects from aerial retardant use on non-federal lands that adjoin or occur in the same watersheds where retardant is used on federal lands.

Aerial fire retardant is suspected to have cumulative effects when used with road deicing and dust abatement products. The application rate of road salts has increased since 1950, and recent evidence suggests that road salts have effects on aquatic communities (Van Meter et al. 2011, Van Meter and Swan 2014, Hintz et al. 2017, Jones et al. 2017, Schuler et al. 2017 in Schuler & Relyea, 2018). Magnesium chloride is used as a dust abatement and deicing agent on paved roads. Transportation agencies are increasingly seeking alternatives, such as magnesium chloride, to traditionally-used salts such as sodium chloride, in order to minimize the ecological effects of de-icing and dust abatement products (Schuler & Relyea, 2018). Although magnesium chloride appears to be less toxic to aquatic invertebrates than sodium chloride, road salts in general can cause changes in the composition of aquatic invertebrate and aquatic and riparian vegetation communities. These impacts could have cascading effects across trophic levels (Schuler & Relyea, 2018). Road salts are typically applied outside of fire season and in colder climates. Because deicers and retardant chemicals are used at different times of year and generally not in the same areas, cumulative effects are unlikely.

Dust abatement products are used on unpaved roads and may co-occur in watersheds inhabited by Endangered Species Act listed species and where aerial fire retardants could be used. Lignon sulfonates and calcium chloride are two of the most popular dust abatement products. These salts are sprayed directly on the unpaved road and work by soaking up water from the air, thus keeping the top level of soil damp enough to prevent it from turning into dust. While neither dust abatement product is likely to cause direct mortality, there may be synergistic effects between retardant and dust abatement products if they enter water at the same time of year. Both dust abatement and fire retardant contain ingredients that would lower pH and change the biotic community if they were to run off into streams. Vegetated strips between salted roadways and Endangered Species Act listed waterways, where they occur, reduce the likelihood of a cumulative effect with retardant, but a low likelihood of negative cumulative effects remains, particularly in standing waterbodies where the salt may accumulate.

Agriculture fertilizers applied on non-federal lands pose a risk of cumulative toxic effects to Endangered Species Act-listed resources when used in the same watersheds as aerial fire retardants on National Forest System lands. Fertilizers contain some of the same ingredients, such as ammonia (NH_3), and could have the same effect on the aquatic environment as fire retardant and could also lead toward eutrophication and cascading negative effects on NOAA Fisheries listed resources. While retardant application locations on National Forest System lands may be in the same watershed as agriculture lands with fertilizer, there is a low likelihood of cumulative toxic effects because deleterious conditions in National Forest System waters would probably be diluted sufficiently before combining with waters adjacent to agricultural lands.

Nevertheless, cumulative negative effects on individual aquatic species might result from fertilizer use, but the risk is reduced by the distance between the two activities.

Overall, a low risk of adverse cumulative effects to listed aquatic species exists from dust abatement, fertilizer use, and fire retardant use on non-federal lands. The products used for these activities contain some of the same (or similar) ingredients as retardant that when deposited in water could cause toxic effects and impacts to habitat and food webs. Cumulative effects of these actions could be greater for species confined to specific areas where the use of road chemicals or agricultural fertilizers might overlap or occur in close proximity. Species that use those areas for only part of their life history are less likely to encounter co-occurring effects. There are a wide variety of non-federal actions (e.g., pollution, harvest, recreational activities, etc.) that could have impacts to species addressed in this analysis but that cannot be addressed at this nationwide, programmatic scale.

5.5.4 Determinations of Effect to Listed Aquatic Species and Critical Habitats

Because of the national scale of this analysis and the need to address a large number of aquatic species listed as threatened, endangered, or proposed, and associated critical habitats, that occur on National Forest System lands affected by the proposed action, only a short summary on each species habitat and distribution is provided; refer to the Fish and Wildlife Service Environmental Conservation Online website (https://ecos.fws.gov/ecp/), or to NatureServe (https://www.natureserve.org/) for complete species account information.

The analysis is organized into groupings by major animal type: Bivalves (also referred to as mussels) Crustaceans Gastropods, and Fish. The analysis for each species includes listing date, occurrence by National Forest unit and associated retardant application potential, anticipated effects to the species, critical habitat (if designated) description and anticipated effects, and determination(s) for the species and any designated critical habitat

Because this is a national, programmatic action, determinations are made for species across their entire ranges rather than by individual National Forest. Each assessment considers the retardant application for all units where the species occurs, and determinations are based on the highest retardant application potential. For example, if a species occurs on three National Forests, one of which does not use retardant, one of which has low application potential, and one which has high application potential, the determination will be based on the assumption of high application potential. Similarly, requirements or recommendations for avoidance areas are for the entire species across its range, rather than by individual population or National Forest. Adjustments to avoidance areas may be made by local units, in coordination with the local Fish and Wildlife Service office

5.5.4.1 Summary of Effects and Determinations

The Forest Service lists 146 aquatic species federally listed as either threatened, endangered or proposed under the Endangered Species Act, analysis for impacts based on aerial application of fire retardant used by individual national forests (appendix D).

For Effects to Species:

- 59 species and 16 critical habitats would have a no effect (NE) determination due to occurring on national forests that do not use aerial application of fire retardant or occur in habitats where fire retardant would not be applied. See appendix F for a complete listing of no effect species.

- 56 species and 18 critical habitats would have a may affect - not likely to adversely affect (NLAA) determination due to a low likelihood of impacts from very low use of aerial fire retardants and resultant toxicity.
- 31 species and 14 critical habitats would have a may affect - likely to adversely affect (LAA) determination due to impacts expected from either from change in habitat, disturbance, or toxicity expected from the use of aerial application of fire retardants.

5.5.4.2 Species Discussions

Bivalves (mussels)

Aerially applied retardant was found to have No Effect on Cumberland elktoe (*Alasmidonta atropurpea*), fanshell (*Cyprogenia stegaria*), dromedary pearlymussel (*Dromus dromas*), Cumberlandian combshell (*Epioblasma brevidens*), southern combshell (*Epioblasma penita*), green blossom pearlymussel (*Epioblasma torulosa gubernaculum*), northern riffleshell (*Epioblasma torulosa rangiana*), shiny pigtoe (*Fusconaia cor*), southern sandshell (*Hamiota australis*), orangenacre mucket (*Hamiota perovalis*), cracking pearlymussel (*Hemistena lata*), Arkansas fatmucket (*Lampsilis powellii*), Neosho mucket (*Lampsilis rafinesqueana*), speckled pocketbook (*Lampsilis streckeri*), Carolina heelsplitter (*Lasmigona decorata*), birdwing pearlymussel (*Lemiox rimosus*), Louisiana pearlshell (*Margaritifera hembeli*), Alabama pearlshell (*Margaritifera marrianae*), orangefoot pimpleback (*Plethobasus cooperianus*), clubshell (*Pleurobema clava*), James spinymussel (*Pleurobema collina*), dark pigtoe (*Pleurobema furvum*), rough pigtoe (*Pleurobema plenum*), fuzzy pigtoe (*Pleurobema strodeanum*), fat pocketbook (*Potamilus capax*), inflated (Alabama) heelsplitter (*Potamilus inflatus*), southern kidneyshell (*Ptychobranchus jonesi*), rough rabbitsfoot (*Quadrula cylindrica strigillata*), winged mapleleaf (*Quadrula fragosa*), Cumberland monkeyface (*Quadrula intermedia*), Appalachian monkeyface (*Quadrula sparsa*), Choctaw bean (*Villosa choctawensis*), rayed bean (*Villosa fabalis*), purple bean (*Villosa perpurpurea*). A summary of the rationale for each species is found in appendix F.

Table 34. Summary of determinations for bivalve species and critical habitats

Scientific Name	Common Name	Status	Critical Habitat Determination	Species Determination
Alasmidonta raveneliana	Appalachian elktoe	E, CH	NLAA	NLAA
Amblema neislerii	fat three-ridge mussel	E, CH	NLAA	NLAA
Arkansia wheeleri	Ouachita rock pocketbook	E	na	NLAA
Cumberlandia monodonta	spectaclecase	E	na	NLAA
Elliptoideus sloatianus	purple bankclimber	T, CH	NLAA	NLAA
Epioblasma capsaeformis	oyster mussel	E, XN, CH	NE	NLAA
Epioblasma florentina curtisi	Curtis pearlymussel	E	na	NLAA

Scientific Name	Common Name	Status	Critical Habitat Determination	Species Determination
Epioblasma florentina walkeri	tan riffleshell	E	na	NLAA
Epioblasma metastriata	upland combshell	E, CH	NE	NLAA
Epioblasma othcaloogensis	southern acornshell	E, CH	NE	NLAA
Epioblasma triquetra	snuffbox mussel	E	na	NLAA
Fusconaia cuneolus	finerayed pigtoe	E, XN	na	NLAA
Hamiota altilis	finelined pocketbook	T, CH	NLAA	NLAA
Hamiota (Lampsilis) subangulata	shinyrayed pocketbook	E, (CH)	na	NLAA
Lampsilis abrupta	pink mucket	E	na	NLAA
Leptodea leptodon	scaleshell mussel	E	na	NLAA
Medionidus acutissimus	Alabama moccasinshell	T, CH	NLAA	NLAA
Medionidus parvulus	coosa moccasinshell	E, CH	NE	NLAA
Medionidus simpsonianus	Ochlockonee moccasinshell	E, (CH)	na	NLAA
Pegias fabula	littlewing pearlymussel	E	na	NLAA
Plethobasus cyphyus	sheepnose mussel	E	na	NLAA
Pleurobema decisum	southern clubshell	E, CH	NLAA	NLAA
Pleurobema georgianum	southern pigtoe	E, CH	NLAA	NLAA
Pleurobema hanleyianum	Georgia pigtoe	E, CH	NLAA	NLAA
Pleurobema perovatum	ovate clubshell	E, CH	NE	NLAA
Pleurobema pyriforme	oval pigtoe	E, (CH)	na	NLAA
Pleuronaia dolabelloides	slabside pearlymussel	E, CH	NLAA	NLAA
Ptychobranchus greenii (P. foremanianus)	triangular (rayed) kidneyshell	E, CH	NLAA	NLAA
Ptychobranchus subtentum	fluted kidneyshell	E, CH	NLAA	NLAA
Quadrula cylindrica cylindrica	rabbitsfoot	T, CH	NLAA	NLAA
Villosa trabalis	Cumberland bean	E, XN	na	NLAA

Effects common to all bivalves and their critical habitat

In general, bivalve critical habitat primary constituent elements include permanent flowing water, a flow regime necessary for normal behavior, a stable stream channel, stable substrates with low sediment, water quality that meets or exceeds aquatic life criteria under the Clean Water Act, fish hosts, and no non-native competitive or predatory species. Most physical characteristics of critical habitat (substrate, stream channel, etc.) will not be impacted by aerial retardant. If retardant enters critical habitat it has the potential to impact water quality for a short time (several hours), and to impact the fish host species. The degree of impacts is dependent on the amount of retardant that enters the water and the amount and flow of water.

The ecological risk assessment (Auxilio Management Services 2021) analyzed the potential effects of retardant on representative animal species. For bivalves specifically, potential effects from ammonia toxicity were included as ammonia is considered very highly toxic to fish and bivalves by the Environmental Protection Agency. Based on published studies, fish exhibited the greatest susceptibility to acute lethal effects, while bivalves were the most sensitive to short-term sublethal effects and to the long-term effects of ammonia. Two retardants (Phos-Chek 259-Fx and Phos-Chek LCE20-Fx) were found to have potential risks of sublethal effects to bivalves from runoff. Although risks of sublethal effects were identified, this conclusion is extremely conservative and represents an upper bound on the potential risks. Some amount, depending on the stream's pH, of the ammonium compound would be present as the ionized (and much less toxic) ammonium. Long-term exposure to this compound would be unlikely because retardants are not repeatedly applied to one location (unlike their use as common fertilizers), flowing water in a stream would continually increase their lengthwise dispersal in a stream (and therefore continuously dilute a single application), and environmental degradation and use by aquatic vegetation and algae (as nutrients) would further decrease their presence in the aquatic system. Therefore, if aerial retardant enters water either directly or through runoff, there is some potential for impacts to bivalves. Whether direct or indirect effects occur would depend the amount of retardant, waterway characteristics, and other factors.

An aerial retardant avoidance area is defined as an area in which application of aerial fire retardant is prohibited in order to avoid, limit, or mitigate potential impacts to specified resources. Data from 2012 through 2019 indicate that there were 248 intrusions into water out of 56,868 retardant drops, or a rate of 0.43 percent. Aquatic avoidance areas with a 300-foot buffer are required on all waterways where water is present at the time of retardant use; they are also required around bivalve occupied and designated critical habitat. The Cherokee, Ozark and Ouachita National Forests have implemented 500-feet wide buffers on waterways occupied with threatened and endangered species. The Mark Twain National Forest implemented ridgetop to ridgetop avoidance areas, or a minimum of ¼ mile-wide areas. The George Washington and Jefferson National Forests has implemented a retardant avoidance area that includes the entire 6th-field watershed around occupied habitat. The National Forests in North Carolina have implemented 1500-foot buffers around occupied and designated critical habitat. Wider avoidance areas area expected to further reduce the probability of retardant entering water. Although aerially delivered retardant poses a risk to threatened and endangered bivalve species (Auxilio Management Services 2021), the very low retardant application potential along with expanded avoidance areas reduce the probability of retardant entering habitat to a discountable level.

Species and critical habitat information

Many of the critical habitat designations for bivalves include multiple species. In this section species are addressed in groups based on common critical habitat designation. Within each group, the critical habitat information is provided first, followed by individual species information. The determinations are based on the effects common to all bivalves and critical habitat discussion above. Information on species status and habitat comes from NatureServe (2021).

Appalachian elktoe – *Alasmidonta raveneliana*

Critical habitat for Appalachian elktoe was designated on 27 September 2002 (67 FR 61016). Critical habitat occurs on the Cherokee National Forest and National Forests in North Carolina. The primary constituent elements essential for the conservation of the species are:

- Permanent, flowing, cool, clean water;
- Geomorphically stable stream channels and banks;
- Pool, riffle, and run sequences within the channel;
- Stable sand, gravel, cobble, and boulder or bedrock substrates with no more than low amounts of fine sediment;
- Moderate to high stream gradient;
- Periodic natural flooding; and
- Fish hosts, with adequate living, foraging, and spawning areas for them.

Appalachian elktoe was listed as endangered on 23 November 1994 (59 FR 06324). The majority of the surviving occurrences of the Appalachian elktoe appear to be small to extremely small (most with poor viability) and restricted to scattered pockets of suitable habitat. The few remaining populations are threatened by pollutants in wastewater discharges; habitat loss and alteration associated with impoundments, channelization, and dredging operations; and the run-off of silt, fertilizers, pesticides, and other pollutants from land disturbance activities implemented without adequate measures to control erosion and/or storm water. Mussels are known to be sensitive to numerous pollutants, including, but not limited to, a wide variety of heavy metals, high concentrations of nutrients, ammonia, and chlorine-pollutants commonly found in many domestic and industrial effluents. Appalachian elktoe occurs on the Cherokee National Forest and the national Forests in North Carolina, which have very low retardant application potential.

Because of the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect Appalachian elktoe and its designated critical habitat**.

Fat threeridge mussel-*Amblema neislerii* and purple bankclimber - *Elliptoideus sloatianus* and shinyrayed pocketbook - *Hamiota subangulata*, and Ochlockonee moccasinshell - *Medionidus simpsonianus*, and oval pigtoe - *Pleurobema pyriforme*

Critical habitat was designated on 15 November 2007 (72 FR 64286). Fish and Wildlife Service determined that these mussel species require the primary constituent elements described below.

- A geomorphically stable stream channel (a channel that maintains its lateral dimensions, longitudinal profile, and spatial pattern over time without a consistent aggrading or degrading bed elevation).
- A predominantly sand, gravel, and/or cobble stream substrate with low to moderate amounts of silt and clay.
- Permanently flowing water.
- Water quality (including temperature, turbidity, dissolved oxygen, and chemical constituents) that meets or exceeds the current aquatic life criteria established under the Clean Water Act (33 U.S.C. 1251– 1387).
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval life stages of the mussels.

Fat threeridge mussel-*Amblema neislerii*

Fat threeridge was listed as endangered on 16 March 1998 (63 FR 12664). Records for this species are limited to the Apalachicola River system, where it is known from the lower Flint River in Georgia, and the Apalachicola and lower Chipola rivers in Florida. The fat threeridge appears to have been extirpated from the main stem of the Flint River (and thus from Georgia), and from Dead lake in the Chipola River. It is documented in recent collections from 15 main stem sites on the Apalachicola River and lowermost portion of the Chipola River in Florida, and now occupies only 42 percent of its historic range. This species and its designated critical habitat occur on the National Forests in Florida, which have very low retardant application potential.

The fat threeridge mussel inhabits the main channel of small to large rivers in slow to moderate current. Substrate used varies from gravel to cobble to a mixture of sand and sandy mud; 60 percent of the specimens were in a sandy silt substrate. Habitat loss and degradation resulting from impoundments, sedimentation and turbidity, dredging and channelization, and contaminants contained in numerous point and nonpoint sources have led to the decrease in numbers and distribution of the fat threeridge mussel. These habitat changes have resulted in significant localized extirpations, restricted and fragmented distributions, and poor recruitment of young. The habitat issues described above, along with sedimentation and erosive land practices, water quantity and withdrawal, construction of new impoundments, and alien species are primary threats to the fat threeridge mussel.

Because of the use of avoidance areas around all waterways, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect Fat threeridge mussel**.

Purple bankclimber mussel-*Elliptoideus sloatianus*

Purple bankclimber was listed as threatened on 16 March 1998 (63 FR 12664). Generally distributed in the Flint, Apalachicola, and Ochlockonee Rivers, it was also known from the lower halves of the Chattahoochee and Chipola Rivers, and from two tributaries in the Flint River system. he abundance and distribution of the purple bankclimber decreased historically from habitat loss and degradation caused by impoundments (Talquin Reservoir), sedimentation and turbidity, dredging and channelization, and contaminants contained in numerous point and nonpoint sources. These habitat changes have resulted in significant extirpations, restricted and fragmented distributions, and poor recruitment of young. Purple bankclimber and its designated critical habitat occur on the Apalachicola National Forest (National Forests in Florida) that has very low retardant application potential.

The purple bankclimber inhabits small to large river channels in slow to moderate current over sand or sand mixed with mud or gravel substrates. Over 80 percent of the specimens located during the Apalachicola-Chattahoochee-Flint Basin portion of the status survey were found at sites with a substrate of sand/limestone and collections were often in waters over 10 feet in depth.

Because of the use of avoidance areas around all waterways, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect purple bankclimber and its designated critical habitat**.

Shinyrayed pocketbook- *Hamiota subangulata*

The shinyrayed pocketbook was listed as endangered on 16 March 1998 (63 FR 12664). This species has a restricted distribution, generally low and declining populations, and has experienced a reduction of approximately 63 percent from its historic range. It occurs in generally small subpopulations and shows little evidence of recovering. Principal causes of decline include impoundments, channelization, pollution, and sedimentation that have altered or eliminated habitats required by this species. The shinyrayed pocketbook and its habitats continue to be impacted by excessive sediment bed loads, changes in turbidity, increased suspended solids (primarily resulting from nonpoint-source loading from poor land-use practices, lack of best management practices, and maintenance of existing best management bractices), and pesticides. Other primarily localized impacts include gravel mining, reduced water quality below dams, developmental activities, water withdrawal, impoundments, and non-native species. This species is analyzed because data from Fish and Wildlife Service indicate it may be present on the National Forests in Florida Designated critical habitat occurs upstream of the Apalachicola National Forest. The National Forests in Florida have very low retardant application potential.

Habitat used by this species has been described as muddy sand and sand in slight to moderate current. It is found in medium-sized creeks to medium-sized river, in clean or silty sand substrates in slow to moderate current; specimens are often found in the interface of stream channel and sloping bank habitats. It has been found in the Chipola River in a backwater below a riffle in sand between large rocks. It has also been reported as occurring in the flow-through large river-lake, Dead Lake, near the confluence of the Chipola and Apalachicola Rivers.

Because of the use of avoidance areas around all waterways, and the generally discountable effects (refer to the section on effects common to all bivalves), **use of aerially delivered retardant may affect, but is not likely to adversely affect shinyrayed pocketbook**.

Ochlockonee moccasinshell - *Medionidus simpsonianus*

Ochlockonee moccasinshell was listed as endangered on 16 March 1998 (63 FR 12664). This species is highly restricted in distribution and occurs in generally small subpopulations. Drastic population declines have occurred at all the historical occurrences. It is restricted to only two sites in the main channel of the Ochlockonee River and no longer occurs at six of the seven known historical occurrences. The creation of Talquin Reservoir destroyed much riverine habitat, including probably the once productive occurrence at the upstream end of the reservoir. The species and its habitat continue to be impacted by excessive sediment bed loads of smaller sediment particles, changes in turbidity, increased suspended solids (primarily resulting from nonpoint-source loading from poor land-use practices,), and pesticides. Other primarily localized impacts include gravel mining, reduced water quality below dams, developmental activities, water withdrawal, impoundments, and non-native species. Competition from Asiatic clam is a possibility, due to their great density at upper Ochlockonee sites. Toxic spills are also a possibility in all extant populations. Ochlockonee moccasinshell occurs on the Apalachicola National Forest (National Forests in Florida) and designated critical habitat is upstream off of National Forest System lands. Retardant application potential is very low on the National Forests in Florida.

Ochlockonee moccasinshell has been reported from muddy sand, sand, and gravel substrates in moderate current in medium rivers. In recent surveys it was found in large creeks of the Ochlockonee River main stem in areas with current in sandy substrates with some light gravel in mid-channel areas.

Because of the use of avoidance areas around all waterways, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect Ochlocknee moccasinshell**.

Oval pigtoe– *Pleurobema pyriforme*

Oval pigtoe was listed as endangered on 16 March 1998 (63 FR 12664). This species is experiencing declining populations, limited distribution, restricted habitat, and probable decreasing numbers of extant occurrences. It has lost 73 percent of its historic extent of occurrence, but still persists in 386 river miles of several watersheds. Deteriorating habitat and water quality are potential problems throughout much of its range. Principle causes of decline include impoundments, channelization, pollution, and sedimentation. The species and its habitats continue to be impacted by excessive sediment bed loads of smaller sediment particles, changes in turbidity, increased suspended solids, and pesticides. Other primarily localized impacts include gravel mining, reduced water quality below dams, developmental activities, water withdrawal, impoundments, and non-native species (Asian clam). Toxic spills are also a possibility in all extant populations. Urban sprawl in upper Flint and Chattahoochee may impact potential populations. Chicken farms and silvicultural activities are on the increase in southeastern Alabama, thus threatening stream habitat there. The species is not tolerant of impoundments. Oval pigtoe is found on the Apalachicola National Forest (National Forests in Florida) with critical habitat upstream of National Forest System lands. National Forests of Florida have very low retardant application potential.

Habitat is medium-sized creeks to small rivers where it inhabits silty sand to sand and gravel substrates, usually in slow to moderate current. Stream channels with clean substrates possibly offer the best habitat. Oval pigtoe was recently collected at sites with a wide range of substrate types, including sand and detritus (36 percent), sand and clay or silt (25 percent), and sand and cobble (24 percent) and was more common in mid-channel areas with current than along slack-water areas near stream banks.

Because of the use of avoidance areas around all waterways, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect oval pigtoe**.

Ouachita rock pocketbook-*Arkansia wheeleri*

Ouachita rock pocketbook was listed as endangered on 23 October 1991 (56 FR 54950). This species has experienced historical declines, and currently occupies roughly 30 percent of the area it occupied in the recent past. Ongoing threats include water impoundments, other habitat alterations, and pollution. Only one substantially viable population remains among four or five extant populations (including a few new populations found in the late 1990s) that are incompletely isolated from each other. This species occurs on the Ouachita National Forest, which does not use aerially delivered retardant, and on the National Forests and Grasslands in Texas, which have very low retardant application potential. Critical habitat has not been designated.

This mussel is found in backwater areas of rivers with sluggish current. More specifically, in the Kiamichi River in Oklahoma, these areas are usually found adjacent to sand/gravel/cobble bars that either are scoured clean or support aquatic vegetation. Young have been found in shallow waters in sand bars, and muddy bottoms on the margins of the river where there is little or no current. The Ouachita rock pocketbook inhabits pools, backwaters, and side channels of rivers and large creeks in or near the southern slope of the Ouachita Uplift. This species occupies stable substrates containing gravel, sand, and other materials. The Ouachita rock pocketbook always occurs within large mussel beds containing a diversity of mussel species.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas on the Ouachita National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant may affect, but is not likely to adversely affect Ouachita rock pocketbook.

Spectaclecase - *Cumberlandia monodonta*

Spectaclecase was listed as endangered effective 12 April 2012 (77 FR 14914). The species has largely been reduced to a relatively few disjunct sites, some of which may not be capable of reproduction either through loss of fish hosts or due to adverse environmental conditions. Area of occupancy of this species has been drastically reduced (near 50 percent) with continuing decline of populations. Range extent has also been reduced as the species is extirpated from several states (Indiana, Kansas, Nebraska, Ohio) and many of the remaining populations have poor or no viability. Only populations in the Gasconade and Meramec Rivers of Missouri and perhaps also in the Upper Clinch River, Tennessee are fairly stable for now with the remaining populations in decline. The decline of the spectaclecase in the Mississippi River system is primarily the result of habitat loss and degradation. Chief among the causes of decline are impoundments, channelization, chemical contaminants, mining, and sedimentation. Spectaclecase occurs on the Ozark, Ouachita, George Washington and Jefferson, and Shawnee National Forests, which do not use aerially delivered retardant, and on the Mark Twain National Forest, which has very low retardant application potential. Critical habitat has not been designated.

The spectaclecase occurs in large rivers and is a habitat-specialist, relative to other mussel species. It seems to most often inhabit riverine microhabitats that are sheltered from the main force of current, such as outside rivers bends below bluff lines. Historic records of this species in the Northwest Missouri Lakes is puzzling, but may refer to seasonally flooded oxbow lakes along the Missouri River. It occurs in substrates from mud and sand to gravel, cobble, and boulders in relatively shallow riffles and shoals with slow to swift current. Spectaclecase is usually found in firm mud between large rocks in quiet water very near the interface with swift currents. Specimens have also been reported in tree stumps, root masses, and in beds of rooted vegetation. Like other margaritiferids, spectaclecase tend to be aggregated, particularly under slab boulders or bedrock shelves, where they are protected from the current.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Ozark, Ouachita, George Washington and Jefferson, and Mark Twain National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect spectaclecase**.

Oyster mussel - *Epioblasma capsaeformis*

Critical habitat was designated for oyster mussel and four other species on 31 August 2004 (69 FR 53136). Critical habitat occurs on the Daniel Boone and Jefferson National Forests, which do not use retardant. The primary constituent elements of critical habitat consist of:

- Permanent, flowing stream reaches with a flow regime (i.e, the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish;
- Geomorphically stable stream and river channels and banks (structurally stable stream cross section);
- Stable substrates, consisting of mud, sand, gravel, and/or cobble/boulder, with low amounts of fine sediments or attached filamentous algae;
- Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the five mussels and their host fish; and
- Fish hosts with adequate living, foraging, and spawning areas for them.

There will be no impacts to the primary constituent elements because the forests do not use retardant.

Oyster mussels was listed as endangered on 10 January 1997 (62 FR 1647). This species has declined greater than 80 percent to a few disjunct occurrences from its historic distribution. Populations are distributed in nine tributaries and it is rare at these localities with evidence of decline. One population is threatened by dam construction. The greatest threat to this species is habitat alteration. Principal causes include impoundments, channelization, pollution, and sedimentation. The species and its designated critical habitat occur on the Daniel Boone and Jefferson National Forests, which do not use aerially delivered retardant. The species is also found on the Cherokee National Forest, which has very low retardant application potential.

Oyster mussel inhabits small to medium-sized rivers, and sometimes large rivers, in areas with coarse sand to boulder substrate (rarely in mud) and moderate to swift currents. It is sometimes associated with water-willow beds and in pockets of gravel between bedrock ledges in areas of swift current.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is**

not likely to adversely affect oyster mussel. Because there is not retardant use on the Daniel Boone and Jefferson National Forests there will be **no effect to designated critical habitat**.

Curtis pearlymussel - *Epioblasma florentina curtisi*

Curtis pearlymussel was listed as endangered on 14 June 1976 (41 FR 24062). This subspecies is confined to the Ozark region of Arkansas and Missouri. It may be extinct; however, one live specimen was collected in 1994. Surveys in 1995, 1996, and 1998 did not yield any specimens. Habitat alteration is the chief cause of decline in *Epioblasma florentina curtisi*. Impoundments, gravel dredging, destruction of riparian habitat, channelization, and urbanization all may have played a role in habitat destruction. Habitat destruction and alteration continue to be major threats. The timing of impacts can be as important as the magnitude or duration. Disruptive events at the time of fertilization or when glochidia are released could eliminate an entire cohort. The cause of a severe decline in all mussel populations observed in 1992 is not known. There is no noticeable change in the habitat and no obvious sources of chemical contamination, such as sewage treatment plants or industrial inputs. This species occurs on the Mark Twain National Forest, which has very low retardant application potential. Critical habitat has not been designated.

This species requires high quality water conditions in fourth to seventh order streams. These streams are transition areas between headwater and lowland stream reaches, with a gradient ranging from 0.9 to 8.0 feet per mile and a typically slow current ranging from less than 0.07 to 0.7 feet per second. As with other *Epioblasma*, this species requires stable substrate ranging from sand and gravel to gravel to cobble and boulders; shifting sand or organic material is unsuitable. Water depth is shallow, typically 4 to 30 inches, and it may be found in riffles as well as in runs.

Because of the use of expanded avoidance areas used by the Mark Twain National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect Curtis pearlymussel**.

Tan riffleshell - *Epioblasma florentina walker*

Tan riffleshell was listed as endangered on 26 September 1977 (42 FR 42351). The species is known from the Cumberland and Tennessee River systems. Specimens were historically collected from the Buffalo River in Perry County, Tennessee. It inhabited headwaters of the Flint River, Hurricane Creek, Bear Creek, main channel Tennessee River at Muscle Shoals, French Broad Creek in North Carolina, and possibly Georgia. The federal recovery plan lists historical sites in the Stones, Harpeth, Middle Fork Holston Rivers, as well. This subspecies has declined severely from throughout the Cumberlandian region to only a few occurrences in the Big South Fork Cumberland River in Kentucky and Tennessee. Threats to tan riffleshell include construction of dams, siltation, strip mining, agricultural practices and poor water quality. This species occurs on the Daniel Boone National Forest with no retardant use and on the Cherokee National Forest with very low retardant application potential. Critical habitat has not been designated.

Found in headwaters, riffles, and shoals in sand and gravel substrates. This species is sedentary within relatively silt-free substrates of sand, gravel, and cobble in good flows of smaller streams.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect tan riffleshell**.

Upland combshell (*Epioblasma metastriata*) and southern acornshell (*Epioblasma othcaloogensis*) and fine-lined pocketbook (*Hamiota altilis*) and Alabama moccasinshell (*Medionidus acutissimus*) and Coosa moccasinshell (*Medionidus parvulus*) and southern clubshell (*Pleurobema decisum*) and southern pigtoe (*Pleurobema georgianum*) and ovate clubshell (*Pleurobema perovatum*), and triangular kidneyshell (*Ptychobranchus greenii*)

Critical habitat was designated on 1 July 2004 (69 FR 40084). The primary constituent elements essential for the conservation of these mussel species include the following:

- Geomorphically stable stream and river channels and banks;
- A flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of mussels and their fish hosts in the river environment;
- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages;
- Sand, gravel, and/or cobble substrates with low to moderate amounts of fine sediment, low amounts of attached filamentous algae, and other physical and chemical characteristics necessary for normal behavior, growth, and viability of all life stages;
- Fish hosts with adequate living, foraging, and spawning areas for them; and,
- Few or no competitive or predaceous nonnative species present.

Upland combshell - *Epioblasma metastriata*

Upland combshell was listed as endangered on 17 March 1993 (58 FR 14330). The last collection was made in 1988 (single specimen) from a portion of the Conasauga River around the Georgia/Tennessee border. Surveys since that time have been unable to relocate the species, but potentially suitable habitat is still available in the upper Coosa River drainage. However, it is likely that this species is extinct. Disappearance from significant portions of its range is primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters and more than 1056 miles of large and small river habitat in the Basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes. This species is threatened by habitat modification, sedimentation, and other forms of water quality degradation. Potential habitat is locally impacted by carpet mill and other industrial discharge, sewage treatment plant discharge, urban and agricultural runoff, and surface mine drainage. Upland combshell and its designated critical habitat is found on the National Forests in Alabama, which do not use retardant. The species is also found on the Cherokee National Forest, which has very low retardant application potential.

This species has been located in shoals in rivers and large streams, above the fall line, on stable substrates in moderate to swift currents.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect upland combshell**. Aerial retardant is not used on the National Forests in Alabama therefore there would **be no effect to designated critical habitat**.

Southern acornshell- *Epioblasma othcaloogensis*

Southern acornshell was listed as endangered on 17 March 1993 (58 FR 14330). The last collection was made in 1974 from a portion of the Coosa River drainage in Alabama and Georgia. Surveys in 1990 and 1991 failed to relocate the species, but potentially suitable habitat is still available in the upper Coosa River drainage. Historically, this species was known from the upper Coosa River system and the Cahaba River above the fall line in Alabama, Georgia, and Tennessee, but has not been reported in many years and is likely extinct. The only available information indicates this species is from Lily Shoals of the Cahaba River. Species of this genus typically were found in strong currents and coarse particle substrates. Disappearance from significant portions of its range are primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters and more than 1056 miles of large and small river habitat in the Basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes. This species is threatened by habitat modification, sedimentation, and other forms of water quality degradation. Potential habitat is locally impacted by carpet mill and other industrial discharge, sewage treatment plant discharge, urban and agricultural runoff, and surface mine drainage. Southern acornshell and its designated critical habitat is found on the National Forests in Alabama, which do not use retardant. The species is also found on the Cherokee National Forest, which has very low retardant application potential.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect southern acornshell**. Because aerial retardant in not used on the National Forests in Alabama there would be **no effect to designated critical habitat**.

Finelined pocketbook-*Hamiota altilis*

Finelined pocketbook was listed as threatened on 17 March 1993 (58 FR 14330). This species is a declining regional endemic that was once widespread throughout the Mobile River basin in the Tombigbee, Black Warrior, Cahaba, Alabama, Tallapoosa, and Coosa Rivers in Alabama, Georgia, Mississippi, and Tennessee but has been reduced to a few dozen widespread but isolated occurrences across its range. Disappearance from significant portions of its range is primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters and more than 1056 miles of large and small river habitat in the Basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes. Habitat modification, sedimentation and water quality degradation represent the major threats to this species. The species may also be threatened by overutilization for commercial, recreational, scientific or educational purposes as well as disease and predation. This species is found on the National Forests in Alabama, which have no retardant use, and on the Chattahoochee and Cherokee National Forests, which have very low retardant application potential. Critical habitat occurs on the National Forests in Alabama and the Chattahoochee National Forest.

Habitat information is lacking on this species. Historically, it was found in large rivers to small creek habitats and generally occupies creeks and smaller rivers. It has been found associated with swift flowing riffles and gravel-cobble substrates in the Conasauga River. It has been found in stable sand and in gravel in small streams above the Fall Line.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect finelined pocketbook or its designated critical habitat**.

Alabama moccasinshell- *Medionidus acutissimus*

Alabama moccasinshell was listed as threatened on 17 March 1993 (58 FR 14330). It has disappeared from a significant portion of its historical range including much of southern Alabama and all of the Florida panhandle, primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters and more than 1056 miles of large and small river habitat in the basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes This is a declining regional endemic which could face extinction should the species face further loss or degradation of habitat. Although the population in the Sipsey Fork appears stable, trends in other populations are towards decline or are not known. Habitat modification, sedimentation, and water quality degradation represent the major threats to this species; and it may also be threatened by overutilization for commercial, recreational, scientific or educational purposes as well as disease and predation. Alabama moccasinshell is found on the National Forests in Alabama, which have no retardant use, and on the Chattahoochee and Cherokee National Forests, which have very low retardant application potential. Critical habitat occurs on the National Forests in Alabama and the Chattahoochee National Forest.

This species is usually found in sand on the margins of streams with a typical sand and gravel substrate in clear water of moderate flow in small to large rivers.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect Alabama moccasinshell or its designated critical habitat**.

Coosa moccasinshell- *Medionidus parvulus*

Coosa moccasinshell was listed as endangered on 17 March 1993 (58 FR 14330). The Coosa moccasinshell is a declining regional endemic species whose low numbers make it vulnerable to any impact. All populations have been eliminated (including all occurrences in Alabama) leaving only Conasauga headwaters occurrences (2 or 3) that may not be viable. The species has disappeared from significant portions of its range is primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters and more than 1056 miles of large and small river habitat in the Basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes. Habitat modification, sedimentation and water quality degradation represent the major threats to this species. The species may also be threatened by overutilization for commercial, recreational, scientific or educational purposes as well as disease and predation. Unrestricted cattle access is a direct threat in portions on the Conasauga River in Bradley and Polk Counties, Tennessee. Coosa moccasinshell and its designated critical habitat is found on the National Forests in Alabama, which do not use retardant. The species is also found on the Cherokee National Forest , which has very low retardant application potential.

The species is usually found in sand and gravel in highly oxygenated, clear streams with moderate to strong flow in streams and small rivers.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect coosa moccasinshell**. Because aerial retardant in not used on the National Forests in Alabama there would be **no effect to designated critical habitat**.

Southern clubshell– *Pleurobema decisum*

Southern clubshell was listed as endangered on 17 March 1993 (58 FR 14330). The former area of occupancy included every major drainage system in the Mobile Basin except the Mobile Delta. Recently a few new populations were discovered in the Conasauga, Luxapallila, and Tombigbee drainages. Southern clubshell is a declining regional endemic which faces major threats. Its disappearance from a significant portion of its range is primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters; more than 1056 miles of large and small river habitat in the Basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes. Habitat modification, sedimentation, and water quality degradation represent the major threats to the species. It may also be threatened by overutilization for commercial, recreational, scientific or educational purposes. Any impact to the species is significant and threats continue to be ongoing. This species and its designated critical habitat occur on the National Forests in Alabama, which have no retardant use, and on the Chattahoochee National Forest, which has very low retardant application potential.

The southern clubshell is usually found in highly oxygenated streams with sand and gravel substrate in shoals of large rivers to small streams; may be found in sand and gravel in the center of the stream or in sand along the margins of the stream.

Because of the use of avoidance areas around all waterways, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect southern clubshell or its designated critical habitat.**

Southern pigtoe- *Pleurobema georgianum*

Southern pigtoe was listed as endangered on 17 March 1993 (58 FR 14330). This species is known from only a handful of records in one river system; its disappearance from a significant portion of its range is primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters, and more than 1056 miles of large and small river habitat in the Basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes. This species has also experienced a greater than 70 percent decline in recent years, attributed to changes in river and stream channels due to dams, including extensive impoundment of the Coosa River and its primary tributaries, the effects of point and non-point source pollution on the surviving isolated populations. Excessive nutrient input from multiple sources (for example, nitrogen and phosphorus from fertilizer, sewage waste, animal manure, etc.) into an aquatic system can also have negative cumulative effects. Although about a half dozen occurrences are known, all are widely scattered, localized, and small. Recovery is unlikely and the species continues to face ongoing threats of habitat loss and degradation. Southern pigtoe and its designated critical habitat are found on the National Forests in Alabama, which do not use retardant, and on the Chattahoochee National Forest, which has very low retardant application potential.

This species inhabits high quality rivers (small rivers to large streams) in shoals and runs with stable gravel and sandy-gravel substrates.

Because of the use of avoidance areas around all waterways, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect southern pigtoe or its designated critical habitat**.

Ovate clubshell- *Pleurobema perovatum*

Ovate clubshell was listed as endangered on 17 March 1993 (58 FR 14330). Disappearance from significant portions of its range is primarily due to changes in river and stream channels due to dams, dredging, or mining, and historic or episodic pollution events. The species is not known to survive in impounded waters, and more than 1056 miles of large and small river habitat in the Basin have been impounded by dams for navigation, flood control, water supply, and/or hydroelectric production purposes. This species is a declining regional endemic which may not recover from further loss of habitat. About a half dozen occurrences remain (compared to about two dozen historically) widely scattered in the Mobile basin, and most are threatened by habitat loss. Habitat modification, sedimentation, and water quality degradation are the major threats. It may also be threatened by overutilization for commercial, recreational, scientific, and educational purposes. In the Mobile River basin, the greatest threats are dams, channelization, dredging, mining in locally concentrated areas, and point and nonpoint pollution. Ovate clubshell and its designated critical habitat is found on the National Forests in Alabama, which have no retardant use. The species also occurs on the Cherokee National Forest, which has very low retardant application potential.

This species occupies sand/gravel shoals and runs of small rivers and large streams. Habitat in Tennessee is described as a sand and fine gravel substrate in stretches of river with moderate current and typically at a depth of less than three feet.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect ovate clubshell**. Because there is no aerial retardant use on the National Forests in Alabama, there would be **no effect on designated critical habitat**.

Triangular kidneyshell– *Ptychobranchus greenii*

Triangular kidneyshell was listed as endangered on 17 March 1993 (58 FR 14330). According to NatureServe (2021), rayed kidneyshell (Ptychobranchus foremanianus) was considered synonymous with triangular kidneyshell until 2008. Information from the federal register notice indicates the Fish and Wildlife Service considered individuals to belong within triangular kidneyshell and therefore we are considering extant populations under this species.

Triangular kidneyshell is endemic to the Alabama, Cahaba, Coosa and Tallapoosa River drainages of the Mobile Basin in Alabama, Georgia, and Tennessee. In the Coosa River basin in Georgia, it is known historically from the Coosa, Etowah, Oostanaula, Conasauga, and Coosawattee River drainages. As with the other species in this critical habitat grouping, changes in river and stream channels in the Mobile Basin have resulted in disappearance in significant portions of its range. This is a declining regional endemic species that is rare throughout most of its range. Although some range restriction has occurred, the primary decline is in area of occupancy with a loss of 50 percent of the sites it formerly occupied. This species is found on the National Forests in Alabama , which have no retardant use, and on the Chattahoochee and Cherokee National Forests, which have very low retardant application potential. Critical habitat occurs on the National Forests in Alabama and the Chattahoochee National Forest.

This species appears most prevalent in sections of river three feet in depth and having a good current and a firm substrate as opposed to coarse gravel and sand. It is found in shoals and runs of small rivers and large streams.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect triangular kidneyshell or its designated critical habitat**.

Snuffbox mussel– *Epioblasma triquetra*

Snuffbox mussel was listed as endangered effective 15 March 2012 (77 FR 8632). This species was historically widespread in the upper Mississippi and Ohio River drainages, and widespread but never abundant in the Tennessee River system. This species is declining throughout its range and has become increasingly rare, although several dozen occurrences remain, many of them with good viability. Distribution is greatly fragmented but remains relatively wide. Extant populations can still be found in Wisconsin, Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, Tennessee, and West Virginia. Most populations are small and geographically isolated from one another. Long-term viability of most populations is questionable, especially those in large rivers where zebra mussel populations are now established. It is also threatened by pollution, lowered dissolved oxygen content and elevated ammonia levels, development, and destruction of habitat. This species occurs on the Daniel Boone, George Washington and Jefferson, Ozark, Allegheny and Wayne National Forests, which do not use aerially delivered retardant. It can also be found on the Mark Twain National Forest, which has very low retardant application potential. Critical habitat has not been designated for this species.

This species is found in riffles of small and medium creeks, in large rivers, and in shoals and wave-washed shores of lakes. Except when spawning, adults are usually burrowed deep in sand, gravel or cobble substrates. They are suspension feeders, typically feeding on algae, bacteria, detritus, microscopic animals, and dissolved organic material.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the George Washington and Jefferson, Ozark, and Mark Twain National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect snuffbox mussel**.

Finerayed pigtoe– *Fusconaia cuneolus*

Finerayed pigtoe was listed as endangered on 14 June 1976 (41 FR 24062). This species was historically known from 15 Tennessee River tributaries and is currently known from seven rivers. Many of the historic populations of the finerayed pigtoe were apparently lost when the river sections they inhabited were impounded. The species is currently found in portions of the Clinch and Powell Rivers, the North Fork of the Holston, and in the Paint Rock River. The Clinch River has the only remaining large population; it is reproductively isolated from the Powell River population. Threats include declining water quality and habitat alteration. This species occurs on the George Washington and Jefferson National Forests, which do not use retardant and on the Cherokee National Forest , which has very low retardant application potential. Critical habitat has not been designated.

This species inhabits clear, high gradient streams in firm cobble and gravel substrates. The finerayed pigtoe is found in moderate to high gradient streams with firm cobble or gravel substrates. It appears to prefer riffle areas; however, given the rarity of the species, little is known about specific habitat needs.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect finerayed pigtoe.**

Pink mucket- *Lampsilis abrupta*

Pink mucket was listed as endangered on 14 June 1976 (41 FR 24062). Historically, this widespread mussel was known chiefly from several USA interior basins, including the Ohio, Mississippi, Tennessee, and Cumberland rivers. The overall range of this once very widespread species has diminished by approximately 80%. Surviving populations generally inhabit small stretches of rivers and are typically isolated from others. Although currently known from more than two dozen localities, most are represented by very few, old individuals and likely have poor viability. Known threats include modification of habitat, degradation of water quality (siltation and pollution), and over harvest by the commercial mussel industry This species occurs on the Daniel Boone, George Washington and Jefferson, Ozark, Shawnee and Wayne National Forests, which do not use aerially delivered retardant. It can also be found on the Mark Twain National Forest, which has very low retardant application potential. Critical habitat has not been designated for this species.

Pink mucket is described as a large river species associated with fast-flowing waters. It has been able to survive and reproduce in impoundments with river-lake conditions but never in standing pools of water. It is found in waters with strong currents, rocky or boulder substrates, with depths up to about 3.3 feet, but is also found in deeper waters with slower currents and sand and gravel substrates.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the George Washington and Jefferson, Ozark, and Mark Twain National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect pink mucket**.

Scaleshell mussel– *Leptodea leptodon*

Scaleshell mussel was listed as endangered 9 October 2001 (66 FR 51322). This species has experienced aa approximately 75 percent reduction in number of streams with extant occurrences that has reduced this species from a fairly widespread species to a "regional endemic" in the Interior Highlands region. Extirpations have occurred in Alabama, Iowa, Illinois, Indiana, Kentucky, Minnesota, Ohio, Tennessee, and Wisconsin. While it exists in 14 streams, only three or four populations are thought to be stable and most occurrences are widely disjunct. This species is severely impacted by alteration and inundation of channels, siltation from agriculture and clear-cutting, chemical and organic pollution. The decline of scaleshell is primarily due to threats that cause habitat loss and degradation from construction activities and intensive land use. Scaleshell occurs on the Ouachita and Ozark National Forests, which have no retardant use, and the Mark Twain National Forest, which has very low retardant application potential. Critical habitat has not been designated.

This species occurs in riffles with moderate to high gradients in creeks to large rivers. It is typically associated with riffles, relatively strong currents, and substrate of mud, sand, or assemblages of gravel, cobble, and boulder. It has been found completely buried in the substrate down to depths of 6 inches. It occurs in medium to large rivers with low to moderate gradients in a variety of stream habitats including gravel, cobble, boulders, and occasionally mud or sand substrates.

Because of expanded avoidance areas used by Ouachita, Ozark, and Mark Twain National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect scaleshell**.

Littlewing pearlymussel - *Pegias fabula*

Littlewing pearlymussel was listed as endangered on 14 November 1988 (53 FR 45861). This is a declining regional endemic formerly known from 27 river systems. There are only very few widely disjunct populations remaining at fewer than a dozen sites. Habitat loss continues to threaten the species and some populations are no longer viable. Deterioration of water quality, especially from acid mine drainage is the primary threat to the species. Development of coal, oil, and/or natural gas reserves in the watersheds of the Horse Lick Creek, Big South Fork Cumberland River, Little South Fork Cumberland River, Clinch River, and Cane Creek are potential threats. All populations could potentially be impacted by road construction, stream channel modifications, logging activities, agricultural activities, impoundments, land use changes, and pesticide use. Because all populations inhabit only short stream reaches within 1 to 5 miles of bridges and fords, they are also vulnerable to toxic spills. Historically, many of the isolated populations have been extirpated from acid mine drainage, domestic pollution, and impoundment of rivers which it inhabited. Littlewing pearlymussel occurs on the Daniel Boone and George Washington and Jefferson National Forests, which have no retardant use, and on the National Forests in North Carolina, which have very low retardant application potential. Critical habitat has not been designated.

Littlewing pearlymussel is restricted to small, cool streams. This species is most common at the head of riffles, but also found in and below riffles on sand and gravel substrates with scattered cobbles. It also inhabits sand pockets between rocks, cobbles and boulders, and underneath large rocks. It is usually found lying on top or partially buried in sand and fine gravel between cobble in only 6 to 10 inches of water.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the George Washington and Jefferson, and National Forests in North Carolina, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect littlewing pearlymussel**.

Sheepnose mussel- *Plethobasus cyphyus*

Sheepnose mussel was listed as endangered effective 12 April 2012 (77 FR 14914). The sheepnose has been extirpated throughout much of its former range or reduced to several dozen isolated populations. This species has been eliminated from two-thirds of the total number of streams from which it was historically known although it still has a very wide distribution with dozens of occurrences in the Mississippi and Ohio basins (over two dozen streams in 14 states). Chief among the causes of decline are impoundments (probably the greatest contributing factor to decline), channelization, chemical contaminants, mining, and sedimentation. The majority of the remaining populations are small and geographically isolated. Pollution through point and non-point sources is perhaps the greatest ongoing threat to this species and most freshwater mussels. Residential, mineral and industrial development also pose a significant threat. Destruction of habitat through stream channelization and maintenance and the construction of dams is still a threat in some areas. Sheepnose occurs on the George Washington and Jefferson, Allegheny, Hoosier, Shawnee, and Wayne National Forests, which do not use aerial retardant. It also occurs on the Mark Twain National Forest, which has very low retardant application potential. Critical habitat has not been designated.

Sheepnose mussel generally has been considered a large-river species although it does inhabit medium-sized rivers. It may be associated with riffles and gravel/cobble substrates but usually has been reported from deep water (greater than 6.6 feet) with slight to swift currents and mud, sand, or gravel bottoms. It also appears capable of surviving in reservoirs, such as upper Chickamauga Reservoir immediately below Watts Bar Dam. Specimens in larger rivers may occur in deep runs.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the George Washington and Jefferson and Mark Twain National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect sheepnose mussel**.

Georgia pigtoe- *Pleurobema hanleyianum*

Critical habitat for Georgia pigtoe was designated 2 November 2010 (75 FR 67512). Critical habitat occurs within the boundaries of the National Forests in Alabama (Taladega National Forest), which does not use aerial retardant; and the Cherokee and Chattahoochee National Forests, which have very low retardant application potential. The primary constituent elements of critical habitat for the Georgia pigtoe are the habitat components that provide:

- Geomorphically stable stream and river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation).
- A hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species is found.

Unless other information becomes available, existing conditions at locations where the species occurs will be considered as minimal flow requirements for survival.

- Water quality (including temperature, pH, hardness, turbidity, oxygen content, and chemical constituents) that meets or exceeds the current aquatic life criteria established under the Clean Water Act (33 U.S.C. 1251–1387).
- Sand, gravel, cobble, boulder, or bedrock substrates with low to moderate amounts of fine sediment and attached filamentous algae.
- The presence of fish host(s) for the Georgia pigtoe (species currently unknown). Diverse assemblages of native fish will serve as a potential indication of presence of host fish.

Georgia pigtoe was listed as endangered on 2 November 2010 (75 FR 67512). This species has experienced a tremendous reduction in number of locations and population size. It had formerly been thought extinct until a single subpopulation with only a few live individuals was found in a very localized portion of the upper Conasauga River in Georgia. Causes of the decline can be attributed to extensive impoundment of the Coosa River and its primary tributaries, and the effects of point and non-point source pollution on the surviving isolated populations. This species is found on the Taladega, Cherokee, and Chattahoochee National Forests.

This species inhabits stretches of a medium sized river with good current and a sand/gravel substrate. A substrate composed of coarse sand and gravel in stretches of rivers with good current provides the most suitable habitat. It is found in shallow runs and riffles with strong to moderate current and coarse sand-gravel-cobble bottom.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Cherokee National Forest, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect Georgia pigtoe or its designated critical habitat**.

Slabside pearlymussel – *Pleuronaia dolabelloides*, and fluted kidneyshell – *Ptychobranchus subtenum*

Critical habitat for slabside pearlymussel and fluted kidneyshell was designated 26 September 2013 (78 FR 59555). Critical habitat for both species is found on the George Washington and Jefferson National Forests, which do not use aerial retardant, and on the Cherokee National Forest, which has very low retardant application potential. Critical habitat for fluted kidneyshell is also found on the Daniel Boone National Forest, which does not use retardant. The primary constituent elements for the fluted kidneyshell and slabside mussel are:

- Riffle habitats within large, geomorphically stable stream channels (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation).
- Stable substrates of sand, gravel, and cobble with low to moderate amounts of fine sediment and containing flow refugia with low shear stress.
- A natural hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found, and connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for habitat maintenance, food availability for all life stages, and spawning habitat for native fishes.

- Water quality with low levels of pollutants and including a natural temperature regime, pH (between 6.0 to 8.5), oxygen content (not less than 5.0 milligrams per liter (mg/L)), hardness, and turbidity necessary for normal behavior, growth, and viability of all life stages.
- The presence of abundant fish hosts, which may include
  - the barcheek darter, fantail darter, rainbow darter, redline darter, bluebreast darter, dusky darter and banded sculpin, necessary for recruitment of the fluted kidneyshell.
  - the popeye shiner, rosyface shiner, saffron shiner, silver shiner, telescope shiner, Tennessee shiner, whitetail shiner, white shiner, and eastern blacknose dace, necessary for recruitment of the slabside pearlymussel

These species were listed as endangered on 26 September 2013 (78 FR 59269). They are restricted to the Cumberland (in Kentucky and Tennessee) and Tennessee (in Alabama, Tennessee, and Virginia) River systems.

Slabside Pearlymussel

Historically, this species occurred in the lower Cumberland River main stem from about Caney Fork downstream to the vicinity of the Kentucky State line, and in the Tennessee River main stem from eastern Tennessee to western Tennessee. This species has been eliminated from at least three-fifths of the total number of streams where it was historically recorded. It is experiencing recent and continuing sharp declines in occurrences; with most surviving individuals apparently restricted to two to three populations. Records are known from two Cumberland River tributaries, Caney Fork and Red River. In addition, it is known from nearly 30 Tennessee River system tributaries, Populations remain in nine streams in the Tennessee River system: the Powell River, Clinch River, North Fork Holston River, Big Moccasin Creek, Middle Fork Holston River, Hiwasee River, Paint Rock River, Larkin Fork, Estill Fork, Hurricane Creek, Elk River, Bear Creek, and Duck River. It is also known from Lake Pontchartrain in Mississippi. The species and its designated critical habitat are found on the George Washington and Jefferson National Forests, which have no retardant use and on the Cherokee National Forest, which has very low retardant application potential.

Slabside pearlymussel occurs in moderate to high gradient riffles systems in creeks to large rivers. It is generally found at depths less than 6.6 feet in moderate to swift current velocities. The slabside pearlymussel inhabits sand, fine gravel, and cobble substrates in relatively shallow riffles and shoals. This species requires flowing, well-oxygenated waters to thrive.

Because of the expanded avoidance areas used by the George Washington and Jefferson, and Cherokee National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect slabside pearlymussel or its designated critical habitat**.

Fluted kidneyshell

Historically, this species occurred in the Cumberland River main stem from below Cumberland Falls in southeastern Kentucky downstream through the Tennessee portion of the river to the vicinity of the Kentucky-Tennessee State line. In the Tennessee River main stem it occurred from eastern Tennessee to western Tennessee. Its range has been drastically reduced presumably due to loss of suitable habitat. Although it is still declining today, most of the range reduction occurred historically. Remaining populations are fragmented and only one is truly viable in the long-term. Records are known from approximately 16 Cumberland River tributaries and 21 Tennessee River system tributaries. Currently, it is limited to nine streams in the Cumberland River system and seven streams in the Tennessee River system. It was reported recently in the upper Clinch and Copper Creek (Upper Clinch drainage) and upper South Fork Holston River in Virginia. Fluted kidneyshell and its designated critical habitat are found on the Daniel Boone and George Washington and Jefferson National Forests, which do not use retardant, and on the Cherokee National Forest, which has very low retardant application potential.

This species inhabits small to medium rivers in areas with swift current or riffles, although a few populations were recorded from larger rivers in shoal areas. It is often found embedded in sand, gravel, and cobble substrates. It requires flowing, well-oxygenated waters.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the George Washington and Jefferson, and Cherokee National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect fluted kidneyshell or its designated critical habitat**.

Rabbitsfoot– *Quadrula cylindrica cylindrical*

Rabbitsfoot was listed as threatened effective 17 October 2013 (78 FR 57076). Historically, the rabbitsfoot occurred in the lower Great Lakes sub-basin and Mississippi River Basin from 137 streams in 15 states. The rabbitsfoot is believed extirpated from Georgia and West Virginia, while its continued existence in several other states (e.g., Alabama, Kansas, Louisiana, Mississippi, Missouri) is extremely perilous. Populations are extant in 46 streams in 13 states including: lower Great Lakes sub-basin, Ohio River system, Cumberland River system, Tennessee River system, lower Mississippi River sub-basin, White River system, Arkansas River system, Red River system; in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee, and perhaps Virginia. The species is widespread, but few viable populations remain. Rabbitsfoot is found on the Ouachita, Ozark, Allegheny, and Shawnee National Forests, which do not use retardant; and on the Mark Twain National Forest, which has very low retardant application potential. Critical habitat occurs on the Ouachita and Mark Twain National Forests.

The typical habitat for this species is small to medium rivers with moderate to swift currents, and in smaller streams it inhabits bars or gravel and cobble close to the fast current. It is found in medium to large rivers in sand and gravel at depths up to 9.8 feet. Despite their streamlined appearance, specimens are more often found fully exposed lying on their sides on top of the substrate.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the Ouachita, Ozark, and Mark Twain National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect rabbitsfoot or its designated critical habitat**.

Cumberland bean – *Villosa trabalis*

Cumberland bean was listed as endangered on 14 June 1976 (41 FR 24062). Critical habitat has not been designated. Once found throughout the Cumberlandian region, it is now restricted to four rivers and has become extirpated from a significant portion of its range. Only a few disjunct occurrences remain, some with questionable viability. Reasons for decline include impoundment, siltation, and pollution Cumberland bean is found on the Daniel Boone, and George Washington and Jefferson National Forests, which do not use retardant. It also occurs on the Cherokee National Forest and National Forests in North Carolina, which have very low retardant application potential.

This species is found in sand, gravel, and cobble substrates in waters with moderate to swift currents and depths less than 3.3 feet. Mussels are most often observed in clean, fast-flowing water in substrate which contain relatively firm rubble, gravel, and sand swept-free from siltation. It is usually buried in shallow riffle and shoal areas.

Because of the use of avoidance areas around all waterways and the expanded avoidance areas used by the National Forests in North Carolina, and the George Washington and Jefferson, and Cherokee National Forests, and the generally discountable effects (refer to the section on effects common to all bivalves), use of aerially delivered retardant **may affect, but is not likely to adversely affect Cumberland bean**.

Gastropods

Aerially applied retardant was found to have No Effect on lacy elimia (*Elimia crenatella*), round rocksnail (*Leptoxis ampla*), painted rocksnail (*Leptoxis taeniata*), flat pebblesnail (*Lepyrium showalteri*), cylindrical lioplax (*Lioplax cyclostomaformis*), and Tulotoma snail (*Tulotoma magnifica*). A summary of the rationale for each species in found in appendix F.

Table 35. Summary of effects determinations for gastropod species and critical habitats

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Antrobi culveri	Tumbling Creek cavesnail	E, (CH)	na	NLAA
Athearnia anthonyi	Anthony's riversnail	E, XN	na	NLAA, NLJ
Patera (Mesodon) clarki nantahala	noonday globe	T	na	NLAA
Pyrgulopsis trivialis	Three Forks springsnail	E, CH	LAA	LAA
Tryonia alamosae	Alamosa springsnail	E	na	NLAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Tumbling Creek cavesnail - *Antrobi culveri*

Tumbling Creek cavesnail was listed as endangered on 14 August 2002 (67 FR 52879). It was historically known from small section of Tumbling Creek in southwestern Missouri, in the middle one-third of the lower stream. It is now found only in a single stream in Tumbling Creek Cave. Population numbers of this species remain precariously low and the species consequently remains on the verge of extinction (NatureServe 2021).

Tumbling Creek cavesnail habitat occurs on the Mark Twain National Forest, which has very low retardant application potential. Critical habitat for the species (76 FR 37663) occurs off National Forest System lands, just south of the forest boundary. Tumbling Creek does receive runoff from the forest, therefore there would be no downstream effects to critical habitat. ***Habitat for the cavesnail is protected by an aquatic avoidance area (300-foot buffer)***, which reduces the probability of retardant entering the water. Because retardant application potential on the Mark Twain is very low, and habitat is within an avoidance area, any potential effects are discountable. Therefore, aerially applied retardant **may affect but is not likely to adversely affect Tumbling Creek cavesnail**.

Anthony's Riversnail - *Athearnia anthonyi*

Anthony's riversnail was listed as endangered on 15 April 1994 (59 FR 17994) and an experimental, non-essential population was established effective 15 October 2007 (72 FR 52434). This species occurs on the Cherokee National Forest, which has very low retardant application potential. The experimental, non-essential population area overlaps much of the species' range on the forest.

The Anthony's riversnail is known from only three disjunct populations in Tennessee, in the Tennessee River system: the Tennessee River, Sequatchie River, and Limestone Creek. The species prefers medium to large river habitats with cobble/boulder substrates in the vicinity of riffles with strong current. Habitat and water quality degradation remain the greatest threats to the snail rangewide, and the species remains highly vulnerable to increased urbanization and potential stochastic events. Due to the limited distribution, small population size, and continued threats to Anthony's riversnail, it continues to be in danger of extinction throughout its range NatureServe 2021).

The Cherokee National Forest has implemented avoidance areas with 500-foot buffers. This reduces the probability of retardant entering the species habitat to discountable levels. Therefore, aerially applied retardant **may affect but is not likely to adversely affect Anthony's riversnail**. The action **would not jeopardize the experimental, non-essential population**.

Noonday Globe – *Patera (Mesodon) clarki nantahala*

The noonday globe is a snail that is endemic to a two-to-five mile area along the southeast side of the Nantahala River Gorge in the Nantahala National Forest, Swain County, North Carolina. It was listed as Threatened in 1978 (43 FR 28932); there is no designated critical habitat. The noonday globe appears to be most abundant on and around moist, calcareous rocky outcrops that are often covered with a variety of bryophytes and fungi, along the north-facing slope of the gorge where there are many small streams and waterfalls. It can also be found in thick leaf litter and humus layers around the base of ferns. Within its known distribution, it appears to be most strongly associated with places where shade exists for most of the day (USDI Fish and Wildlife Service 2019). Little is known about the species, but threats appear to include habitat loss due to transportation developments, and associated non-native invasive vegetation. A fire in 2016 burned through nearly all of the known habitat of the noonday globe, but subsequent surveys found abundant snails in the area and slightly expanded the known distribution of the species (USDI Fish and Wildlife Service 2019). The potential effects of aerial retardant to this species are unknown.

The National Forests in North Carolina have very low application potential. During the period from 2012 through 2019, aerial retardant was used in only one year, in which 19,583 gallons was used, affecting a maximum of 50 acres. There have been no reported intrusions into avoidance areas since record-keeping began in 2000.

The potential for effects is discountable because of very low retardant application potential, type of habitat (moist, very steep north-facing) where retardant is not typically used, and proximity to streams and other waterbodies protected by avoidance areas. Because of the low retardant application potential, type of habitat, and very limited distribution, aerially applied retardant **may affect but is not likely to adversely affect the noonday globe**.

Avoidance area mapping is required for noonday globe snail due to the very limited distribution and non-mobility of this species.

Three Forks Springsnail - *Pyrgulopsis trivialis*

Three Forks springsnail (*Pyrgulopsis trivialis*) was listed endangered with critical habitat effective 17 May 2012 (77 FR 23060). The species is known to occur in spring complexes along Boneyard Creek and the North Fork East Fork Black River, in the White Mountains on the Apache National Forest in eastern Arizona. These spring complexes are found in open-mountain meadows at 8,200 feet elevation. The species has been found in free-flowing springheads, concrete boxed springheads, spring runs, spring seeps, and shallow ponded water. The species can be locally abundant but has experienced localized population declines.

A total 17.2 acres has been designated as critical habitat, all on the Apache National Forest. The primary constituent elements of critical habitat are:

- Adequately clean spring water (free from contamination) emerging from the ground and flowing on the surface;
- Periphyton (attached algae), bacteria, and decaying organic material for food;
- Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation, for egg laying, maturing, feeding, and escape from predators; and
- Either an absence of nonnative predators (crayfish) and competitors (snails) or their presence at low population levels.

Aerially delivered retardant would not impact the substrate or predator/competitor primary constituent elements. If retardant were to enter the water it would cause short term contamination, and could result in increased growth of algae, or killing of algae from the fertilizing properties of the retardant.

Springsnail habitat is protected by avoidance areas with 300-foot buffers. However, these springs may be difficult to identify from the air. Fire retardant drops in 2004 are suspected to be the cause of the near extirpation of the species from Three Forks springs. Although the probability of intrusion into habitat is reduced by implementation of avoidance areas and the low retardant potential, this species appears to be highly susceptible to adverse impacts of retardant. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Three Forks springsnail and its designated critical habitat**. ***Avoidance area mapping is required*** due to its limited distribution and the threat fire retardant poses.

Alamosa springsnail– *Tryonia alamosae*

The Alamosa springsnail is a rare, hydrobiid snail that was listed as Endangered on 30 September 1991 (56 FR 49646); no critical habitat is designated. The species is endemic to a single thermal spring system in southwestern Socorro County, New Mexico. It has been observed in two spring complexes within the system: Ojo Caliente and Alamosa Warm Springs. Suitable habitat is located within five thermal springs sources and associated spring runs, downstream from the area of known occurrence to Monticello Box on private and State land within Alamosa Creek Canyon. Neither the springsnail nor its habitat occur on the Cibola National Forest; occupied habitat is approximately 0.6 miles from the forest boundary. Because habitat occurs downstream of the Cibola National Forest within the same watershed, potential impacts of aerially applied retardant are analyzed.

Population numbers appear to be slowly increasing at Ojo Caliente after a reported flood event (USDA Forest Service Cibola National Forest 2020). Threats include climate change, groundwater pumping, declines in water quality, and non-native invasive species, as well specialized habitat preferences and extremely limited dispersal capability (NatureServe 2021)

Aerially applied retardant could alter the water chemistry if it reaches the stream. Alamosa Warm Springs is not hydrologically connected to lands on the Cibola. Although the watershed upstream of Ojo Caliente includes Cibola National Forest lands, Alamosa Creek is ephemeral upstream of the springs and a significant run-off event would be required to transport retardant chemical downstream (USDA Forest Service 2011). The ecological risk assessment (Auxilio Management Services 2021) uses the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model to predict the risks of aerial retardant use in a runoff scenario. The risk assessment concluded that the modeled retardants do not pose any risks to threatened or endangered species from runoff.

The Cibola National Forest has moderate retardant application potential in lands adjacent to where this species lives. The Forest has not reported any intrusions of retardant into avoidance areas in the last eight years. Because the Forest has more than one retardant drop a year, the chance of intrusion is greater than 0.1 percent (refer to aquatics portion of the National Effects Screening Process, section 4.2 of this document). However, because the occupied habitat is approximately 0.6 miles from the forest boundary, and the risk assessment indicated no risks from runoff, use of aerial retardant **may affect but is not likely to adversely affect** this species. ***Avoidance area mapping is not required for the species because it does not occur on National Forest System lands.***

Crustaceans

Aerially applied retardant was found to have No Effect on Madison Cave isopod (*Antrolana lira*), Benton County Cave crayfish (*Cambarus aculabrum*), Big Sandy crayfish (*Cambarus callainus*), and Hell Creek Cave crayfish (*Cambarus zophonastes*). A summary of the rationale for each species in found in appendix F.

Table 36. Summary of effects determinations for crustacean species

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Branchinecta conservatio	Conservancy fairy shrimp	E, (CH)	na	NLAA
Branchinecta lynchi	vernal pool fairy shrimp	T, CH	NLAA	NLAA
Branchinecta sandiegonensis	San Diego fairy shrimp	E, (CH)	na	NLAA

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Lepidurus packardi	vernal pool tadpole shrimp	E, (CH)	na	NLAA
Streptocephalus wootoni	Riverside fairy shrimp	E, (CH)	na	NLAA
Pacifastacus fortis	Shasta crayfish	E	na	LAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

Vernal pool shrimp species

Vernal pools are depressions in areas where a hard underground layer prevents rainwater from draining downward into the subsoils. When rain fills the pools in the winter and spring, the water collects and remains in the depressions. In the springtime the water gradually evaporates away, until the pools become completely dry in the summer and fall (https://wildlife.ca.gov/Conservation/Plants/Vernal-Pools).

The life cycle of the five shrimp species occurs from December to May and follows the same general pattern. When the vernal pools fill with water the young hatch and mature rapidly. Prior to the pool drying, females lay hardy resting eggs, called cysts, in the bottom of the pools. These cysts survive the dry season and hatch when the rain again inundates the pool.

A description of each species status and its habitat is provided, followed by a combined discussion of effects to all five shrimp species considered here. Only one of the species considered (vernal pool fairy shrimp) had designated critical habitat that occurs on National Forest System lands. The discussion of and determination for that critical habitat is at the end of the species discussion.

Conservancy fairy shrimp– *Branchinecta conservatio*

Conservancy fairy shrimp was listed as endangered on 19 September 1994 (59 FR 48136). It is restricted to approximately ten disjunct localities each comprised of one to twenty separate vernal pools in areas that face continued urban and agricultural development. It inhabits turbid, slightly alkaline, large, deep, vernal pools and winter lakes in California grassland areas. These pools are filled with winter and spring rains and last into June. The species ranges in elevations from 16 to 475 feet (NatureServe 2021). This species is known to occur on the Los Padres National Forest which has high retardant application potential. Designated critical habitat does not occur on National Forest System lands (71 FR 7118).

Vernal pool fairy shrimp-*Branchinecta lynchi*

Vernal pool fairy shrimp were listed as threatened on 19 September 1994 (59 FR 48136). This is the most widely distributed of the California endemic large branchiopods occurring throughout most of the length of California's Central Valley. While it is not as restricted in range as some of the other fairy shrimp, it is not considered abundant at any site and its habitat continues to be threatened by urban and agricultural development and climate change (NatureServe 2021).

Vernal pool fairy shrimp occurs on the Los Padres National Forest, which has high retardant application potential.

This species inhabits vernal pools and similar ephemeral wetlands. It is most commonly found in grassed or mud bottomed pools or basalt flow depression pools in unplowed grasslands. Vernal pool fairy shrimp also inhabit a variety of natural and artificial seasonal wetland habitats, such as alkali pools, ephemeral drainages, stock ponds, roadside ditches, vernal swales, and rock outcrop pools. Whatever the habitat, the wetlands in which this species is found are generally small and shallow, although they are occasionally found in large, deeper wetlands (NatureServe 2021).

Critical habitat was designated on 10 February 2006 (71 FR 7118). Unit 32 lies wholly on the Los Padres National Forest and includes 44,580 acres. Unit 31 is 5,527 acres and the northernmost portion includes the Los Padres National Forest. The primary constituent elements of critical habitat for vernal pool fairy shrimp are the habitat components that provide:

- Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools described below in paragraph, providing for dispersal and promoting hydroperiods of adequate length in the pools.
- Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years, thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands.
- Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and
- Structure within the pools described above, consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter.

Aerially delivered retardant would not impact the topographic or depressional features that create vernal pool fairy shrimp critical habitat. Fire season on the Los Padres National Forest occurs from June to December and ends when the rains begin. Because the active period of the shrimp occurs after the fire season there would be no effects to the food sources. The fertilizing properties of retardant can result in increased growth of the organic structure found in vernal pools, or possibly the premature death of these plants from overfertilization. This is not expected to alter the available shelter within the pools from these organic structures. **Aerially delivered fire retardant may affect but is not likely to adversely affect conservancy fairy shrimp critical habitat.**

San Diego fairy shrimp- *Branchinecta sandiegonensis*

San Diego fairy shrimp was listed as endangered on 3 February 1997 (62 FR 4925). It is generally restricted to vernal pools and other ephemeral basins in coastal Orange and San Diego Counties in southern California and in northwestern Baja California, Mexico. Vernal pools in southern California typically contain water in the winter and are dry in the summer. The San Diego fairy shrimp is a habitat specialist found in shallower pools that range in depth from 2 to 12 inches in groups of vernal pools referred to as vernal pool complexes. These complexes tend to include between 5 and 50 vernal pools that are hydrologically connected, although some contain as few as two vernal pools and some contain several hundred vernal pools. San Diego fairy shrimp occur on the Cleveland National Forest, which has high retardant application potential. There is no designated critical habitat.

Vernal pool tadpole shrimp- *Lepidurus packardi*

Vernal pool tadpole shrimp was listed as endangered on 19 September 1994 (59 FR 48136). It is one of the more widely distributed California tadpole shrimp and is endemic to the northern Central Valley of California. It is found in a variety of natural and artificial, seasonally ponded habitat types including vernal pools, swales, ephemeral drainages, stock ponds, reservoirs, ditches, backhoe pits, and vehicle ruts. Wetland habitats vary in size, depth and volume (NatureServe 2021). The species may be present on the Sequoia National Forest, although known occurrences are near the forest but not on it. Designated critical habitat does not occur on National Forest System lands (71 FR 7118).

Riverside fairy shrimp - *Streptocephalus woottoni*

Riverside fairy shrimp was listed as endangered on 3 August 1993 (58 FR 41384). Once thought to have the most restricted distribution of any fairy shrimp, it is estimated that 59 acres of occupied habitat remains at 45 separate complexes in Los Angeles, Orange, San Diego, and Ventura Counties, California and Baja California, Mexico. The species occurs on the Angeles National Forest, which has high retardant application potential. Designated critical habitat does not occur on National Forest System lands (77 FR 72069).

Riverside fairy shrimp is generally found in vernal pool complexes, which average five to 50 pools although some contain as few as two and a few contain several hundred; that are generally hydrologically connected. It is also found at one man-made complex at Johnson Ranch. Sites in Riverside County are vernal pools that occur in earth slump basins or tectonic swales, in patches of grassland and agriculture interspersed in coastal sage scrub vegetation. This species appears later in the season than other fairy shrimp and is considered a warm water species (NatureServe 2021).

Effects to shrimp species

The fire season, and therefore the period during which aerial fire retardant would be used, on each of the National Forest units occupied by the species described above occurs during the dormant period for vernal pool shrimp (USDA Forest Service 2020d). The dormant cysts are very resilient, and retardant is not expected to affect them. Based on studies conducted by the United States Geological Survey, the toxicity of any retardant drops in pools when they are dry would be reduced by weathering events. Because each of the species has limited distribution and the pools are dry during the fire season, avoidance areas (300-foot buffer) are required around species habitat. The potential effects to the species are discountable because retardant use is during the dormant season and avoidance areas lessen the probability of retardant drops in habitat. Aerially applied fire retardant may affect but is not likely to adversely affect conservancy fairy shrimp, vernal pool fairy shrimp, Sand Diego fairy shrimp, vernal pool tadpole shrimp, and Riverside fairy shrimp.

Shasta crayfish - *Pacifastacus fortis*

Shasta crayfish was listed as endangered on 30 September 1988 (53 FR 38460). This species is known from a limited range (less than 3200 acres) that is now reduced to scattered, disjunct occurrences with declining numbers of individuals. There is also declining habitat quality in headwaters areas fragmented by dams. Shasta crayfish is threatened by habitat modification and introduction of non-native species of fish and crayfish. This species is found on the Lassen National Forest, which has moderate retardant application potential, and on the Modoc National Forest, which has high retardant application potential. Critical habitat has not been designated.

Shasta crayfish prefer rocky, gravelly bottoms in spring pools and slow to moderately flowing waters. They live in cool, clear, spring-fed lakes, rivers and streams, usually at or near a spring inflow source, where water shows little annual fluctuation in temperature and remains cool during the summer. The most important habitat requirement appears to be the presence of adequate volcanic rock rubble to provide escape cover from predators (NatureServe 2021).

This species is gregarious. Individuals are active year round, but more so in the summer. Brooding females are more secretive and probably more active at night. Shasta crayfish do not migrate and are not strong swimmers (NatureServe 2021).

The Forest Service implemented avoidance areas with 1,000-foot buffers for a distance of 6.2 miles upstream of Shasta crayfish occurrences. These avoidance areas minimize the potential for an intrusion to occur in hydrologically connected waterways (Krueger 2011). Because of the moderate to high retardant use potential, the limited distribution and disjunct occurrences, and the potential toxicity of retardant to this aquatic species, **aerial retardant may affect and is likely to adversely affect Shasta crayfish**. ***Avoidance area mapping is required for the species***.

Fish

Aerially applied retardant was found to have No Effect on blackside dace (*Chrosomus cumberlandensis*), pygmy sculpin (*Cottus paulus*), slender chub (*Erimystax cahni*), yellowcheek darter (*Etheostoma moorei*), candy darter (*Etheostoma osburni*) or its designated critical habitat, rush darter (*Etheostoma phytophilum*), Kentucky arrow darter (*Etheostoma spilotum*) or its critical habitat, Cumberland darter (*Etheostoma susanae*) and its critical habitat, delta smelt (*Hypomesus transpacificus*), palezone shiner (*Notropis albizonatus*), Cahaba shiner (*Notropis cahabae*), pearl darter (*Percina aurora*) or its critical habitat, leopard darter (*Percina pantherina*), Roanoke logperch (*Percina rex*), and Alabama sturgeon (*Scaphirhynchus suttkusi*) or it designated critical habitat. A summary of the rationale for each species in found in appendix F.

Table 37. Summary of effects determinations for fish species and critical habitats

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Acipenser transmontanus	white sturgeon - Kootenai River population	E, (CH)	na	NLAA
Catostomus discobolus yarrowi	Zuni bluehead sucker	E, CH	LAA	LAA
Catostomus santaanae	Santa Ana sucker	T, CH	LAA	LAA

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Catostomus warnerensis	Warner sucker	T, (CH)	NLAA	NLAA
Chasmistes brevirostris	shortnose sucker	E, CH	LAA	LAA
Chasmistes liorus	June sucker	E, (CH)	NLAA	NLAA
Crenichthys nevadae	railroad valley springfish	T, (CH)	na	LAA
Cyprinella caerulea	blue shiner	T	na	NLAA
Cyprinodon macularius	desert pupfish	E, (CH)	na	LAA
Deltistes luxatus	Lost River sucker	E, CH	LAA	LAA
Erimonax monachus	spotfin chub	T, XN, CH	NLAA	NLAA
Etheostoma etowahae	Etowah darter	E	na	NLAA
Etheostoma percnurum	duskytail darter	E, XN	na	NLAA
Gasterosteus aculeatus williamsoni	unarmored 3-spine stickleback (Shay Creek stickleback)	E	na	LAA
Gila(Siphateles) bicolor snyderi	Owens tui chub	E, CH	LAA	LAA
Gila cypha	humpback chub	T, (CH)	na	LAA
Gila ditaenia	Sonora chub	T, CH	LAA	LAA
Gila elegans	bonytail chub	E, (CH)	na	LAA
Gila intermedia	Gila chub	E, CH	LAA	LAA
Gila nigrescens	Chihuahua chub	T, (CH)	na	LAA
Gila purpurea	Yaqui chub	E, (CH)	na	LAA
Hybognathus amarus	Rio Grande silvery minnow	E, (CH)	na	NLAA
Ictalurus pricei	Yaqui catfish	T, (CH)	na	LAA
Lepidomeda vittata	Little Colorado spinedace	T, CH	LAA	LAA
Meda fulgida	spikedace	E, CH	LAA	LAA
Notropis girardi	Arkansas River shiner	T, (CH)	na	LAA
Noturus baileyi	smoky madtom	E, CH	NLAA	NLAA
Noturus flavipinnis	yellowfin madtom	T, CH	NE	NLAA
Oncorhynchus aguabonita whitei	Little Kern golden trout	T, CH	LAA	LAA
Oncorhynchus apache	Apache trout	T	na	LAA
Oncorhynchus clarki henshawi	Lahontan cutthroat trout	T	na	LAA

Scientific Name	Common Name	Status[1]	Critical Habitat Determination[2]	Species Determination[2]
Oncorhynchus clarki seleniris	Paiute cutthroat trout	T	na	LAA
Oncorhynchus clarki stomias	greenback cutthroat trout	T	na	LAA
Oncorhynchus gilae gilae	Gila trout	E	na	LAA
Percina antesella	amber darter	E, (CH)	na	NLAA
Percina aurolineata	goldline darter	T, (PCH)	na	NLAA
Percina jenkinsi	conasauga logperch	E, CH	NLAA	NLAA
Percina tanasi	snail darter	T	na	NLAA
Poeciliposis occidentalis occidentalis	Gila topminnow	E	na	LAA
Ptychocheilus lucius	Colorado pikeminnow	E, (CH), XN	na	LAA
Rhinichthys osculus thermalis	Kendall Warm Springs dace	E	na	NLAA
Salvelinus confluentus	bull trout	T, CH	LAA	LAA
Scaphirhynchus albus	pallid sturgeon	E	na	NLAA
Tiaroga cobitis	loach minnow	E, CH	LAA	LAA
Xyrauchen texanus	razorback sucker	E, CH	LAA	LAA

[1] T= Threatened, E=Endangered, XN= Nonessential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System lands.
[2] NE= No Effect; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect; NLJ= Not Likely to Jeopardize the continued existence of the species (applies only to non-essential, experimental populations)

White sturgeon (Kootenai River population) - *Acipenser transmontanus*

The Kootenai River population of white sturgeon was listed as endangered on 6 September 1994 (59 FR 45989). It occurs on the Kootenai and Idaho Panhandle National Forests, which have moderate retardant application potential. Designated critical habitat occurs downstream of National Forest System lands in the vicinity of Bonners Ferry, Idaho.

This sturgeon occurs in 168 miles of the Kootenai River and Kootenay Lake. Sturgeons move into the deepest holes on the river and in Kootenay Lake in late summer and fall and remain there for the winter. In spring they migrate to the spawning reach near Bonners Ferry. Successful spawning requires:

- water depths of at least 16 feet,
- flows with a minimum mean water column velocity of at least 3.3 feet per second,

- stable temperatures of roughly 50 degrees Fahrenheit from May through July with no sudden drops in temperature exceeding 3.6 degrees, and
- rocky substrate for at least 5 miles.

White sturgeon has a limited range with an isolated population with small numbers (1468 adults). There has been very limited reproduction since 1977. This species is negatively impacted by river impoundment and probably other habitat alterations (NatureServe 2021).

During 2018, operations on the Highway 37 fire on the Kootenai National Forest resulted in three retardant intrusions into water a few miles upstream of known white sturgeon distribution. The 2011 biological assessment (USDA Forest Service 2011b) and biological opinion (USDI Fish and Wildlife Service 2011) assumed that any white sturgeon present in the upstream extent of their known range would be adults, and less susceptible to retardant effects as compared to young life stages. In addition, the ecological risk assessment (Auxilio Management Services 2021) found no risks to threatened or endangered fish species in large streams (flow over 350 cubic feet per second). The occupied portion of the Kootenai River in western Montana generally flows at more than 3,000 cubic feet per second at all times of the year. Therefore, these intrusions are unlikely to have resulted in toxic effects to the sturgeon. Based on no risk of lethal or sublethal toxic effects, the presence of aquatic avoidance areas (300-foot buffers) that reduce the probability of retardant entering the water, and the moderate retardant application potential, effects to white sturgeon are considered discountable. Therefore, aerially applied retardant **may affect but is not likely to adversely affect white sturgeon**.

Zuni bluehead sucker - *Catostomus discobolus yarrowii*

Zuni bluehead sucker was listed as endangered on 24 July 2014 (79 FR 43131). This sucker is native to headwater streams of the Little Colorado River in east-central Arizona and west-central New Mexico, at elevations of 2,000-6,760 feet. Currently the subspecies occurs in low numbers in several creeks in the Kinlichee Creek and Canyon de Chelly areas in Arizona and is restricted to three isolated populations in the upper Rio Nutria drainage in the Zuni River watershed in west-central New Mexico. The species occurs on streams of the Cibola National Forest, which has moderate retardant application potential.

Critical habitat was designated 7 June 2016 (81 FR 36761). There are 12.1 miles of designated critical habitat on the Cibola National Forest. The primary constituent elements specific to the Zuni bluehead sucker are:

- A riverine system with habitat to support all life stages of the Zuni bluehead sucker (egg, larval, juvenile, and adult), which includes:
    - ♦ Dynamic flows that allow for periodic changes in channel morphology and adequate river functions, such as channel reshaping and delivery of coarse sediments;
    - ♦ Stream courses with perennial flows or intermittent flows that serve as connective corridors between occupied or seasonally occupied habitat through which the subspecies may disperse when the habitat is wetted;
    - ♦ Stream mesohabitat types including runs, riffles, and pools with substrate ranging from gravel, cobble, and bedrock substrates with low or moderate amounts of fine sediment and substrate embeddedness;

- ♦ Streams with depths generally less than 23.3 feet, and with slow to swift flow velocities less than 1.15 feet per second;
- ♦ Clear, cool water with low turbidity and temperatures in the general range of 35.6 to 73.4 degrees Fahrenheit;
- ♦ No harmful levels of pollutants; and
- ♦ Adequate riparian shading to reduce water temperatures when ambient temperatures are high and provide protective cover from predators.

- An abundant aquatic insect food base consisting of fine particulate organic material, filamentous algae, midge larvae, caddisfly larvae, mayfly larvae, flatworms, and small terrestrial insects.
- Areas devoid of nonnative aquatic species or areas that are maintained to keep nonnatives at a level that allows the Zuni bluehead sucker to continue to survive and reproduce.

If retardant enters critical habitat it has the potential to create harmful levels of pollutants for a short time (several hours), and to reduce the insect food base. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, it does not eliminate the possibility of that occurring. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Zuni bluehead sucker critical habitat**.

Habitat for this species is generally low-velocity pools and pool-runs with seasonally dense algae, particularly shady areas with cobble/boulder/bedrock substrates. Occupied pools often are edged by emergent aquatic vascular plants (for example, willows, cattail). Fry and young prefer shallow areas in backwaters or near the shoreline (NatureServe 2021).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Because the Cibola National Forest has moderate retardant potential, and despite having avoidance area for this species, aerial retardant **may affect and is likely to adversely affect Zuni bluehead sucker**. ***Avoidance area mapping is required due to the limited distribution of the species.***

Santa Ana sucker - *Catostomus santaanae*

Santa Ana sucker was listed as threatened on 12 April 2000 (65 FR 19686). It is restricted to southern California, where a few viable populations exist. Santa Ana sucker are found on the Angeles and San Bernardino National Forests, which have high retardant application potential.

Revised critical habitat was designated 14 December 2010 (75 FR 77962). Critical habitat subunit 1A, the Upper Santa Ana River, includes 74 acres of federal land, a portion of which is on the San Bernardino National Forest. This unit was not occupied at the time of listing. Unit 2, the San Gabriel River, is entirely within the boundary of the Angeles National Forest. This unit is 917 acres of National Forest System lands and 83 acres of private land. Subunit 3a includes 242 acres of the upper reaches of Big Tujunga Creek on the Angeles National Forest. Subunit 3B is entirely on the Angeles National Forest and includes 44 acres of Gold, Delta and Stone Creeks. This unit was not occupied at the time of listing. The primary constituent elements essential to the conservation of Santa Ana sucker are the following:

- A functioning hydrological system within the historical geographic range of Santa Ana sucker that experiences peaks and ebbs in the water volume (either naturally or regulated) that encompasses areas that provide or contain sources of water and coarse sediment necessary to maintain all life stages of the species, including adults, juveniles, larvae, and eggs, in the riverine environment;

- Stream channel substrate consisting of a mosaic of loose sand, gravel, cobble, and boulder substrates in a series of riffles, runs, pools, and shallow sandy stream margins necessary to maintain various life stages of the species, including adults, juveniles, larvae, and eggs, in the riverine environment;
- Water depths greater than 1.2 inches and bottom water velocities greater than 0.01 feet per second;
- Clear or only occasionally turbid water;
- Water temperatures less than 86 degrees Fahrenheit;
- Instream habitat that includes food sources (such as zooplankton, phytoplankton, and aquatic invertebrates), and associated vegetation such as aquatic emergent vegetation and adjacent riparian vegetation to provide:
  - ♦ Shading to reduce water temperature when ambient temperatures are high,
  - ♦ shelter during periods of high water velocity, and
  - ♦ protective cover from predators; and
- Areas within perennial stream courses that may be 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.

If retardant enters critical habitat it has the potential to create turbid or red-colored water for a short time (several hours), and to reduce the insect food base. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, it does not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Santa Ana sucker critical habitat.**

This species is usually found in pools and runs of small to medium-sized (less than 23 feet wide), shallow streams with cool, unpolluted water. It is generally associated with coarse substrates of boulder, rubble, and sand, but sometimes occurs on sand/mud bottom. Santa Ana sucker can inhabit reservoirs. Population sizes normally fluctuate drastically in conjunction with periodic, severe flooding. This species is adapted for rapid population recovery following those events (NatureServe 2021). Seventy-five percent of the native range of this species has been lost, and the remaining suitable habitat is threatened by dams, draining, and pollution.

Avoidance area mapping for the Santa Ana sucker includes a 600-foot wide buffer from known populations due to steep slope/terrain, reduced water levels, isolated populations, and risk of loss of the population. The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. The Angeles and San Bernardino National Forests have high retardant potential, and despite having large avoidance areas for this species, **aerial retardant may affect and is likely to adversely affect Santa Ana sucker**.

Warner sucker - *Catostomus warnerensis*

Warner sucker was listed as threatened with designated critical habitat on 27 September 1985 (50 FR 39117). The species is restricted to one small hydrologic basin in Oregon and a very small area in Nevada. Warner sucker is found approximately one mile downstream of the Fremont-Winema National Forest, which has moderate retardant application potential.

Critical habitat is also found approximately one mile downstream of National Forest System lands. Because of its downstream proximity to National Forest System lands where aerial retardant may be used, potential effects to critical habitat are addressed in this analysis. Habitat for the Warner sucker includes lakes, ephemeral bodies of water, streams, beaver ponds, and sloughs. In streams, adults tend to be in pools. In lakes, suckers are generally found in the deepest available water (generally less than 11 feet deep) where food is plentiful. Spawning occurs over silt-free sand or gravel substrates in slow pools in low gradient streams. At least some young move immediately into lakes. In years when access to stream spawning areas is limited by low flow or by physical in-stream blockages (such as beaver dams or diversion structures), suckers may attempt to spawn on gravel beds along the lake shorelines (NatureServe 2021).

Avoidance areas on waterways (300-feet wide) will limit the probability of retardant entering the water and traveling downstream. Because of the distance between the Forests and the fish or its designated critical habitat, and the moderate retardant application potential, aerially applied retardant **may affect but is not likely to adversely affect Warner sucker and its designated critical habitat**.

Shortnose sucker - *Chasmistes brevirostris* and Lost River sucker – *Deltistes luxatus*

Shortnose and Lost River suckers were listed as endangered on 18 July 1988 (53 FR 27130). Shortnose sucker is restricted to a small area in Oregon and California. Lost River sucker occurs in lakes and streams in northern California and southern Oregon. Its area of occupancy and population size are much reduced from historical conditions. Currently, the species is represented by two self-sustaining populations that are recently relatively stable. Both species are found on the Fremont-Winema National Forest, which has moderate retardant application potential, and on the Modoc National Forest, which has high retardant application potential

Extensive alteration of shortnose sucker habitat has resulted in poor recruitment and ongoing declines Adult and juvenile shortnose sucker prefer shallow, turbid, and highly productive lakes that are cool, in summer (generally 59 to77 degree Fahrenheit), with adequate dissolved oxygen, and moderately alkaline water. Spawning occurs in lake tributaries, in riffles or runs with gravel or cobble substrate, moderate flows, and depths of 4 to 51 inches. Spawning in tributary streams occurs from February through May. Fry migrate into lakes soon after hatching. Historically, spawning occurred along the margins of Upper Klamath Lake, but that now appears to be rare. Shoreline river and lake habitats are important for larvae and young (especially emergent vegetation for larvae) (NatureServe 2021).

Lost River sucker is threatened primarily by habitat degradation (quality and quantity of water). Habitat includes deep-water lakes and impoundments, and swift water and deep pools of small to medium rivers. Suckers can be found throughout the reservoirs they inhabit, but they appear to prefer shorelines with emergent vegetation that can provide cover from predators and invertebrate food. Suckers move (February through May) from lakes into tributary streams to spawn in riffles or runs with gravel or cobble substrate, moderate flows, and depths of 8 to 50 inches. Spawning also occurs along shore of Upper Klamath Lake. Juveniles move downstream (through June) into lakes soon after hatching. Larval suckers prefer shallow, nearshore, and emergent vegetated habitat in both the lakes and rivers (NatureServe 2021).

Critical habitat for shortnose and Lost River suckers was designated on 11 December 2012 (77 FR 73739). It occurs on the Fremont-Winema and Modoc National Forests. The primary constituent elements for these two species are:

- Water:
    - ♦ Areas with sufficient water quantity and depth within lakes, reservoirs, streams, marshes, springs, groundwater sources, and refugia habitats with minimal physical, biological, or chemical impediments to connectivity.
    - ♦ Water must have varied depths to accommodate each life stage: shallow water (up to 3.28 feet) for larval life stage, and deeper water (up to 14.8 feet) for older life stages.
    - ♦ The water quality characteristics should include water temperatures of less than 82.4 degrees Fahrenheit; pH less than 9.75; dissolved oxygen levels greater than 4.0 parts per million; low levels of microcystin (toxins); and un-ionized ammonia (less than 0.5 parts per million).
    - ♦ Elements also include natural flow regimes that provide flows during the appropriate time of year or, if flows are controlled, minimal flow departure from a natural hydrograph.
- Spawning and rearing habitat:
    - ♦ Streams and shoreline springs with gravel and cobble substrate at depths typically less than 4.3 feet with adequate stream velocity to allow spawning to occur.
    - ♦ Areas containing emergent vegetation adjacent to open water, providing habitat for rearing and facilitating growth and survival of suckers, as well as providing protection from predation and from currents and turbulence.
- Food. Areas that contain an abundant forage base, including a broad array of midges, crustaceans, and other aquatic macroinvertebrates.

If retardant enters critical habitat it has the potential to impact water quality for a short time (several hours), and to reduce the insect food base. Phos-Chek retardant products are ammonia-phosphate based, and can increase the un-ionized ammonia levels in the water. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect shortnose sucker and Lost River sucker critical habitat**.

Avoidance area mapping for these suckers includes a 300-feet wide buffer from known populations in both stream and lake habitat. The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. The Fremont-Winema and Modoc National Forests have moderate and high retardant potential, and despite having avoidance areas for this species, aerial retardant **may affect and is likely to adversely affect shortnose and Lost River sucker**.

June sucker - *Chasmistes liorus*

June sucker was listed as endangered on 31 March 1986 (51 FR 10851) with designated critical habitat. It was reclassified as threatened on 4 January 2021 (86 FR 192). The species is restricted to Utah Lake and the Provo River, in addition to stocked refuge populations elsewhere in Utah. The wild adult population includes only a few hundred individuals and the existing population may consist of hybrids between June sucker and Utah sucker. The population is being maintained through releases of captive-reared individuals. Habitat alteration and introduced fishes are major problems that result in little or no recruitment. June sucker occurs downstream of the Uinta National Forest, which has high retardant application potential. Critical habitat does not occur on National Forest System lands.

This sucker inhabits Utah Lake and tributaries that feed into it.). Utah Lake is shallow (maximum depth 14 feet, average depth 9 feet), turbid, and slightly saline. Spawning occurs in large tributary streams (lower portion of Provo River and, at least formerly, lower Spanish Fork River), in shallow riffles over coarse gravel and cobble. The water depth at spawning sites is 12 to 30 inches, and water velocity is 0.2 to 4.5 feet per second. Newly hatched larvae remain on the bottom for several days, move downstream immediately after swim-up (NatureServe 2021).

Because of the distance at which the June sucker and its critical habitat occur downstream from the Uinta National Forest, and because of the presence of avoidance areas (300-foot buffers), any impacts would be discountable. Aerial retardant **may affect, but is not likely to adversely affect June sucker and its critical habitat.**

Railroad Valley springfish, - *Crenichthys nevadae*

Railroad Valley springfish was listed as threatened 31 March 1986 (51 FR 10857) with designation of critical habitat. It has a small native range in springs in Railroad Valley, Nevada. This species is reported to occur on the Toiyabe National Forest. Critical habitat does not occur on National Forest System lands.

Habitat includes warm spring pools, outflow streams, and adjacent marshes. This fish tolerates high temperatures and low dissolved oxygen. Duckwater and Lockes Ranch springs have outflow temperatures of 90 to 99 degrees Fahrenheit and minimum oxygen concentrations of 0.5 and 0.9 parts per million, respectively (NatureServe 2021). Threats include excessive groundwater pumping, water diversion, and introduced fishes.

The Toiyabe National Forest has high retardant application potential. The ecological risk assessment (Auxilio Management Services 2021) indicated that aerially delivered retardant posed a risk to threatened and endangered fish species from lethal and sublethal toxic effects. Aerially delivered retardant **may affect and is likely to adversely affect Railroad Valley springfish.** ***Avoidance areas (300-foot buffers) are required for this species due to its limited distribution***.

Blue shiner – *Cyprinella caerulea*

Blue shiner was listed as threatened on 22 April 1992 (57 FR 14786). Critical habitat has not been designated. The species has small home range in Coosa River system of Alabama, Georgia, and Tennessee. Populations persist in the Conasauga River system in Georgia and Tennessee. The species is apparently extirpated in the Cahaba River system due to habitat alteration and degradation. Blue shiner requires cool, clear, small to medium-sized rivers over firm substrates (sand, gravel, or rubble) in pools, backwaters, and areas of moderate current (NatureServe 2021).

The species occurs on Cherokee National Forest and Chattahoochee-Oconee National Forests, which have very low retardant application potential, and on National Forests in Alabama, which have no retardant use. Blue shiner habitat is included in aquatic avoidance areas. Based on the avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect blue shiner**.

Desert pupfish - *Cyprinodon macularius*

Desert pupfish was listed as endangered with critical habitat on 31 March 1986 (51 FR 10842.) This species has a small range in southern California, Arizona, and northwestern Mexico. Reintroductions of desert pupfish have occurred across southern Arizona in small streams, pools, ponds, tanks, and other small aquatic habitats. Desert pupfish are found on the Coconino National Forest, which has moderate retardant application potential, and the Tonto National Forest, which has high retardant application potential. Critical habitat does not occur on National Forest System lands.

Habitat for the species includes desert springs and outflow marshes, river-edge marshes, backwaters, saline pools, and streams below 4,000 feet in elevation. The fish prefers areas with sand and silt substrates, aquatic plant life, limited surface flow, and water less than 3.3 feet in depth. The pupfish tolerates low oxygen levels, high temperatures, and high salinity. It forages in shallows in early morning, and deeper water most of day. It often rests on the bottom, especially at night. Desert pupfish may dive into anoxic bottom mud. Pupfish are remarkably adaptable and can survive in aquatic habitats with high temperatures and salinities, although they likely prefer more moderate conditions. Given the opportunity, they will move into areas of lower salinities and temperatures. Its range was reduced due to loss of native habitat and the species is threatened by introduced fishes, inbreeding, genetic drift, and disease.

The ecological risk assessment (Auxilio Management Services 2021) indicated that aerially delivered retardant posed a risk to threatened and endangered fish species from lethal and sublethal toxic effects. Despite implementation of avoidance areas on waterways, there is a small probability (less than one percent) of retardant entering occupied waterways. Aerially delivered retardant **may affect and is likely to adversely affect desert pupfish**. ***Avoidance areas (300-foot buffers) are required for this species due to its limited distribution***.

Spotfin chub - *Erimonax monachus*

Spotfin chub was listed as threatened on 9 September 1977 (42 FR 45526). It has a restricted, reduced range in the Tennessee River drainage in Virginia, Tennessee, and North Carolina. Spotfin chub occurs on George Washington and Jefferson National Forests, which do not use aerial retardant, and the Cherokee National Forest and National Forests in North Carolina, which have very low retardant application potential. Critical habitat was designated 22 September 1977 (42 FR 47840) on the Nantahala National Forest (National Forests in North Carolina). Primary constituent elements have not been identified.

Habitat includes cool and warm, typically clear, large creeks or medium-sized rivers of moderate gradient. These fish are found in upland and montane areas, generally in or near moderate and swift currents over gravel to bedrock substrate, rarely over sand or silt. Eggs are laid in stone cracks, crevices, or in the narrow interface of two touching rocks. Breeding sites are reported from the shallow portions of runs with moderate current, in areas strewn with unsilted rubble and boulders (NatureServe 2021). The species is threatened by habitat loss and degradation.

The George Washington and Jefferson National Forests has implemented a retardant avoidance area that includes the entire 6th-field watershed around occupied habitat. The Cherokee National Forest avoidance areas around occupied habitat have 500-foot buffers. The National Forests in North Carolina have implemented 1500-foot buffers around occupied and designated critical habitat. Although aerially delivered retardant poses a risk to threatened and endangered fish species (Auxilio Management Services 2021), the very low retardant application potential along with expanded avoidance areas reduce the probability of retardant entering habitat to a discountable level. Therefore, aerially applied retardant **may affect but it not likely to adversely affect Spotfin chub or it designated critical habitat**. ***Due to the limited distribution of the species, avoidance area mapping is required and has been implemented***.

Etowah darter - *Etheostoma etowahae*

Etowah dater was listed as threatened on 20 December 1994 (59 FR 65505). It occurs in only a few sites in the upper Etowah River system, Georgia. The Etowah darter is found on the Chattahoochee-Oconee National Forest, which has very low retardant application potential. Critical habitat has not been designated for this species.

The Etowah darter lives in warm and cool, medium and large creeks or small rivers that have moderate or high gradient and rocky bottoms; in relatively shallow riffles, with large gravel, cobble, and small boulder substrates. It is typically associated with the swiftest portions of shallow riffles, but occasionally adults are taken at the tails of riffles. It is most abundant in sites with clear water and relatively little silt in the riffles. It avoids pools and is intolerant of stream impoundment (NatureServe 2021). The main threat to this species is habitat loss and degradation resulting from impoundments, pollution, and land development.

Although aerially delivered retardant poses a risk to threatened and endangered fish species (Auxilio Management Services 2021), the very low retardant application potential along with avoidance areas reduce the probability of retardant entering habitat to a discountable level. Therefore, aerially applied retardant **may affect but it not likely to adversely affect Etowah darter**. Due to the limited distribution of the species, ***avoidance area mapping is required and has been implemented***.

Duskytail darter - *Etheostoma percnurum*

Duskytail darter was listed as endangered on 27 April 1993 (58 FR 2578). This species has a small range in one creek in Virginia. This species occurs on the Daniel Boone, and George Washington and Jefferson National Forests, which do not use aerial retardant, and on the Cherokee National Forest, which has very low retardant application potential. Critical habitat has not been designated for this species.

Duskytail darter habitat includes the lower main channel of Copper Creek, which is a clear, warm, moderate-gradient, intermontane stream in the Ridge and Valley Province of Virginia. Adults occur primarily in pools, and much less frequently in swift runs. These fish are associated with relatively clean gravel, cobble, and boulders. The range of habitats used includes slack water, detritus, slightly silted stones, and bedrock (NatureServe 2021). Impoundments, siltation associated with poor land-use practices, coal mining, and logging have contributed to the decline.

The George Washington and Jefferson National Forests have implemented a retardant avoidance area that includes the entire 6th-field watershed around occupied habitat. The Cherokee National

Forest avoidance areas around occupied habitat have 500-foot buffers. Although aerially delivered retardant poses a risk to threatened and endangered fish species (Auxilio Management Services 2021), the lack of retardant use or very low retardant application potential along with expanded avoidance areas reduce the probability of retardant entering habitat to a discountable level. Therefore, aerially applied retardant **may affect but it not likely to adversely affect duskytail darter**. Due to the limited distribution of the species, ***avoidance area mapping is required and has been implemented***.

Unarmored Threespine stickleback (Shay Creek stickleback) - *Gasterosteus aculeatus williamsoni*

Unarmored threespine stickleback was listed as endangered on 13 October 1970 (35 FR 16047). This species has a small, remnant range in southern California streams with a few remaining populations. Unarmored threespine stickleback is found on the San Bernardino and Angeles National Forests, both of which have high retardant application potential. Critical habitat has not been designated.

The species requires clear, slow-flowing streams with sand or mud substrate, water temperature less than 75 degrees Fahrenheit, and abundant aquatic vegetation. The stickelback occurs in deeper pools with slow current or, in stronger currents, behind obstructions. A lack of turbidity is a requirement. Juveniles congregate in backwaters among aquatic plants (NatureServe 2021). Urban encroachment is responsible for the reduction in range for this species.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Because the San Bernardino and Angeles National Forests have high retardant application potential, and despite having avoidance area for this species, aerial retardant **may affect and is likely to adversely affect unarmored threespine stickleback**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Owens tui chub - *Gila bicolor snyderi (Siphateles bicolor snyderii)*

Owens tui chub was listed as endangered on 5 August 1985 (50 FR 31592) with designation of critical habitat. It is restricted to a handful of sites in the Owens Valley, California. It is found on the Inyo National Forest, which has high retardant application potential.

This species is generally found in shallow water associated with submerged objects or beds of aquatic vegetation, or in the quiet waters of sluggish rivers. It was historically found in various habitats, including thermal spring pools, lakes, rivers, and canals. Primary habitat requirements appear to include clear, clean water, adequate cover in the form of rocks, undercut banks, or aquatic vegetation, and adequate insect food (NatureServe 2021). Populations of this species are small and threatened by introduced predatory fishes and by interbreeding with introduced conspecifics of another subspecies.

Critical habitat includes Hot Creek, the adjacent springs and their outflows in the vicinity of Hot Creek Hatchery; and the Owens River from long Valley Dam downstream for 8 miles; and 50 feet on each side of the creek and river. Critical habitat is owned by the State of California; however, it is located on Inyo National Forest lands. Primary constituent elements include high quality, cool water with adequate cover in the form of rocks, undercut banks, or aquatic vegetation, and a sufficient insect food base.

If retardant enters critical habitat it has the potential to create harmful levels of pollutants for a short time (several hours), and to reduce the insect food base. The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, it does not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Owens tui chub and its designated critical habitat.** ***Avoidance area mapping is required due to the limited distribution of the species***.

Humpback chub - *Gila cypha*

Humpback chub was listed as endangered under the Endangered Species Protection Act on 11 March 1967 (32 FR 4001). It was reclassified as a threatened species on 18 October 2021 (86 FR 57588). The humpback chub is restricted to the Colorado River system, where distribution and abundance are greatly reduced. This species is found on the following national forests, listed below according to retardant application potential:

- Very low: Grand Mesa Uncompahgre and Gunnison, Rio Grande, Ashley, Fishlake, and Manti-LaSal National Forests;
- Low: Arapaho & Roosevelt National Forest;
- Moderate: Medicine Bow-Routt, San Juan, and White River National Forests;
- High: Bridger-Teton, Dixie, and Uinta-Wasatch-Cache National Forests

Designated critical habitat does not occur on National Forest System lands (59 FR 13374).

Humpback chubs inhabit large rivers within the Colorado River system. Adults use various habitats, including deep turbulent currents, shaded canyon pools, areas under shaded ledges in moderate current, riffles, and eddies. At Black Rocks and Westwater Canyon of the upper Colorado River basin (upstream of Lee's Ferry, Arizona), adults inhabit deep, swift river regions but use microhabitats with low water velocity, and the young use shallow areas. In Yampa River, Colorado, also in the upper basin, adults were most often captured in eddy habitat (average depth 6.6 feet), particularly in shoreline eddies created by large boulders and rapids; most young were captured in shoreline eddies and runs. In the Little Colorado River, which is in the the lower basin of the Colorado River system, adults inhabit a variety of habitats, including pools adjacent to eddies, large pools with little or no current, and areas below travertine dams. In this basin, young occupy sandy runs and backwaters.

Populations in the upper basin are not considered self-sustaining, whereas numbers in the Grand Canyon portion of the lower basin appear to have increased, and that population is regarded as self-sustaining (NatureServe 2021). Threats to this species are primarily associated with habitat loss and modification due to impoundments (large dams), as well as introduced predatory fish and potentially introduced parasites.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. The Fish and Wildlife Service (2011) has indicated that humpback chub does not occur near the National Forest boundaries. However, their Information for Planning and Consultation (iPaC) website and the Forest Service regional lists indicate that humpback chub may occur on National Forest System lands, so they are included in this analysis. Based on the risk assessment and on the retardant application potential of the National Forests within the range of this species, aerially delivered retardant **may affect and is likely to adversely affect humpback chub.**

Sonora chub - *Gila ditaenia*

Sonora chub was listed as threatened on 30 April 1986 (51 FR 16042) with designation of critical habitat. It has a small range in Sycamore Canyon, Santa Cruz County, Arizona, and adjacent Sonora, Mexico. It occurs on the Coronado National Forest, which has high retardant application potential.

Habitat includes stream pools near cliffs, boulders or other cover in the channel; headwaters springs and seeps; and intermittent streams. When flow is adequate it is distributed throughout the stream system; during dry periods it is restricted to permanent rocky and sandy pools. Sonora chub is vulnerable to severe predation by giant water beetles when concentrated in seasonal pools during drought (NatureServe 2021). This species is also vulnerable to natural and human-caused changes in habitat (for example, dewatering), development or other activities that would change channel morphology, and to introductions of exotic fishes and parasites.

Primary constituent elements of critical habitat include clean permanent water with pools maintained by subsurface flow, and having intermediate riffle areas. If retardant enters critical habitat it has the potential to create harmful levels of pollutants for a short time (several hours).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, it does not eliminate it. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Sonora chub and its designated critical habitat**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Bonytail - *Gila elegans*

Bonytail was listed as endangered on 23 April 1980 (45 FR 27710). The species is endemic to the Colorado River Basin of the southwestern United States. An unknown, but small number of wild adults exist in Lake Mohave on the mainstem Colorado River in the Lower Colorado River Basin (below Lee’s Ferry, Arizona), and there are small numbers of wild individuals in the Green River and upper Colorado River subbasins of the Upper Colorado River Basin. The bonytail was historically common in warm water reaches of larger rivers from Mexico to Wyoming. This species is found on the following national forests, listed below according to retardant application potential:

- Very low: Grand Mesa Uncompahgre and Gunnison, Ashley, Fishlake, and Manti-LaSal National Forests;
- Low: Arapaho & Roosevelt National Forest;
- Moderate: Medicine Bow-Routt, San Juan, and White River National Forests;
- High: Bridger-Teton, Dixie, and Uinta-Wasatch-Cache National Forests

Designated critical habitat does not occur on National Forest System lands (59 FR 13374).

Little is known about the specific habitat requirements of bonytail because the species was extirpated from most of its historic range prior to extensive surveys. The bonytail is considered adapted to mainstem rivers where it has been observed in pools and eddies. Similar to other closely -related *Gila* species, bonytail probably spawn in spring over rocky substrates when in rivers. Spawning in reservoirs has been observed over rocky shoals and shorelines. There is some indication, based on available distribution data, that flooded bottomland habitats are important growth and conditioning areas for bonytail, particularly as nursery habitats for young. Threats to the species include streamflow regulation, habitat modification, competition with and predation by nonnative fish species, hybridization, and pesticides and pollutants.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Bonytail**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Gila chub - *Gila intermedia*

Gila chub was listed as endangered with critical habitat on 2 November 2005 (70 FR 66664). This species is extirpated or greatly reduced in numbers and distribution in the majority of its historical range, which was in the upper Gila River basin in Arizona, New Mexico, and adjacent Sonora, Mexico. It occurs on the Apache-Sitgreaves National Forest, which has low retardant application potential; the Coconino and Gila National Forests, which have moderate retardant application potential; and on the Coronado, Prescott, and Tonto National Forests, which have high retardant application potential.

Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and they can survive in small artificial impoundments. They are highly secretive, preferring quiet, deeper waters, especially pools, or remaining near cover including terrestrial vegetation, boulders, and fallen logs. Spawning may occur over beds of aquatic plants. This species has been affected by habitat degradation and introduction of exotic fishes.

Critical habitat for Gila chub is found on all national forests where it occurs except the Tonto National Forest. Primary constituent elements for Gila chub include:

- 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;
- Water temperatures for spawning ranging from 62.6 to 75.2 degrees Fahrenheit, and seasonally appropriate temperatures for all life stages (varying from approximately 50 to 86 degrees Fahrenheit.
- Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (ranging from 6.5 to 9.5), dissolved oxygen (ranging from 3.0 to 10.0) and conductivity (100 to 1000 mmhos).
- Food base consisting of invertebrates (aquatic and terrestrial insects) and aquatic plants (diatoms and filamentous green algae);
- 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 streambank stability, and a healthy, intact riparian vegetation community;

- Habitat devoid of nonnative aquatic species detrimental to Gila chub or habitat in which detrimental nonnatives are kept at a level that allows Gila chub to continue to survive and reproduce; and
- Streams that maintain a natural flow pattern including periodic flooding.

If retardant enters critical habitat it has the potential to alter the pH of the water and to color the water for a short time (several hours); it also has potential to reduce the insect food base. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, it does not eliminate it. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Gila chub critical habitat.**

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Gila chub**. ***Avoidance area mapping is required on occupied streams***.

Chihuahua chub - *Gila nigrescens*

Chihuahua chub was listed as threatened on 11 October 1983 (48 FR 46053). It has a small range in Chihuahua, Mexico and into New Mexico; it has declined dramatically in both range and abundance. The species is found on the Gila National Forest, which has high retardant application potential. Critical habitat does not occur on National Forest System lands.

These fish are most often in flowing pools of shallow creeks and small rivers in canyons, but they can survive and reproduce in isolated pools. Typically, they occur in association with cover such as submerged or overhanging trees, boulders, or undercut banks, over a substrate of sand, gravel, and cobble with some occasional fine mud or silt. Habitat is subject to extreme drying in summer and flash floods in the rainy season. Spawning occurs over beds of aquatic vegetation in deep quiet pools. Juveniles tend to occupy shallower habitats with or without cover. Almost all macrohabitats having chubs were characterized by extensive cover composed of snags and organic debris or root masses of large trees. Chihuahua chubs were rare or absent where non-native fishes (particularly potential predators) were common (NatureServe 2021). This species is threatened by habitat loss/degradation (for example, dewatering, channelization, pollution of streams) and effects of non-native fishes.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Chihuahua chub**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Yaqui chub - *Gila purpurea*

Yaqui chub was listed as endangered with designated critical habitat on 31 August 1984 (49 FR 34490). This species has a very small range in southeastern Arizona and adjacent Mexico. Its status has improved with habitat acquisition, management, and reintroduction, but the very small area of occupancy makes this species susceptible to localized events that could result in major declines. The species is found on the Coronado National Forest, which has high retardant application potential. Critical habitat does not occur on National Forest System lands.

Habitat includes deep pools in creeks, springheads, scoured areas of cienegas, and other stream-associated quiet waters. This fish seeks shade, often near undercut banks or debris, and is often associated with higher aquatic plants. Similarly, in artificial ponds, adults tend to occupy the lower part of the water column and seek shade. Juvenile chub occupy near-shore zones, often near the lower ends of riffles. Spawning occurs probably in deep pools where there is aquatic vegetation (NatureServe 2021). This species is vulnerable to habitat dewatering and introductions of exotic fishes.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Yaqui chub**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Rio Grande silvery minnow - *Hybognathus amarus*

Rio Grande silvery minnow was listed as endangered on 20 July 1994 (59 FR 36988). Historically, it occurred in the Rio Grande and Pecos River systems in Texas, New Mexico, and Mexico, but is currently found in only 182 miles of the Rio Grande River in New Mexico. The decline in distribution and numbers has resulted from destruction and modification of habitat due to dewatering and diversion of water, water impoundments that both alter and fragment habitat, modification of the river (channelization), and lack of refugia during periods of low flow. Competition, predation by and hybridization with introduced non-native species, water quality degradation, and other factors may also contribute to small population size. Most of these threats continue to affect this species.

The species exhibits large annual fluctuations in numbers, but the current population size generates concerns about genetically effective population size. The combination of extremely limited distribution and small population size make this species particularly vulnerable to single random events. Rio Grande silvery minnow occurs downstream of the Cibola and Santa Fe National Forests which have moderate retardant application potential. Effects of retardant moving downstream into occupied habitat are considered here. Critical habitat does not occur on National Forest System lands (68 FR 8088).

This riverine minnow occurs in waters with slow to moderate flow in perennial sections of the Rio Grande and associated irrigation canals. Most often it uses silt substrates (much less often sand) and typically occurs in pools, backwaters, or eddies formed by debris piles. Larger individuals use a broad range of habitats, including main and side channel runs, but this species rarely uses areas with high water velocities. The species most commonly occurs in depths of less than 8 inches in the summer and 12 to 16 inches (median) in the winter. Few individuals use areas with depths greater than 20 inches. Winter habitat tends to be near instream debris piles. This is a pelagic spawner that produces thousands of semi buoyant, non-adhesive eggs that passively drift downstream while developing. Developing eggs and larvae drift passively with river currents for about three to five days. Drift distances may extend more than 62 miles with elevated river flows during the spring-time spawning period.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants in small riverine basins if retardant was delivered directly to the water. Aquatic avoidance areas (300-foot buffers) are in place on National Forest System lands to limit the probability of retardant entering the water. Because this species occurs downstream of National Forest System lands the probability of retardant entering habitat is discountable. Therefore, aerially delivered retardant **may affect but is not likely to adversely affect Rio Grande silvery minnow**.

Yaqui catfish - *Ictalurus pricei*

Yaqui catfish was listed as threatened with critical habitat on 31 August 1984 (49 FR 34490). This species is currently confined to the Rio Yaqui basin in Mexico and southeast Arizona, though taxonomic uncertainties make it unclear whether the range extends to other basins. Yaqui catfish are bottom-dwelling omnivores representing the only known native catfish west of the Continental Divide. In their Five-Year Status Review, the Fish and Wildlife Service described Yaqui catfish status as poor in the United States; they recommended that the species be considered critically endangered and be uplisted to endangered (USDI Fish and Wildlife Service 2019). The species is "imperiled" and declining in Mexico and is threatened by habitat modification and actual and potential hybridization with non-native catfishes. The species occurs downstream of the Coronado National Forest, which has high retardant application potential. Critical habitat does not occur on National Forest System lands.

Yaqui catfish inhabits small to medium rivers but is most abundant in larger rivers in medium to slow currents over gravel/sand substrate. Habitat in Mexico includes moderate to large streams, at elevations up of 6.890 feet, in moderate to swift currents. Substrates of mud, sand, gravel, rock, and scattered boulders are used. Vegetation may be sparse except for diatoms and green algae on riffles. The species is found at depths of 3.3 to 13.1 feet (NatureServe 2021).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate the possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Yaqui catfish**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Little Colorado spinedace- *Lepidomeda vittata*

Little Colorado spinedace was listed as threatened under the Endangered Species Protection Act on 11 March 1967 (32 FR 4001). The Fish and Wildlife Service published a final rule determining Little Colorado spinedace to be a threatened species with critical habitat on 16 September 1987 (52 FR 25034) This species has a small range in north-flowing tributaries of the Little Colorado River in eastern Arizona. Little Colorado spinedace occurs on the Apache-Sitgreaves National Forest, which has low retardant application potential, and the Coconino and Gila National Forests, which have moderate retardant application potential.

Habitat includes rocky and sandy runs and pools of creeks and small rivers, Water ranges from clear to turbid and is often cold enough for trout. The substrate is often sand, gravel, and silt with rock and bedrock. This fish is most common in slow to moderate water currents, over fine gravel bottoms. It often inhabits unshaded pools with rocks or undercut banks and avoids deep, heavily shaded pools and shallow, open areas. During dry periods, these fish retreat to springs and pools in intermittent streambeds (NatureServe 2021). The Little Colorado spinedace has declined due to habitat alteration and loss, introduction and spread of exotic predatory and competitive fishes, and chemical manipulation of fish populations in native streams.

More than 40 miles of designated critical habitat was designated including streams on the Apache-Sitgreaves and Coconino National Forests. Constituent elements for all areas of critical habitat include clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate. If retardant enters critical habitat it has the potential to create harmful levels of pollutants for a short time. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Little Colorado spinedace critical habitat**.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Little Colorado spinedace**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Spikedace- *Meda fulgida*

Spikedace was listed as threatened on 1 July 1986 (51 FR 23769). The Fish and Wildlife Service changed the status of spikedace to endangered on 23 February 2012 (77 FR 10810). This species occupies only ten to 15 percent of its historical range in streams in Arizona and New Mexico. Spikedace is found on the Apache-Sitgreaves National Forest, which has low application potential, on the Coconino, Coronado, and Gila National Forests, which have moderate retardant application potential, and the Prescott and Tonto National Forests, which have high retardant application potential.

The range and abundance of spikedace have been severely reduced by habitat destruction and alteration (dam construction, stream channelization, water diversion, groundwater pumping, excessive sedimentation, destruction and alteration of riparian vegetation), and probably competition with exotic fishes. Introduced predatory fishes also pose a threat.

Revised critical habitat was designated on 23 February 2012 (77 FR 10810). The Fish and Wildlife Service determined that primary constituent elements for the spikedace are:

- 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, 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 degrees Fahrenheit.
- An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies.

- Streams with no or no more than low levels of pollutants.
- 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.
- No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace.
- 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.

If aerially delivered retardant were to enter spikedace critical habitat it could impact the aquatic insect food base, reducing the quantity of insects available. It would also temporarily introduce pollutants to the water. There would be no impacts to other primary constituent elements. Although the probability of retardant entering the water is less than one percent because of the avoidance areas (300-foot buffer), the moderate or high retardant application potential increases the risk of an intrusion into a waterway. Aerially delivered retardant **may affect and is likely to adversely affect spikedace critical habitat.**

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate the possibility. herefore, aerially delivered retardant **may affect and is likely to adversely affect spikedace**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Arkansas River shiner- *Notropis girardi*

Arkansas River shiner was listed as threatened on 23 November 1998 (63 FR 64771). The Arkansas River shiner historically inhabited wide, shallow, sandy bottomed rivers and larger streams of the Arkansas River basin. It was formerly widespread in the Arkansas River system between Arkansas and New Mexico. It was recently collected at 23 sites in Oklahoma, Texas, and New Mexico, but has disappeared from most of the historic range over the past few decades, due largely to human-caused alteration of natural stream-flow patterns and introduced fishes. The species occurs on the Cimarron National Grassland (Pike-San Isabel National Forest) and Black Kettle National Grassland (Cibola National Forest). Although both these national forests have moderate retardant application potential, retardant use on grasslands is generally very low. Critical habitat does not occur on National Forest System lands (70 FR 59808).

Arkansas River shiner is considered a habitat generalist, with no obvious selection for any particular habitat. It is typically found in turbid waters of broad, shallow, unshaded channels of creeks and small to large rivers, over mostly silt and shifting sand bottom. It tends to congregate on the downstream side of large transverse sand ridges. The Arkansas River shiner is believed to be a generalized forager, with its diet consisting of grass seeds, detritus (decaying organic material), sand, sediment, and aquatic and terrestrial invertebrates

Arkansas River shiner habitat is included in aquatic avoidance areas (300-foot buffers). Based on the avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect Arkansas River shiner**. ***Avoidance area mapping is required for the species***.

Smoky madtom- *Noturus baileyi*

Smoky madtom was listed as endangered with designation of critical habitat on 26 October 1984 (49 FR 43065). This species occurs only in two small sections of stream in Tennessee (one site represents a reintroduction). Smoky madtom occurs on the Cherokee National Forest which has very low retardant application potential.

The species requires clear, cool, rocky riffles, runs, and flowing pools of creeks. In Citico Creek, madtoms are found near the junction of pools and riffles in water about 9 inches deep. From late spring to fall it is generally under slab rocks in riffles, especially riffle crests. In other months it is found under slab rocks in pools. Nests have been found under large slab rocks in pool areas (NatureServe 2021). This species is threatened by activities that degrade water quality.

Constituent elements of the critical habitat include the present good water quality in Citico Creek and run/pool areas with relatively silt-free pea-size gravel substrate containing scattered large flat rocks for breeding habitat. The species uses palm size slab rocks for cover and relatively silt free riffle areas during other times of the year. The area designated as critical habitat provides the smoky madtom with all of the necessary constituent elements for completion of its life cycle.

Habitat is included in aquatic avoidance areas (300-foot buffers). Based on the avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect smoky madtom or its designated critical habitat.** ***Avoidance area mapping is required for the species***.

Yellowfin madtom- *Noturus flavipinnis*

Yellowfin madtom was listed as threatened effective 11 October 1977 (42 FR 45526). The species has a small range and area of occupancy in the upper Tennessee River drainage in Georgia (formerly), Tennessee, and Virginia. Several extant occurrences remain, and reintroductions are in progress. The species is found on the Jefferson National Forest, which does not use retardant, and on the Cherokee National Forest, which has very low retardant application potential.

Yellowfin madtom habitat includes medium-sized and large creeks and small rivers that are unpolluted, warm or warm to cool, usually relatively unsilted, and of moderate to gentle gradient. This species generally occurs in slow pools and occasionally small backwaters off runs and riffles, and rarely in runs. It is generally under cover (sticks, logs, leaf litter, undercut banks, tree roots, rocks, trash) during daylight hours. At night, it is often on the streambed in open clean gravel and rubble areas away from banks and riffles. It may occur in slightly to moderately silted bank areas during day or night. Eggs are laid in cavities beneath flat rocks in pools at depths of usually less than 3.3 feet. The species has declined as a result of impoundments and water pollution; habitat degradation remains a threat to some populations.

A Final Correction and Augmentation of Critical habitat was published on 22 September 1977 (42 FR 47840). Primary constituent elements were not identified. Critical habitat occurs on the Jefferson National Forest. The Jefferson National Forest has implemented avoidance areas for the entire sixth level hydrologic unit codes (or watershed) containing this species. Because the Jefferson does not use retardant and has large avoidance areas, there would be **no effect to yellowfin madtom designated critical habitat**.

The species occurs on the Jefferson National Forest with no retardant use and large avoidance areas (as described above), and on the Cherokee National Forest, which has very low retardant application potential and uses avoidance areas with 500-foot buffers. Based on the large avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect yellowfin madtom**. ***Avoidance area mapping is in place for the species***.

Little Kern golden trout- *Oncorhynchus aguabonita whitei*

Little Kern golden trout was listed as threatened with designation of critical habitat on 13 April 1978 (43 FR 15427). Historically, the Little Kern golden trout occupied approximately 100 miles of the Little Kern River and its tributaries. By 1973, the range was greatly reduced to approximately 10 percent of its historic extent. This range reduction was most notably the result of introduced salmonids, and to some extent of habitat loss associated with grazing, logging, and mining activities. Except for Coyote Creek, a stream immediately adjacent to the Little Kern River drainage, no known populations of Little Kern golden trout occur outside of the Little Kern River watershed. Current distribution of pure Little Kern golden trout is limited to a few small populations in the Little Kern River, Tulare County, California. The species and its designated critical habitat occur on the Sequoia National Forest, which has high retardant application potential (NatureServe 2021). Primary constituent elements have not been identified.

Little Kern golden trout inhabits small, clear, cool, swift-flowing streams. It spawns in gravel riffles and flowing waters with clean gravel substrates (NatureServe 2021).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Avoidance areas around Little Kern golden trout habitat were increased to 600-foot buffers to further reduce the probability of retardant entering the water on this high application potential forest. Although aquatic avoidance areas are in place to limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Little Kern golden trout and its designated critical habitat**. ***Avoidance area mapping is implemented for the species***.

Apache trout- *Oncorhynchus apache*

Apache trout was listed as endangered under the Endangered Species Preservation Act on 11 March 1967 (32 FR 4001). The species was reclassified as threatened on 16 July 1975 (40 FR 17847). There is no designated critical habitat. Historically, the Apache trout occurred in the upper Salt River division of the Gila River basin, in the headwaters of Little Colorado River drainage, and in the Blue River in the San Francisco River drainage. The species currently exists in small headwater streams above 5900 feet in the White Mountains of Arizona. Suitable habitat is limited, and Apache trout easily hybridizes with rainbow trout. Non-native brook and brown trout compete with Apache trout. Recovery efforts have reduced threats and increased the number of self-sustaining populations. Criteria for delisting have nearly been met. A five-year status review (USDI Fish and Wildlife Service 2010) reported pure Apache trout were present in 32 populations within historical range. Apache trout occurs on the Kaibab National Forest, which has very low retardant application potential, and on the Apache-Sitgreaves National Forest, which has low retardant application potential.

Presently, Apache trout are restricted to clear, cool, high-elevation mountain streams that flow through cienegas (marshes) and coniferous forests, upstream from natural barriers. This species has been introduced into several streams and lakes. It spawns in flowing water in saucer-like depressions excavated by females. The eggs are covered with gravel after fertilization takes place. Apache trout feeds on aquatic and terrestrial insects (NatureServe 2021).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Avoidance areas around Apache trout habitat were increased to 600-foot buffers to further reduce the probability of retardant entering the water. Although aquatic avoidance areas are in place to limit the probability of retardant entering the water and retardant application potential is very low or low, there is still a less than one percent change of getting retardant into habitat. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Apache trout**. ***Avoidance area mapping is implemented for the species.***

Lahontan cutthroat trout- *Oncorhynchus clarki henshawi*

Lahontan cutthroat trout was added to the endangered species list under the Endangered Species Preservation Act on 13 October 1970 (35 FR 16047). The species was reclassified as threatened on 16 July 1975 (40 FR 17847). There is no designated critical habitat. Lahontan cutthroat trout historically occupied large freshwater and alkaline lakes, small mountain streams and lakes, small tributary streams, and major rivers of the Lahontan Basin of northern Nevada, eastern California, and southern Oregon. Lahontan cutthroat trout currently occupy approximately 8.6 percent of their historical stream habitat and 46.8 percent of their historical lake habitat; however, only two of the lakes have self-sustaining populations. Since the mid 1990’s, the species has been introduced/established in 12 new waters, have remained in 147 streams, and have been extirpated from 32 streams. Populations have been and continue to be impacted by nonnative species interactions (hybridization and competition), habitat fragmentation and isolation, degraded habitat conditions, drought, and fire. A five-year status review (USDI Fish and Wildlife Service 2009) recommended no change to the listing status because of small population sizes, lack of gene flow between populations, and continued threats throughout its range. The species occurs on the Lake Tahoe Basin Management Unit, which has very low retardant application potential, and the Humboldt-Toiyabe, Inyo, Sierra, Stanislaus, and Tahoe National Forests, all of which have high retardant application potential.

Lahontan cutthroat trout require relatively clear, cold, and well-oxygenated water to maintain viable populations. Habitat for the Lahontan cutthroat trout includes lakes and streams. Unlike most freshwater fish species, this species tolerates relatively high alkalinity and total dissolved solid levels found in some lake environments. In streams, Lahontan cutthroat trout use rocky areas, riffles, deep pools, and areas under logs and overhanging banks. In optimal habitat, cover is at least 25 percent of the stream area. They reproduce in the spring and are obligatory stream spawners, sometimes migrating large distances to find adequate spawning areas. Spawning and nursery habitat is characterized by cool water, with an approximate 1:1 pool-riffle ratio, well-vegetated and stable stream banks, and relatively silt-free rocky substrate in riffle-run areas. Fry may move out of spawning tributaries shortly after emergence or may remain in nursery streams for 1 to 2 years (NatureServe 2021).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Avoidance areas around Lahontan cutthroat trout habitat were increased to 600-foott buffers to further reduce the probability of retardant entering the water on these high application potential forests. Although aquatic avoidance areas are in place to limit the probability of retardant entering the water, they do not eliminate the possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Lahontan cutthroat trout**. ***Avoidance area mapping is implemented for the species.***

Paiute cutthroat trout- *Oncorhynchus* (*Salmo*) *clarki seleniris*

Paiute cutthroat trout was listed as endangered under the Endangered Species Preservation Act on 11 March 1967 (32 FR 4001). The species was reclassified as threatened on 16 July 1975 (40 FR 17847). Critical habitat has not been designated. Paiute cutthroat trout is known from drainages in the Sierra Nevada range in east-central California. The presumed historic distribution was limited to 9.1 miles of habitat in Silver King Creek (Alpine County) from Llewellyn Falls downstream to barriers in Silver King Canyon as well as the accessible reaches of three small named tributaries: Tamarack Creek, Tamarack Lake Creek, and the lower reaches of Coyote Valley Creek downstream of barrier falls. Paiute cutthroat trout now occupy approximately 20.6 miles of habitat in five widely distributed drainages outside of their historic range and none within their historical range. The trout is vulnerable to detrimental impacts from non-native trout, excessive harvest, and habitat alteration from overgrazing. The species is found on the Toiyabe, Inyo, and Sierra National Forests, all of which have high retardant application potential.

Paiute cutthroat trout requires cool, well-oxygenated water and prefers streams with moderate current in meadow areas. Adult fish prefer stream pool habitat in low gradient meadows with undercut or overhanging banks and abundant riparian vegetation. Pools are important rearing habitat for juveniles and act as refuge areas during winter. During the winter months, trout move into pools to avoid physical damage from ice scouring and to conserve energy. As with other salmonids, suitable winter habitat may be more restrictive than summer habitat. Paiute cutthroat trout also occupies lakes if suitable spawning habitat is available but there is no evidence that they ever occurred naturally in any lakes within the Silver King basin. Large individuals defend stream pools, forcing smaller fishes into runs and riffles. Spawning occurs in flowing waters above clean gravel substrate. Fingerlings often occupy tributary streams until large enough to survive in main streams. Paiute cutthroat trout demonstrate fluvial spawning behavior and must have access to flowing waters with clean gravel substrates (NatureServe 2021).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Avoidance areas around Paiute cutthroat trout habitat were increased to 600-foot buffers to further reduce the probability of retardant entering the water on these high application potential forests. Although aquatic avoidance areas are in place to limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Paiute cutthroat trout**. ***Avoidance area mapping is implemented for the species***.

Greenback cutthroat trout – *Oncorhynchus clarki stomias*

Greenback cutthroat trout was listed as endangered on 11 March 1967 (32 FR 4001). It was reclassified as threatened on 18 April 1978 (43 FR 16343). Recent genetic studies indicate that the subspecies is native only to the South Platte River drainage and is not native to the upper margins of the Arkansas River drainage. The subspecies may have extended as far east as present-day Greeley, Colorado, during the mid-1800s. The Fish and Wildlife Service completed the most recent status review in 2018 and concluded that no change in status was justified at that time. As of 2019, the Greenback Cutthroat Trout Recovery Team reported that pure greenback cutthroat populations are only known to be present in three streams (Bear Creek, Herman Gulch, and Dry Gulch), and within one lake (Zimmerman Lake). Greenback cutthroat trout occurs on the Arapaho & Roosevelt National Forests, which have low application potential, and on the Pike and San Isabel National Forest, which has moderate retardant application potential. Critical habitat has not been designated.

The main reasons cited for the subspecies' decline are hybridization, competition with nonnative salmonids, and overharvest. New threats have arisen or have become more prevalent. These include increased human population growth within the range of the subspecies along with potential for new water depletions; new introductions of nonnative species; fragmentation and genetic isolation of small populations; the effects of fire and firefighting with chemical retardants; and the effects of global climate change.

This species inhabits cold water streams and lakes with adequate stream spawning habitat present during spring. Field studies, however, have indicated that water temperatures averaging 46 degrees Fahrenheit or below in July may have an adverse effect on greenback fry (young fish) survival and recruitment. In general, trout require different habitat types for different life stages. Juveniles require protective cover and low velocity flow, as inside channels and small tributaries. Spawning habitat is provided by riffles with clean gravels. Over-wintering habitat is deep water with low velocity flow and protective cover. Adult habitat is provided by the juxtaposition of slow water areas for resting and fast water areas for feeding, with protective cover from boulders, logs, overhanging vegetation or undercut banks. Both water quality and quantity are important. Greenbacks, like other cutthroat trout, generally require clear, cold, well-oxygenated water.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (600-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate the possibility. Therefore, aerially delivered **retardant may affect and is likely to adversely affect greenback cutthroat trout**. ***Avoidance area mapping is required on occupied streams***.

Gila trout- *Oncorhynchus gilae gilae*

Gila trout was listed as endangered under the Endangered Species Preservation Act on 11 March 1967 (32 FR 4001). The species was reclassified as threatened on 18 July 2006 (71 FR 40657). Critical habitat has not been designated. This species was known to occur in high elevation streams of the Gila River Basin in New Mexico, San Francisco River drainage in New Mexico and Arizona, and Gila River tributaries in Arizona. The species presently occurs in the San Francisco, Verde, Gila, and Agua Fria River drainages in New Mexico and Arizona, occupying less than 20 percent of its former range. The species is found on the Apache-Sitgreaves National Forest, which has low application potential, on the Gila National Forest, which has moderate application potential, and the Prescott and Tonto National Forests, which have high application potential.

This species lives in clear, cold mountain streams that are largely intermittent, in arid regions. They occupy clear runs in mountain streams that typically are narrow and shallow. They may be confined to pools during prolonged drought. Usually, Gila trout congregate in deeper pools and in shallow water only where there is protective debris or plant beds. They feed opportunistically on insects and insect larvae (NatureServe 2021). Threats to the species include competition and hybridization with introduced trout, and habitat degradation. High-severity forest fires have resulted in the extirpation of known Gila trout populations. Wildfires and drought can exacerbate extremes in stream flow conditions.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate the possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect Gila trout and its designated critical habitat**. ***Avoidance area mapping is required on occupied streams***.

Amber darter- *Percina antesella*

Amber darter was listed as endangered on 5 August 1985 (50 FR 31597) with designation of critical habitat. Critical habitat occurs just downstream of the Cherokee National Forest and is not on National Forest System lands. Amber darter occurs in the Etowah and Conasauga Rivers of Georgia and Tennessee. Both are tributaries to the Coosa River in the biologically-diverse Mobile River Basin. The Conasauga River population is healthy and should remain so with adequate protection from the threats posed by farming in the watershed. In Tennessee, Amber darter are restricted to the main channel of the Conasauga River. This species occurs on the Chattahoochee-Oconee and Cherokee National Forests, which have very low retardant application potential.

Amber darters show a preference for moderate water depths (8 to 20 inches), with deeper depths used less frequently and shallower waters generally avoided. In spring, riffles and shallow runs are used almost exclusively; deeper run habitats are also utilized in fall. The presence of clean moveable gravel appears to be most important in determining distribution, likely due to the fish's benthic feeding behavior and its practice of burrowing into the substrate to seek cover and reduce predation risk (NatureServe 2021). A five-year status report (USDI Fish and Wildlife Service 2019) concluded that habitat loss remains the greatest threat to Amber darter.

Amber darter habitat is included in aquatic avoidance areas. The Cherokee National Forest avoidance areas have 500-foot buffers. Based on the avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect amber darter.** ***Avoidance Area Mapping is required due to the limited distribution of the species***.

Goldline darter- *Percina aurolineata*

Goldline darter was listed as threatened on 22 April 1992 (57 FR 14786). In Alabama, Goldline darters are currently known to occur sporadically in 27 miles of the Cahaba River and three of its tributaries: 1.9 miles of Shultz Creek; about 3 miles of Shades Creek; and sporadically in 7 miles of the Little Cahaba River, including Bulldog Bend. In Georgia, goldline darter is known sporadically from 63.6 miles of the upper Coosa River drainage including portions of the Cartecay (24.2 miles), Ellijay (16.5 miles) and upper Coosawattee (11.3 miles) Rivers, and Mountaintown Creek (11.7 miles). The species occurs on the National Forests in Alabama, which do not use retardant, and on the Chattahoochee-Oconee National Forest, which has very low retardant application potential. Proposed critical habitat does not occur on National Forest System lands (42 FR 60765).

Habitat includes fast rocky runs of small to medium rivers; main channels in areas of white-water rapids to three or more feet deep, and substrates of bedrock, boulders, rubble and gravel

(NatureServe 2021). The goldline darter inhabits mainly fifth-order streams, with widths of 49 feet. to 197 feet, in moderate to swift currents from 4.3 inches per second to 28.7 inches per second and in depths of 11.8 inches to 1.97 feet or greater. Riffle and run substrates consists of sand, gravel and cobble and boulders, often in association with patches of sand, riverweed (*Podostemum ceratophyllum*), water willow (*Justicia* species) and woody debris. Persistence of goldline darters in pebble and gravel habitats throughout the summer suggests that these habitats may also be important for foraging. The lack of relationships with other habitat variables suggests that the species are likely to be detected across a range of depths, velocities and riverweed coverages occurring within riffle-run habitats.

Goldline darter habitat is included in aquatic avoidance areas with 300-foot buffers. Based on the avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect goldline darter**. ***Avoidance area mapping is required due to the limited distribution of the species.***

Conasauga logperch- *Percina jenkinsi*

Conasauga logperch was listed as endangered with designated critical habitat on 5 August 1985 (50 FR 38291). This species is confined to the Conasauga River in Tennessee and Georgia. The Conasauga logperch's range may be restricted by competition with the Mobile logperch (*Percina kathae*), which is widespread in the Mobile Basin. The species currently occurs in very low numbers in Tennessee downstream of the Cherokee National Forest, but rarely is found in the remainder of its 36-mile historic range, suggesting the species, is highly vulnerable to stochastic factors, habitat degradation, and/or catastrophic events. It is highly vulnerable to extinction. Conasauga logperch habitat occurs on the Chattahoochee-Oconee and Cherokee National Forests, which have very low retardant application potential.

The Conasauga logperch is located most frequently in riffles and runs over extensive coarse gravel and small cobble. It generally occurs at water depths greater than 1.6 feet with swift current (often greater than 1.6 feet/second) and can be found in the same shoals as the endangered amber darter (Percina antesella). Even within suitable habitat, the darter is rare, typically observed at low densities of scattered individuals or pairs. The major threat to the species has been siltation resulting from land clearing from agriculture or other land uses.

Critical habitat includes approximately 11 miles of the Conasauga Rivers, including a section that occurs on the Cherokee National Forest. The designated critical habitat listing identified constituent elements that include high quality water, pool areas with flowing water and silt free riffles with gravel and rubble substrate, and fast riffle areas and deeper chutes with gravel and small rubble. If aerially delivered retardant enters water, it can impact water quality for a short time before being flushed through the system.

Conasauga logperch occurs on national forests with very low retardant application potential. Habitat is included in aquatic avoidance areas and on the Cherokee National Forest these avoidance areas have 500-foot buffers. Based on the avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect Conasauga logperch and its designated critical habitat**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Snail darter- *Percina tanasi*

Snail darter was listed as endangered on 9 October 1975 (40 FR 47505). Critical habitat was designated in the Little Tennessee River on 1 April 1976 (41 FR 13927) and augmented a year later (42 FR 47840). Snail darter was down-listed to threatened on 5 July 1984 (49 FR 27510) and the critical habitat designation was rescinded. The range of the snail darter includes the upper Tennessee River system in Tennessee, northern Alabama, and northern Georgia. Snail darter occurs on the Cherokee National Forest, which has very low retardant application potential.

Snail darter habitat includes gravel and sand runs of medium-sized rivers. Adults and spawning individuals inhabit sand and gravel shoals of moderately flowing, vegetated, large creeks and river. These fish are also found in deeper portions of rivers and reservoirs where current is present. Young occur in slackwater habitats, including the deeper portions of rivers and reservoirs. Individuals often burrow into substrate (NatureServe 2021).

Snail darter habitat is included in aquatic avoidance areas on the Cherokee National Forest with 500-foot buffers. Based on the avoidance areas and the very low retardant application potential, aerially applied fire retardant **may affect but is not likely to adversely affect snail darter**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Gila topminnow - *Poeciliposis occidentalis occidentalis*

Gila topminnow was listed as endangered under the Endangered Species Preservation Act on 11 March 1967 (32 FR 4001). Critical habitat has not been designated. Historically, the Gila topminnow was one of the most common fish found throughout the Gila River and Rio Yaqui drainages in southern Arizona, western New Mexico, and northwestern Mexico. Currently, it has a small range in the Gila River system in southern Arizona and northwestern Mexico. The species occurs on the Coconino National forest, which has moderate application potential, and on the Coronado, Prescott and Tonto national Forests, which have high retardant application potential.

The Gila topminnow habitat requirements are broad. Habitat includes lowland and some upland streams of desert and grasslands, and margins of large, lowland rivers below 4,500 feet of elevation. Topminnow prefer shallow, warm, fairly quiet waters in ponds, cienegas, cattle ponds, pools, springs, small streams and the margins of larger streams. It prefers water depths up to 3.3 feet and permanent or intermittent streams. Dense mats of algae and debris along the margins of the habitats are an important component for cover and foraging, and substrates of organic muds and detritus also provide foraging areas This species can tolerate relatively high water temperatures and low dissolved oxygen. The Gila topminnow occurred historically in the backwaters of large rivers but is currently isolated to small streams and springs. Numbers and distribution have declined due to habitat loss and degradation from dewatering and impacts of exotic species. Due to surface and groundwater developments that eliminated connectivity between aquatic habitats, topminnow have limited movement potential out of occupied habitats.

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Because the occupied forests have high retardant application potential, and despite having avoidance area for this species, retardant may still enter water, therefore aerial retardant **may affect and is likely to adversely affect Gila topminnow**. ***Avoidance area mapping is required due to the limited distribution of the species***.

Colorado pikeminnow- *Pytochocheilus lucius*

Colorado pikeminnow was listed as endangered under the Endangered Species Preservation Act on 11 March 1967 (32 FR 4001). Designated critical habitat does not occur on National Forest System lands (59 FR 13374). Historically, Colorado pikeminnow occurred throughout the mainstem and warmwater reaches of the Colorado River basin in Arizona, Nevada, California, Wyoming, Colorado, Utah, New Mexico and in Mexico. As a result of extensive water development, modified hydrology, and reduced habitats, Colorado pikeminnow distribution has been drastically reduced. The species occurs on the Coconino National Forest, which has moderate retardant application potential, and on the Prescot and Tonto National Forests, which have high retardant application potential. Numerous forests in Regions 2 and 4 consider offsite impacts of activities on forest lands to Colorado pikeminnow. Therefore, potential downstream impacts of retardant are considered on the Grand Mesa Uncompahgre, Arapaho & Roosevelt, Medicine Bow-Routt, San Juan, White River, Ashley, Fishlake, Manti-La Sal, Bridger-Teton, Dixie, and Uinta-Wasatch-Cache National Forests.

Habitat includes medium to large rivers. Young prefer small, quiet backwaters. Adults use various habitats, including deep turbid strongly flowing water, eddies, runs, flooded bottoms, or backwaters (especially during high flow). Lowlands inundated during spring high flow appear to be important habitats. This species is found mainly in shoreline habitat over sand. In winter, this species is most common in shallow, ice-covered shoreline areas. Reproductively active adults appear to select river canyons that receive freshwater input of groundwater from sandstone/limestone seeps. In the lower Yampa River, the Colorado pikeminnow spawns where large, deep pools and eddies are intermingled with riffles and runs and cobble bars of gravel, cobble, and boulder substrates. Larvae drift downstream after hatching, then move to shoreline areas and backwaters. Young-of-year (post larval) occupy shallow, alongshore, ephemeral backwaters formed in late summer by receding water levels. Juveniles tend to occur downstream from areas occupied by adults, though larger juveniles are not uncommon in shoreline habitats similar to those occupied by adults (NatureServe 2021).

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. Because the occupied forests have moderate to high retardant application potential, retardant may still enter water, therefore aerial retardant **may affect and is likely to adversely affect Colorado pikeminnow**. ***Avoidance area mapping is required for the species where it occurs on National Forest System lands***.

Kendall Warm Springs dace - *Rhinichthys osculus thermalis*

Kendall warm springs dace was added to the list of endangered species under the Endangered Species Preservation Act on 13 October 1970 (35 FR 16047). Critical habitat has not been designated. The species is endemic to one stream, 984 feet in length, that originates from a series of thermal springs and seeps. The stream ends in a waterfall and empties into the Green River in Sublette County, Wyoming. The dace's entire habitat occurs the Bridger-Teton National Forest, which has high retardant application potential.

The dace is found in a thermal spring-fed stream of fast-flowing waters over cobble and gravel substrate associated with emergent aquatic vegetation. Primary threats at the time of listing were a limited distribution, habitat manipulation, and small population size. Additional threats identified since the time of listing are potential catastrophic habitat loss due to manipulation or pollution of the aquifer that supplies the springs, degradation in habitat quality from potential oil and gas development, and potential non-native species introductions.

Because of the extremely limited range of Kendall warm springs dace and the high retardant application potential, the Bridger-Teton National Forest has implemented an avoidance area around occupied streams and springs with a 1/2.mile buffer. This reduces the probability of retardant entering dace habitat to a discountable level. Therefore, aerially delivered retardant **may affect and is not likely to adversely affect Kendall warm springs dace**.

Bull trout – *Salvelinus confllutentus*

Bull trout was initially listed as threatened for the Klamath River and Columbia River district population segments on 10 June 1998 (63 FR 31647). It was listed as threatened in the coterminous United States on 1 November 1999 (64 FR 58910). The species' historical range included Alaska, California, Idaho, Montana, Nevada, Oregon, Washington, and western Canada north to the extreme southern portion of Yukon. Currently, they are found in Washington, Oregon, Idaho, Nevada, Montana, and Western Canada. Bull trout have declined greatly in the contiguous 48 states, with remaining populations primarily small and/or fragmented and isolated. Bull trout occur on the following national forests, grouped below according to retardant application potential:

- No use: Mt. Baker-Snoqualmie, and Olympic National Forests;
- Very low: Columbia River Gorge National Recreation Area and Mt. Hood National Forest;
- Low: Colville, Flathead, Gifford Pinchot, and Willamette National Forests;
- Moderate: Beaverhead-Deerlodge, Bitterroot, Fremont-Winema, Helena-Lewis and Clark, Idaho-Panhandle, Kootenai, Salmon-Challis, Sawtooth, and Umatilla National Forests;
- High: Boise, Deschutes and Ochoco, Humboldt, Lolo, Malheur, Nez Perce-Clearwater, Okanagon-Wenatchee, Payette, and Wallowa-Whitman National Forests.

Compared to other salmonids, bull trout have more specific habitat requirements that appear to influence their distribution and abundance. They need cold water to survive, so they are seldom found in water where temperatures exceed 59 to 64 degrees Fahrenheit. They also require stable stream channels, clean spawning and rearing gravel, complex and diverse cover, and unblocked migratory corridors (NatureServe 2021).

Critical habitat for bull trout was designated on 18 October 2010 (75 FR 63898). It is found on all of the national forest units where the species occurs. The Fish and Wildlife Service determined that the following primary constituent elements are essential for the conservation of bull trout and may require special management considerations or protection:

- Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity and provide thermal refugia.
- Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
- An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

- Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
- Water temperatures ranging from 36 to 59 degrees Fahrenheit, with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
- In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
- A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.
- Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
- Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

If retardant enters critical habitat it has the potential to create impact water quality for a short time (several hours), and to reduce the insect food base. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect bull trout critical habitat.**

The ecological risk assessment (Auxilio Management Services 2021) indicated that aerially delivered retardant posed a risk to threatened and endangered fish species from lethal and sublethal toxic effects. Despite implementation of avoidance areas on waterways, there is a small probability (less than one percent) of retardant entering occupied waterways. Aerially delivered retardant **may affect and is likely to adversely affect bull trout**. ***Avoidance areas (300-foot buffers) are required for this species***.

Pallid sturgeon – *Scaphirhynchus albus*

Pallid sturgeon was listed as endangered on 6 September 1990 (55 FR 36641). Critical habitat has not been designated. The species historical range included Arkansas, Illinois, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, North Dakota, South Dakota, Tennessee, and Wyoming. The species occurs on the following national forests, grouped below by retardant application potential:

- No use: National Forests in Mississippi, and Ozark-St. Francis National Forest;
- Very low: Dakota Prairie Grasslands;

The species occurs downstream of the following national forests; therefore indirect effects are considered:

- Moderate: Medicine Bow-Routt National Forest and Thunder Basin National Grassland, Arapahoe & Roosevelt National Forest and Pawnee National Grassland;
- High: Bridger-Teton National Forest

Pallid sturgeon is a bottom-oriented, large river obligate fish inhabiting the Missouri and Mississippi rivers and some tributaries, from Montana to Louisiana. Pallid sturgeon evolved in the diverse environments of the Missouri and Mississippi river systems. Floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channel waters formed the large-river ecosystem that met the habitat and life history requirements of pallid. These fish have been documented over a variety of available substrates, but are often associated with sandy and fine bottom materials. Substrate association appears to be seasonal. In the middle Mississippi River, pallid sturgeon transition during May from predominantly sandy substrates to gravel possibly in association with spawning. In these river systems and others, pallid sturgeon appears to use underwater sand dunes. Pallid sturgeon has been documented in waters of varying depths and velocities. Depths at collection sites range from 1.9 to greater than 65 feet, though there may be selection for areas at least 2.6 feet deep. Despite the wide range of depths associated with capture locations, one commonality is apparent: this species is typically found in areas where relative depths (the depth at the fish location divided by the maximum channel cross section depth expressed as a percent) exceed 75 percent. Bottom water velocities associated with collection locations are generally less than 4.9 feet per second with reported averages ranging from 1.9 feet per second to 2.9 feet per second.

The ecological risk assessment (Auxilio Management Services 2021) found no risks to threatened or endangered fish species in large streams (flow over 350 cubic feet per second). Pallid sturgeon is found in the Mississippi and Missouri Rivers, which meet the description of large stream. Based on no risk of lethal or sublethal toxic effects, the presence of aquatic avoidance areas (500-foot buffers on the Ozark-St. Francis and 300-foot buffers elsewhere) that reduce the probability of retardant entering the water, the low or very low potential application on forests where they occur, and the distance from National Forest System lands to occupied streams where indirect effects are considered, effects to pallid sturgeon are discountable. Therefore, aerially applied retardant **may affect but is not likely to adversely affect pallid sturgeon**.

Loach minnow – *Tiaroga cobitis*

Loach minnow was initially listed as threatened on 28 October 1986 (51 FR 39468). Its status was changed to endangered on 23 February 2012 (77 FR 10810), along with designation of critical habitat. The loach minnow was historically endemic to the Gila River Basin of Arizona, New Mexico, and Sonora, Mexico. It currently persists in Arizona in the White River of Gila County, the North and East Forks of the White River in Navajo County, Aravaipa Creek in Graham and Pinal Counties, San Francisco and Blue Rivers and Campbell Blue Creek in Greenlee County. In New Mexico, the species is found in the upper Gila River, including the East, Middle and West forks of Grant and Catron counties, the San Francisco and Tularosa Rivers in Catron County, and the lowermost Whitewater Creek and Dry Blue Creek in Catron County. The species occurs on the Apache-Sitgreaves National Forest, which has low retardant application potential, and on the Coconino and Gila National Forests, which have moderate retardant application potential.

The Loach minnow prefers turbulent, rocky riffles of mainstream rivers and tributaries at or less than 7218 feet in elevation. Habitat that is occupied is relatively shallow, has a moderate to swift current, with gravel to cobble dominated substrates. The depth, velocity, and substrate of occupied habitats can, and is expected to, vary seasonally and geographically. Threats to the minnow are predominantly from impoundments, dewatering, non-native species, and livestock grazing.

Designated critical habitat occurs on all three of the occupied forests. The Fish and Wildlife Service determined that primary constituent elements for the loach minnow are:

- Habitat to support all egg, larval, juvenile, and adult loach minnow which includes:
  - ♦ Perennial flows with a stream depth of generally less than 3.3 feet, and with slow to swift flow velocities (between 0 and 31.5 inches per second);
  - ♦ Appropriate 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 habitats with a low stream gradient of less than 2.5 percent and at elevations below 8,202 feet; and
  - ♦ Water temperatures in the general range of 46.4 to 77 degrees Fahrenheit.
- An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies.
- Streams with no or no more than low levels of pollutants.
- 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.
- No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low to allow persistence of loach minnow.
- 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.

If retardant enters critical habitat it has the potential to create harmful levels of pollutants for a short time (several hours), and to reduce the insect food base. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect loach minnow critical habitat.**

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. Although aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant may affect and is likely to adversely affect loach minnow. ***Avoidance area mapping is required on occupied streams***.

Razorback sucker – *Xyrauchen texanus*

Razorback sucker was listed as endangered on 23 October 1991 (56 FR 54957). The historical range of the species includes most of the Colorado River basin, from Wyoming onto the delta in Mexico, including the states of Colorado, Utah, New Mexico, Arizona, Nevada and California, and Mexican states of Baja and Sonora. The species occurs on the Coconino National Forest, which has moderate retardant application potential, and on the Prescott and Tonto National Forests, which have high retardant application potential. Numerous forests in Forest Service Regions 2 and 4 consider offsite impacts of activities on forest lands to razorback sucker. Therefore, potential downstream impacts of retardant are considered on the Grand Mesa Uncompahgre and Gunnison, Arapaho & Roosevelt, Medicine Bow-Routt, White River, Ashley, Fishlake, Manti-La Sal, Bridger-Teton, Dixie, and Uinta-Wasatch-Cache National Forests.

Habitats required by adults in rivers include deep runs, eddies, backwaters, and flooded off-channel environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter. Spring migrations of adult razorback sucker were associated with spawning historically, and a variety of local and long-distance movements and habitat-use patterns have been documented. Spawning in rivers occurs over bars of cobble, gravel, and sand substrates during spring runoff at widely ranging flows and water temperatures (typically greater than 57 degrees Fahrenheit). Spawning also occurs in reservoirs over rocky shoals and shorelines. Young require nursery environments with quiet, warm, shallow water such as tributary mouths, backwaters, or inundated floodplain habitats in rivers, and coves or shorelines in reservoirs (NatureServe 2021).

Critical habitat was designated on 21 March 1994 (59 FR 13374). It is found on the Grand Mesa Uncompahgre and Gunnison, Coconino, Prescott, and Tonto National Forests. The primary constituent elements determined necessary for survival and recovery of razorback sucker include, but are not limited to:

- A quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species.
- Areas of the Colorado River system that are inhabited or potentially habitable by fish for use in spawning, nursery, feeding, and rearing, or corridors between these areas. In addition to river channels, these areas also include bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100- year flood plain, which when inundated provide spawning, nursery, feeding and rearing habitats, or access to these habitats.
- Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced nonnative fish species in many areas.

If retardant enters critical habitat it has the potential to impact water quality for a short time (several hours), and to reduce the insect food base. Although aquatic avoidance areas (300-foot buffers) limit the probability of retardant entering the water, they do not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect razorback sucker critical habitat.**

The ecological risk assessment (Auxilio Management Services 2021) identified a risk to threatened and endangered fish species from retardants. For forests that are upstream of razorback sucker, impacts are unlikely due to the distance between the forests and occupied habitat. On occupied forests, aquatic avoidance areas (300-foot buffers) are in place to limit the probability of retardant entering the water, although they will not eliminate that possibility. Therefore, aerially delivered retardant **may affect and is likely to adversely affect razorback sucker**. ***Avoidance area mapping is required on occupied streams on National Forest System lands.***

5.6 Plant Species and Habitats Analysis and Determinations

5.6.1 Introduction

Environmental effects to plant species have been analyzed on a nationwide, programmatic scale. The information on amounts of retardant use contained in this analysis is derived from the most accurate, readily available data on aerial application of fire retardant use (refer to Table 1through Table 8).

Due to the national programmatic nature of this document, only a short summary on each species habitat and distribution is provided; refer to the Fish and Wildlife Service endangered species Environmental Conservation Online System website and/or the NatureServe website for complete species account information.

Because the analysis is at such a large scale and addresses a nationwide program rather than a specific action (i.e., we cannot predict when, where, in what habitat type, or how large or long-lasting a wildfire event will happen, nor can we predict when, where, or how much aerial fire retardant may be used on a specific wildfire incident), the analysis is generally not quantitative. Local information is provided by individual national forests to Fish and Wildlife Service Field offices when more detailed or site-specific analysis is required.

Species specific details provided by local Forest Service botanists from the 2011 analysis are preserved as much as possible in this analysis. This serves to provide context for reviewers, and to preserve the logic for decisions such as whether to map for avoidance and susceptibility of habitats to aerial retardant use.

In addition to the species previously analyzed, seventeen new taxa were considered based on current lists of federally listed plants for each Forest Service region. *Oenothera coloradensis* ssp. *coloradensis* (Colorado butterfly plant) and *Chorizanthe parryi* var *fernandina* (San Fernando Valley spineflower) were not analyzed because they have been de-listed. In addition, Michaux's sumac (*Rhus michauxii*) and Tennessee yellow-eyed grass (*Xyris tennesseensis*) were not analyzed because they do not occur on National Forest System lands.

Of the newly analyzed species, those determined to have no effect due to occurring on National Forests that do not use aerial retardant include *Boltonia decurrens* (decurrent false aster), *Lespedeza leptostachya* (prairie bush clover), and *Leavenworthia crassa* (fleshy-fruit gladecress) and critical habitat. Species that were determined to have no effect due to only being suspected of being on National Forests on National Forest System lands (no known occurrence) include *Penstemon penlandii* (Penland beardtongue), *Phacelia formosula* (North Park phacelia) and

Orcuttia californica (California orcutt grass). Refer also to appendix F for a complete list of species with no effect determinations.

Of the newly analyzed species, those determined to be not likely to be adversely affected include *Rhodiola integrifolia* ssp. *leedyi* (Leedy's roseroot), *Pediocactus peeblesianus* var. *fickeisenii* (Fickeisen plains cactus), *Hibiscus dasycalyx* (Neches River rose mallow) and critical habitat, *Houstonia montana* (mountain bluet), *Pectis imberbis* (beardless chinchweed) and critical habitat, *Platanthera integrilabia* (white fringeless orchid).. These species occur on National Forests that apply retardant on average less than 0.01 percent to their land bases annually.

Of the newly analyzed species, those determined as likely to be adversely affected include *Coryphantha sneedii* var *leei* (Lee pincushion cactus), *Coryphantha sneedii* var *sneedii* (Sneed pincushion cactus), *Graptopetalon bartramii* (Bartram stonecrop), and *Ivesia webberi* (Webber ivesia) due to occurring on National Forests that apply retardant on average to 0.01 percent of its land base annually.

Newly proposed species added to the analysis include *Cirsium wrightii* (Wright's marsh thistle), and *Pinus albicaulis* (whitebark pine).

5.6.2 Affected Environment

The potentially affected environment (and analysis area) is limited to Forest Service land, approximately 193 million acres. While the majority of long-term fire retardant is used in the western US, all Forest Service regions except Region 10 (Alaska) have used fire retardant in the last 10 years. A total of 170 federally listed or proposed plant species and 34 critical habitats were identified to occur on or are suspected of occurring on National Forest System lands. As a result of the screening process described in the introduction section of this report combined with species specific information at the local level 104 federally listed plants and 29 critical habitats are included in this consultation (refer to appendix D). The remaining 66 species and 5 critical habitats were determined to have no effect and were eliminated from consultation (refer to appendix F). These species either occur in habitats that do not have fire, occur on forests that have fire but aerial fire retardant is not used to extinguish fires, are suspected but not known on National Forest System lands (previous and ongoing surveys in potential habitat continue), or use of fire retardant does not impact or change the primary constituent elements. If new species or additional occurrences are identified on forests species will be avoidance mapped as necessary in coordination with local Fish and Wildlife Service offices to ensure adequate protection.

5.6.3 Effects Analysis Process

As part of the analysis framework established for the 2011 consultation, a National Effects Screening Process (refer to section 4.2) was developed as a coarse filter for determining effects of aerial retardant to all threatened, endangered, and proposed aquatic and terrestrial species and habitats. The screening process uses assumptions regarding expected retardant use based on historic use. In order to be consistent with the previous analysis for the 2011 EIS, and the 2011 BA and BO; this document will follow the same screening process and assumptions, as described in section 4.2 of this document.

Appendix G presents information on the aerial retardant application potential by forest, including the average annual percent of land base affected, as summarized in 2011 and 2020 by indicating whether a forest exceeded the 0.01 percent annual use threshold (rounded up) referred to in the National Effects Screening process (refer to section 4.2.of this document). Appendix G also includes the general determinations based on the 2020 0.01 percent annual use threshold, without taking into account factors such as habitat. The retardant application potential was considered if a species was on a forest that exceeded the 0.01 percent annual use threshold, but the species was found in habitats that are unlikely to have aerial retardant.

As with wildlife and aquatic species assessments, determinations were made based on the entire species' range, and based on the highest retardant use among the National Forests on which it is found.

Section 3.3.3.5 of this document describes the use of aerial retardant avoidance areas, and section 3.3.3 describes retardant use, including a brief summary of aircraft operational guidance. Mapping of avoidance areas for plant species includes the 300-foot buffer for all waterways (any body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life) and areas outside of waterway buffers around known populations and critical habitats where aerial delivery of retardant may affect species. Additional avoidance mapping is completed for vernal pool and pond species where National Hydrologic Dataset information may be lacking. Pilots delivering retardant near waterway are instructed to terminate retardant application if riparian vegetation is visible when approaching a mapped avoidance area. Mapped areas are expected to protect plant species and critical habitats; therefore, any effects from aerially applied retardant would be a result of an intrusion or invoking of an exception for retardant use. All critical habitats for listed plant species occurring on National Forest System lands are mapped unless deemed unnecessary based on local conditions,

5.6.3.1 General Effects of Fire Retardants on Plants

The effects of aerially applied fire retardants to plants and plant communities are not well documented in the scientific literature. Studies that do exist represent results of short-term (one to two growing seasons) scientific studies conducted in a few geographic regions and vegetation types (California grassland, California forest, North Dakota mixed grass prairie, Great Basin Shrub steppe, and Australian eucalyptus forest and heathland) using various retardant application rates and formulations (current and historical retardants used by the Forest Service). Effects of aerially applied retardant on plants and plant communities within the scope of this analysis depend on a number of factors including exposure to retardant (rates and formulations), environmental responses, and correlation of scientific results to potential geographic areas where retardant could be used in the future. Whenever possible, the effects on individual plant species or plant communities consider chemical and species-specific information. When information is lacking and assumptions are required to determine the impacts to plants and plant communities, the Forest Service uses a conservative approach to ensure protection to the environment. Because of the diversity of species and habitats considered for this effects analysis and the limited data using various retardant formulations and application rates, a conservative qualitative approach was used that does not differentiate among retardant formulations.

Retardant applications are based on factors including fuel type, application rates, variability in delivery systems, and other fire-fighting tactics. Application rates range between 1 to 8 gallons/100 ft2 with most applications being between 4 to 8 gallons/100 ft2 (Johnson 2010). Usually, the width and length of a retardant drop swath varies based on the type of aircraft used for delivery. An average drop is 50 to 75 feet wide by up to 800 feet long. For forests using it, aerial retardant is applied to between one and 2,046 acres per National Forest, or between 0.0001 and 0.2 percent of the land base of each National Forest. Depending on fire-fighting tactics, retardant drop width or length might be strung together creating a continuous path of retardant on the ground. Effects to individual plant species or plant communities depends upon various factors including species characteristics (habitats, physiological and morphological characteristics), soil types, timing of application (active growing season vs. dormant) and what happens to the retardant after application. Figure 14 provides an illustration of the fate of aerially applied retardant.

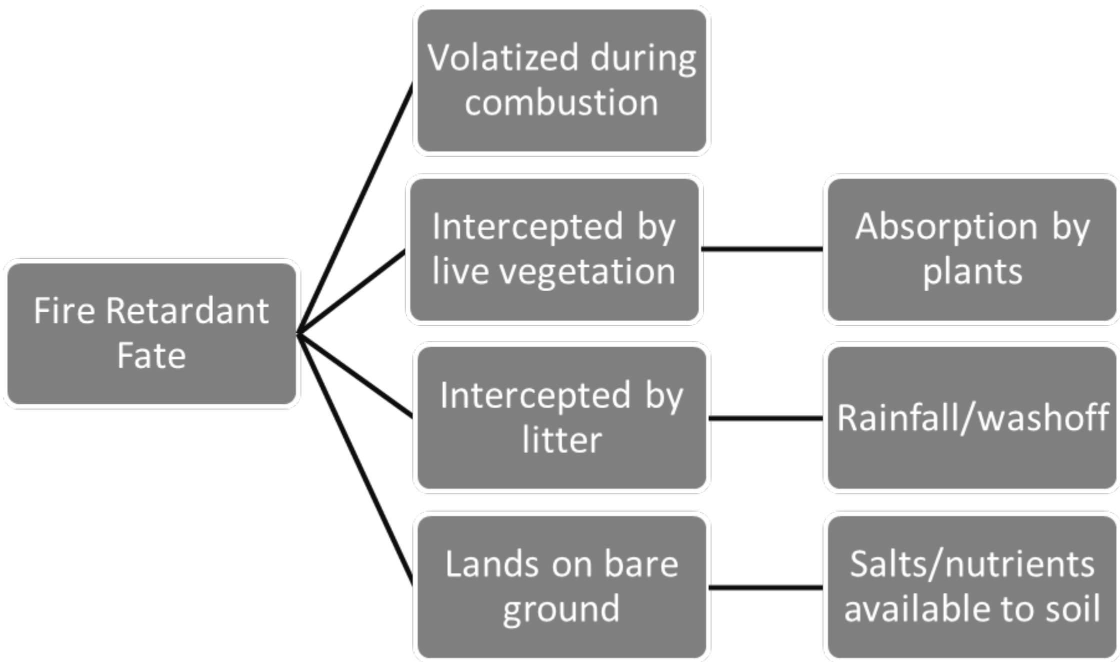

Figure 14. Fate of aerially applied fire retardant

Phytotoxicity

A risk assessment (Auxilio Management Services 2021) was prepared for the Forest Service, evaluating a number of chemicals used in long-term fire retardants. The risk assessment did not address phytotoxicity and impacts to vegetation diversity related to magnesium chloride. Most of the studies on plant responses to magnesium chloride have addressed the application of formulations used for dust abatement. These studies have focused primarily on damage to tree species, and reported needle loss, severe damage, and mortality (Goodrich and Jacobi 2012, Goodrich et al. 2009). Magnesium chloride use for dust abatement occurs repeatedly throughout the life of roadside vegetation, but repeated application of magnesium chloride-based retardant on the same locations where it was used previously is unlikely. Some species may be susceptible to damage from the application of magnesium chloride-based aerial retardant, but the limited number and area of applications would reduce the impact to individual species and to overall vegetation diversity.

Phytotoxic impact to plants discussed in the literature and summarized below are associated with the salt contents within the retardants. No phytotoxic effects to plants from other constituents of retardants (xanthan thickeners, guar gums, fugitive colorants, attapulgus clay, and iron oxide or performance additives) have been reported in the literature. Nitrogen and phosphorus concentration of currently used retardants are summarized in Table 1 at the beginning of this document.

The direct impacts of fire retardants to plants are not well documented in scientific literature. Studies that do exist represent results in various geographic regions, vegetation types and retardant formulations (current and historical). The best available science related to retardant effects is summarized below. Retardant formulations and comparisons to currently approved retardant formulations being used are also provided.

Native legumes were shown to germinate but not mature, in a 2-year study evaluating the application of Phos-Chek XA on a California foothill annual grassland wildland fire (Larson and Duncan 1982). Although Phos-Chek XA fire retardant is no longer used by the Forest Service, it contains nitrogen and phosphorus and therefore may result in some similar effects compared to currently approved retardants listed in Table 1. It is unclear as to the exact amount of retardant applied in this study; Phos-Chek XA has relatively high levels of nitrogen and phosphorus because it is diammonium phosphate based. Phos-Chek 259 is the only currently approved fire retardant containing similar concentrations of nitrogen and phosphorus. Other retardants approved for use contain lower amounts of nitrogen in their formulations. Although Phos-Chek 259 retardant is only used in helicopter delivery that consistently is more accurate in the placement of retardant (Johnson 2010), the potential for an accidental drop and effect to a specific species may result in the same or similar effects as Phos-Chek XA.

Short-term effects (leaf death in tree, shrub and ground cover species) were reported in an Australian eucalyptus forest (Bradstock et al. 1987). In that study the retardant mixture contained ammonium sulfate (20g/L), and an organic polysaccharide (1g/L) applied at a rate of (2L/m2). Leaf death occurred within a week after treatment and continued for many months in both overstory and understory species. While the overstory recovered rapidly, decreased cover in many understory species persisted at one-year post applications. The results of associated greenhouse experiments reported in this study indicated that the ammonium sulfate component was the retardant ingredient responsible for foliar damage and that foliar washing did not minimize the adverse effects. Retardants containing ammonium sulfate have been phased, however (Johnson 2010).

In another Australian study, shoot and whole plant death on individual plants were recorded on five heath-land plant species after experimental application of Phos-Chek D75R (Bell 2003, Bell et al. 2005). This retardant is no longer on the Qualified Products List, but information on its effects may still be informative. Depending on the application rate (1.2 to 3.7 gallons per 100 square feet) adverse effect to plant species varied. Results of this study indicated that the response to retardant in this type of heathland vegetation is variable and that natural variability in composition and cover in areas where retardant was not applied was also high; more refined studies are needed to further elucidate impacts. Some general conclusions indicate that whole plant and shoot death in some species (not all) could be attributed to retardant. Also, in some cases the number of species increases with retardant application at some locations. No effect was documented in foliar cover of woody shrubs and in some cases weedy species increase with retardant application. At the end of this study, there was little change in the visual estimates of percent foliar cover between treated and untreated areas. Final concluding remarks indicate that the application of retardant to undisturbed heathland vegetation did not appear to significantly change species composition or projected foliage cover of the major life forms of native vegetation (herbs, moss, grasses and sedges, woody shrubs). However, application of retardant provided an environment more conducive to weed invasion, particularly at higher levels of retardant application (Bell et al 2005).

Field studies examining effects of Phos-Chek G75-F retardant, which is also no longer in use but similarly may be informative, (applied at a rate of 1gpc) in a North Dakota mixed grass prairie produced a notable increase in herbaceous biomass for the first growing season, yet the effect was transitory and increase in biomass did not differ the following year. The fertilization effect and increase in biomass in this study seemed to be concentrated on Kentucky bluegrass (Poa pratensis) which was present in all study plots and clearly benefitted from retardant fertilization, yet greater than average precipitation during the first growing season after treatments also may have influenced P. pratensis growth (Larson and Newton, 1996). Impacts to shoots and leaves on woody species common to the area, and stem length of *Solidago* sp. do not indicate any effect on growth of these species from Phos-Chek G75-F retardant (Larson and Newton, 1996). Species richness per plot was depressed (not significantly) during the first growing season with retardant application (Larson and Newton 1996). No follow-up studies were completed to determine longer term impacts. Additional studies using the same retardant (applied at a rate of 3gpc) in a Great Basin Shrub steppe vegetation resulted in species richness decline, however by the end of the growing season, no differences were detected between the treated plots compared to the untreated plots (Larson et al. 1999). Although this study was also short in duration, the fact that most immediate responses returned to control levels by the end of the study suggests that effects are likely transitory (Larson et al 1999). Fertilization experiments, in which far greater amounts of nitrogen are added than were added by Phos-Chek applications in this study, document rapid return to pre-fertilization conditions in the absence of additional nitrogen (Wikeem et al. 1993). Many research studies described above indicate the need for longer-term studies or revisitation of sites to determine effects.

Monitoring the results from the effects of retardant on a federally listed plant species on the San Bernardino National Forest, in southern California (Phos-Chek P100, Division Fire, San Bernardino National Forest, June 2010) indicated no foliar burn, phytotoxicity, or mortality to *Eriogonum ovalifolium* var. *vineum* (Cushenbury buckwheat), 4 months after application (Eliason 2010a). Critical habitat impacts including primary constituent elements to this species and *Lesquerella kingii* subsp. *bernardina* (San Bernardino Mountains bladderpod) (not directly impacted) was monitored and emergency consultation with the Fish and Wildlife Service as required under the current Forest Service direction has been completed (Eliason 2010b).

5.6.3.2 Summary of Phytotoxic Effects

Based on the available studies, there may be short-term (1 to 2 growing seasons) phytotoxic effects (leaf burning, shoot die-back, decrease in germination, plant death), if retardant is applied directly on species that are more sensitive to salts within fire retardants. Avoidance mapping around known occurrences or site-specific conditions that limit aerial retardant delivery would protect these species from phytotoxic effects because no retardant would be applied. Potential phytotoxic effects from aerially delivered retardant could occur from an intrusion, exception for retardant use (delivery guidelines), or application on an individual or population that has not yet been documented. Historic retardant applications provide the basis for determining risk. Aerial retardant application occurs on a small percentage of Forest Service lands annually, estimated to be less than 0.025 percent by any individual forest and less than 0.0025 percent nationwide. Forests that apply retardant to 0.01 percent or more of their land base were considered to have a higher probability of effects (more retardant use equals higher potential for intrusion or exception for use) than forests applying less than this amount of retardant, rendering some species to not likely be adversely affected and some to likely be adversely affected.

Areas where a narrow endemic or isolated population occurs on a forest (that is species that occupy a small geographic area and nowhere else) may receive an accidental drop or retardant application from an exception and would be most vulnerable to an impact. It is impossible to predict where or when an accident or an exception for retardant use would occur in the future, however, with identification of avoidance areas around these specific locations that take into consideration this potential (larger avoidance areas as necessary that may completely eliminate aircraft in the area) such populations are considered to be adequately protected.

With respect to native plant communities supporting federally listed plants or habitats that have not yet been documented, no widespread phytotoxic impacts to these native plant communities are expected because only a very small percentage of land is expected to have fire retardant applied to it annually (less than 0.025 percent by any individual forest and less than 0.0025 percent nationwide), in general retardant is applied in linear strips across the landscape (50 to 75 feet wide) and available literature indicates little or no direct phytotoxic impacts after 1 to 2 years post retardant application. Based on the results of the studies and the likely small number of acres that would receive retardant, it is expected that available propagule seed-bank sources or other propagule sources nearby would provide long-term revegetation potential for common native plant species that might be impacted in the short-term.

5.6.3.3 Vegetation Diversity, Fertilizing Effects of Retardant, and Non-Native Invasive Species

Research studies examining the indirect effects of fire retardants associated with changes in plant communities are subsets of the phytotoxicity studies reported above and represent only a few geographic areas and vegetation types. Results indicate a potential for decreases in species richness, increases in forage that may attract herbivores, alternations of vegetative community structure, and enhancement of invasion by non-native invasive species. As with the studies reported above, studies are short-term (1 to 2 years). For the purposes of this analysis non-native invasive species include any species identified at the local forest level as a potential threat to native plant communities.

Larson et al. (1999) suggests that the effects of ammonium-based retardants on plant and plant communities might be similar to the effects shown in fertilizer studies. If so, the impact to soil quality through the fertilizing effects of retardants could increase the vegetative response and change vegetative community composition. Increases in nutrient inputs might encourage the growth of some plant species, including non-native invasive species, and give them a competitive advantage that would result in changes in community composition and species diversity (Tilman 1987, Wilson and Shay 1990, Bell 2003, Larson and Newton 1996).

Retardants serve as a source of plant nutrients (specifically, nitrogen and phosphorus) in the soil whether applied directly to the ground as a retardant or deposited on the ground via rainfall or after being chemically altered during a fire. It is possible that some federally listed species may experience short term benefits from additional nutrients applied from aerial retardant application. Individual and plant community responses from changes in nutrient availability are extremely complex and highly site specific. Additionally, changes in availability of nitrogen and phosphorus in the soil as a result of fire itself may mask effects of retardant application (Napper 2011) making it difficult to differentiate effects. Persistence of nitrogen and phosphorus from fire retardant applications and its availability to plants varies depending on retardant concentration and soil quality (Napper 2011). Plant-available nitrogen was shown to be short-term (12 months), yet plant available phosphorus was found in the surface soil after 12 months (Hopmans and Bickford 2003). Soil properties such as soil texture, organic matter content, soil pH, timing of retardant application, soil condition, salinity, annual and seasonal rainfall, temperature and microbial activity all may influence the degree of response in potential vegetational changes (Napper 2011). Potential soil conditions that might influence plant responses from retardant application include increased salinity from salts in retardant, soil acidification in soils with low pH's and low buffering potential and increases in available nitrogen and phosphorus. Vegetative responses might include changes in vegetative composition, particularly for species in sparsely vegetated areas with low-nutrient soil because they might be poor competitors.

The effect of nutrient additions on vegetation both to increased growth and change in vegetative community composition has been looked at worldwide. Experiments in Australia (Leishman and Thomson 2005) and Europe (Dassonville et al. 2008) show that invasive non-native species might be better competitors than native species communities on nutrient poor sites that have received an increase in nutrients. Kalkhan et al. (2007) showed nutrient rich soils in the Rocky Mountain National Park were more vulnerable to non-native species invasion than less fertile soils. In this study nitrogen was positively linked to non-native plant species richness. Fertilizer studies conducted in Australia (Heddle and Specht 1975) on nutrient poor sandy soils found that phosphorus fertilizer applied for 3 years was retained in the ecosystem for at least two decades. Heedle and Specht also studied heath vegetation for more than 22 years and found change towards an herbaceous sward in response to application of phosphorus fertilizer. These studies indicate a potential for increased vegetative growth and change in vegetative community composition through the addition of nitrogen and phosphorus, but the magnitude and direction of the change are strongly site-specific.

Extensive research studies have been published on fertilizer application rates, soil types, and impacts to crop species, while limited information is available on responses in native plant communities. The lack of information in combination with the various ecosystem properties (soil types, vegetation types and species-specific responses to nutrient inputs, climatic regimes) where retardant application could occur, limit the ability to provide quantitative effects for this analysis. Additionally, results from scientific studies evaluate varying retardant rates and formulations that may vary based on site specific or other environmental conditions.

The effects of Phos-Chek D75 (which is no longer on the Qualified Products List) application on species diversity was evaluated in a North Dakota grassland community (Larson and Newton 1996) and in a shrub steppe area in the Great Basin in Nevada (Larson et al. 1999). Community characteristics, including species richness, evenness, diversity and number of stems of woody and herbaceous plants were measured. The results of these studies indicate the following:

In a North Dakota prairie ecosystem, species richness was reduced in plots exposed to retardant whether the area was burned or unburned. All plots were dominated by Poa pratensis, which gained a competitive advantage from retardant application and crowded out other species.

In a Great Basin shrub steppe ecosystem, species richness declined the first year, but was undetectable after a year and the depression in species richness was most pronounced in the riparian corridors.

Overall, the vegetative community response from burning alone was more dramatic than was the response to retardant application. In both studies, the authors note that each study was short-term, and that the results of the long-term ecological responses during several growing seasons is necessary to evaluate effects.

Phos-Chek XA, which as mentioned, is no longer used by the Forest Service, applied to annual predominately non-native California grassland, produced almost twice the yield of forage in the first year after application in both burned and unburned areas, and growth continued into the second year after application in a retardant treated unburned area (Larson and Duncan 1982). The increases in biomass or quality of forage could attract more herbivores and browsers to retardant application sites (Larson and Duncan 1982). The authors additionally report that, although forbs usually increase in annual grasslands after a fire, nitrogen fertilizer favors grasses, which dominated the first year after the fire with forbs dominating the second year.

Several studies document alterations of vegetation communities as a result of non-native invasive species establishment or spread. Ripgut brome (*Bromus diandrus*), a highly flammable non-native annual grass of significant management concern in western North America, increased by a factor of five in response to fire retardant added to burned areas, and by a factor of eight in response to the same retardant added to unburned areas during the first post-treatment year (Larson and Duncan 1982). This similar variable response seemed to be exhibited by the non-native Kentucky bluegreass (*Poa pratensis*) which increased significantly in growth following fire retardant application in a mesic northern prairie ecosystem (Larson and Newton 1996) but not in a more arid Great Basin ecosystem where soil moisture is more limiting to plant growth than mineral nutrients (Larson et al. 1999). Bell et al. (2005) also recorded enhanced weed invasion in an Australian heathland ecosystem, particularly in areas receiving high concentrations of Phos-Chek D75R. Larson et al. (1999) suggests that even if fire retardant increases growth rates of non-native plants for only a few post fire years, the impacts may be detrimental allowing more acres to burn unchecked.

5.6.3.4 Summary of Potential Effects to Vegetation Diversity

Retardants serve as a source of plant nutrients (specifically, nitrogen and phosphorus) in the soil whether applied directly to the ground as a retardant or deposited on the ground via rainfall or after being chemically altered during a fire. Individual and plant community responses are extremely complex and highly site specific. From a broad-scale perspective, the amount of retardant applied per forest/region/nationwide is small less than 0.025 percent annually across National Forest System lands. However, these impacts do not preclude impacts to individual species, especially threatened and endangered plant species, designated critical habitat areas, and plant species that are considered “narrow endemics”. Impacts to threatened and endangered species habitats by invasive species are one of the threats facing many species nationwide (Pimentel et al. 2005, Wilcove and Chen 1998).

Current Forest Service direction in combination with the proposed federal action as previously described in the phytotoxic discussion above, would reduce potential impacts from fertilizing effects of retardant to native plant diversity and non-native invasive species impacts as a result of the no retardant application or avoidance areas. By eliminating the potential for retardant application and thus removing alterations in nutrients (fertilizing components of retardant) or potential changes in soil properties, no indirect effects (changes in diversity) are expected to occur. It is impossible to predict where or when an accidental intrusion or an exception for retardant use would occur in the future. However, with identification of avoidance areas around these specific locations that take into consideration this potential (larger protection areas that may completely eliminate aircraft in the area) in combination with the amount of individual forest land base receiving fire retardant annually, these species are expected to be adequately protected.

In addition to avoidance areas identified within this proposed federal action, treatment of non-native invasive species will continue on each forest as directed by national policy and regional and forest level direction. These programs will continue to treat non-native invasive species as directed at the local level which include eradication and treatment of non-native invasive species threatening federally listed species and weed programs in general for all forest level activities. If a misapplication of aerially applied retardant results in an increase in non-native invasive species in an avoidance area, these will be removed in compliance with existing forest or regional plans.

5.6.4 Determinations of Effect to Listed Plant Species and Critical Habitats

5.6.4.1 Summary of Effects and Determinations

A total of 170 federally listed or proposed plant species were identified to occur on or suspected of occurring on National Forest System lands. Seventeen new taxa were considered since the last analysis. As a result of the screening process described in the introduction section of this report combined with species specific information at the local level 104 federally listed plants and designated critical habitats are included in this consultation. The remaining 66 were determined to have no effect and were eliminated from consultation (refer to appendix F).

- 66 species would experience no effect from use of aerially delivered retardant
- 52 species would have a may affect, but not likely to adversely affect determination
- 52 species would have a may affect, likely to adversely affect determination

5.6.4.2 Species Discussions

The following determinations provide environmental baseline information for each species considered under this consultation. Baseline information was derived from species profiles from Fish and Wildlife Service Threatened and Endangered Species System online database at http://ecos.fws.gov, Nature Serve Explorer at http://www.natureserve.org, and local expertise from individual forests where species occur. Critical habitat effects are described with each corresponding species. Critical habitat may not necessarily receive the same determination as the species, due to effects to primary constituent elements. Refer to each species discussion for critical habitat determinations.

Plant Species Likely to Be Adversely Affected

Plant species that are likely to be adversely affected by use of aerially delivered retardant include those known on forests likely to have 0.01 percent (landbase percentages were rounded up in appendix G) or more of its land based treated with retardant annually and occur in specific habitats where retardant application is possible. Additionally, any plant species considered to be a narrow endemic (a small isolated population that occupies a small geographic area and nowhere else) located on a forest with potential for retardant application, regardless of how much is used, was also determined to be likely adversely affected. Known occurrences are protected from retardant effects through use of avoidance areas, unless risk from fire outweighs the effects of retardant. In most cases where species are protected by avoidance areas, the effects from retardant use based on potential future intrusions, exceptions for retardant use, or retardant application on populations or occurrences that have not yet been identified and documented.

For this analysis, national forests that have 0.01 percent or more of their land based treated with retardant annually are (see also appendix G): Helena-Lewis and Clark, Lolo, Cibola, Coronado, Lincoln, Prescott, Tonto, Boise, Dixie, Uinta-Wasatch-Cache, Angeles, Cleveland, Eldorado, Inyo, Klamath, Lassen, Los Padres, Mendocino, Modoc, Plumas, San Bernardino, Sequoia, Shasta-Trinity, Sierra, Six Rivers, Stanislaus, Tahoe, Deschutes and Ochoco, Malheur, Okanogan-Wenatchee, Rogue River-Siskiyou, Umatilla, and the Wallowa-Whitman.

Table 38. Summary of analyses for plant species likely to be adversely affected by use of aerially delivered fire retardant

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Acanthomintha ilicifolia	T, CH	San Diego thorn-mint	5	Cleveland	N	Y	Y/Y	Retardant use
Acanthoscyphus parishii var. goodmaniana (Oxytheca parishii)	E, CH	Cushenbury puncturebract	5	San Bernardino	N	Y	Y/Y	Retardant use
Allium munzii	E, CH	Munz's onion	5	Cleveland	Y	Y	Y/Y	Retardant use
Arabis mcdonaldiana	E	McDonald's rockcress	5, 6	Rogue-River Siskiyou, Six Rivers, Klamath and suspected on Shasta Trinity	N	Y	Y	Retardant use
Arenaria ursina	T, CH	Bear Valley sandwort	5	San Bernardino	N	Y	Y/Y	Retardant use
Argemone pleiacantha spp. pinnatisecta	E	Sacramento prickly poppy	3	Lincoln	N	Y	Y	Retardant use
Astragalus albens	E, CH	Cushenbury milk-vetch	5	San Bernardino	N	Y	Y/Y	Retardant use
Astragalus brauntonii	E, CH	Braunton's milk-vetch	5	Angeles, suspected on San Bernardino	N	Y	Y/Y	Retardant use
Astragalus limnocharis var. montii (Astragalus montii)	T, CH	Heliotrope milk-vetch	4	Manti-La Sal	Y	Y	Y/Y	Isolated pop/ Retardant use

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Astragalus tricarinatus	E	triple-ribbed milk-vetch*	5	San Bernardino	Y	Y	Y	Retardant use
Baccharis vanessae	T	Encinitas baccharis	5	Cleveland	N	Y	Y	Retardant use
Berberis nevinii (Mahonia nevinii)	E, CH	Nevin's barberry	5	Angeles, suspected on San Bernardino	N	Y	Y/Y	Retardant use
Brodiaea filifolia	T, CH	thread-leaved brodiaea	5	Angeles, Cleveland, suspected on San Bernardino	N	Y	Y/Y	Retardant use
Calyptridium pulchellum	T	Mariposa pussypaws	5	Sierra	Y	Y	Y	Retardant use / Isolated pop
Calystegia stebbinsii	E	Stebbin's morning glory	5	Tahoe	N	Y	Y	Retardant use
Castilleja cinerea	T, CH	ash-grey paintbrush	5	San Bernardino	N	Y	Y/Y	Retardant use
Caulanthus californicus	E	California jewelflower	5	Los Padres, suspected on Sequoia	N	Y	Y	Retardant use
Ceanothus ophiochilus	T, CH	Vail Lake ceanothus	5	Cleveland	Y	Y	Y/Y	Retardant use / Isolated pop
Chlorogalum purpureum var. reductum (Chlorogalum purpureum)	T, CH	Camatta Canyon amole	5	Los Padres	N	Y	Y/Y	Retardant use

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Cirsium vinaceum	T	Sacramento Mountains. thistle	3	Lincoln	N	Y	Y	Retardant use
Cirsium wrightii	PT; PCH	Wright's marsh thistle	3	Lincoln	N	Y	Y	Retardant use
Clarkia springvillensis	T	Springville clarkia	5	Sequoia	N	Y	Y	Retardant use
Coryphantha sneedii var leei	T	Lee pincushion cactus	3	Lincoln	Y	Y	Y	Retardant use
Coryphantha sneedii var sneedii	E	Sneed pincushion cactus	3	Lincoln	N	Y	Y	Retardant use
Dodecahema leptoceras	E	slender-horned spineflower	5	Angeles, Cleveland, San Bernardino	N	Y	Y	Retardant use
Eriastrum densifolium ssp. sanctorum	E	Santa Ana River woolystar*	5	Suspected on San Bernardino (occurs on mutual aid boundary)	N	Y	Y	Retardant use
Erigeron parishii	T, CH	Parish's daisy	5	San Bernardino	N	Y	Y/Y	Retardant use
Eriogonum kennedyi var. austromontanum	T, CH	southern mountain buckwheat	5	San Bernardino	N	Y	Y/Y	Retardant use
Eriogonum ovalifolium var. vineum	E, CH	Cushenbury buckwheat	5	San Bernardino	N	Y	Y/Y	Retardant use
Graptopetalon bartramii	T	Bartram stonecrop	3	Coronado	N	Y	Y	Retardant use

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Hackelia venusta	E	showy stickseed	6	Okanogan-Wenatchee	Y	Y	Y	Retardant use
Hedeoma todsenii	E	Todsen's pennyroyal	3	Lincoln	N	Y	Y	Retardant use
Ipomopsis sancti-spiritus	E	Holy ghost ipomopsis	3	Santa Fe	Y	Y	Y	Retardant use
Ivesia webberi	T, CH	Webber ivesia	4,5	Toiyabe, possibly on Tahoe, potential on Plumas	N	Y	Y	Retardant use
Lilaeopsis schaffneriana spp. recurva	E, CH	Huachuca water umbel	3	Coronado	N	Y	Y/Y	Retardant use
Mirabilis macfarlanei	T	Mac Farlane's four-o'clock	1,6	Nez Perce, Wallowa Whitman	N	N in WW Y in NP	Y	Retardant use, habitat in retardant prone area
Nolina brittonia	E	Britton's beargrass	8	National Forests in Florida	N	Y	Y	Retardant use
Opuntia treleasei	E	Bakersfield cactus	5	Sequoia	N	Y	N	Habitat
Orcuttia tenuis	T, CH	slender ocutt grass	5	Lassen, Modoc, Plumas, suspected on Shasta Trinity	N	Y	Y/N	Retardant use
Phacelia argillacea	E	Clay phacelia	4	Uinta, suspected on Manti-La Sal	Y	Y	Y	Retardant use and isolated population
Phlox hirsuta	E	Yreka phlox	5	Klamath	N	Y	Y	Retardant use

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Physaria kingii ssp. bernardina (Lesquerella kingii ssp. bernardina)	E, CH	San Bernardino Mountains bladderpod	5	San Bernardino	N	Y	Y/Y	Retardant use
Poa atropurpurea	E, CH	San Bernardino bluegrass	5	Cleveland, San Bernardino	Y	Y	Y/Y	Retardant use
Senecio layneae	T	Layne's butterweed (ragwort)	5	Eldorado, Plumas, Tahoe	N	Y	Y	Retardant use
Sidalcea oregana var. calva	E, CH	Wenatchee Mountains checker-mallow	6	Okanogan-Wenatchee	Y	Y	Y/Y	Retardant use and isolated population
Sidalcea pedata	E	pedate checker-mallow (bird-foot checkerbloom)	5	San Bernardino	N	Y	Y	Retardant use
Silene spaldingii	T	Spalding's catchfly	1,6	Nez Perce, Umatilla, Wallowa Whitman, suspected on Lolo, Kootenai, Idaho Panhandle	N	Y	Y	Local retardant use and habitat in retardant prone areas
Spiranthes delitescens	E	Canelo Hills ladies-tresses	3	Coronado	N	Y	Y	Retardant use
Taraxacum californicum	E, CH	California taraxacum	5	San Bernardino	N	Y	Y/Y	Retardant use

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Thelypodium stenopetalum	E	slender-petaled mustard	5	San Bernardino	N	Y	Y	Retardant use
Townsendia aprica	T	Last Chance Townsendia	4	Dixie, Fishlake	N	Y	Y	Retardant use
Tuctoria greenei	E, CH	Greene's tuctoria (Orcutt grass)	5	Modoc, suspected. on Lassen	N	Y	Y/N	Retardant use

[1]Federal status and Critical Habitat codes are: T=Threatened, E=Endangered, PT=Proposed Threatened, CH= Designated Critical Habitat, PCH=Proposed Critical Habitat
[2]Populations of individuals in a single isolated area refers to a narrow endemic or isolated population occurring only in a single small geographic area, on a National Forest where it may experience an aerial retardant drop because of accidental intrusion or use of an exception, and would be most vulnerable to impacts.
[3]Rationale is tied to the National Effects Screening Process section for terrestrial species, and relies on a combination of retardant application potential and vulnerability due to isolation/narrow endemic, habitat type, or other factors as displayed in the table.

Acanthomintha ilicifolia - San Diego thorn-mint

This species occurs on the Cleveland National Forest and is also documented from occurrences in Mexico. The habitat is restricted to heavy clay soils in coastal sage scrub, grasslands, and chaparral often in open areas, clay depressions, and vernal pool habitats below 2,953 feet (900 m).

The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer. Since the Cleveland National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect** determination is warranted.

Critical habitat (549 acres) is designated in Forest Service Region 5, on the Cleveland National Forest. Primary constituent elements are: seedling establishment and space for growth and development of *Acanthomintha ilicifolia* that are: (a) Within chaparral, grassland, and coastal sage scrub; (b) On gentle slopes ranging from 0 to 25 degrees; (c) Derived from gabbro and soft calcareous sandstone substrates with a loose, crumbly structure and deep fissures approximately 1 to 2 feet (30 to 60 cm); and (d) Characterized by a low density of forbs and geophytes, and a low density or absence of shrubs (http://www.gpo.gov/fdsys/pkg/FR-2008-08-26/pdf/E8-19194.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Acanthoscyphus parishii var. *goodmaniana* (*Oxytheca parishii* var. *goodmaniana*) - Cushenbury oxytheca, and *Astragalus albens* - Cushenbury milk-vetch, and *Erigeron parishii* – Parish's daisy, and *Eriogonum ovalifolium* var. *vineum* - Cushenbury buckwheat, and *Physaria kingii* ssp. *bernardina* (*Lesquerella kingii* ssp. *bernardina*) - San Bernardino Mountains bladderpod

These carbonate plant species are all narrowly distributed endemics in the San Bernardino Mountains with many of the remaining occurrences on the San Bernardino National Forest. The open nature of the habitat for these carbonate plants are sought-after anchor points for retardant lines (USDI Fish and Wildlife Service 2008). Direct effects of retardant on these species are unclear. Avoidance mapping for these species reduces enhancement of non-native invasive species and potential for effect.

Effects to these species are unclear. Monitoring the results from the effects of retardant on *Eriogonum ovalifolium* var. *vineum* (Cushenbury buckwheat), indicated no foliar burn, phytotoxicity, or mortality to 4 months after application (Eliason 2010a).

Avoidance mapping would reduce any potential for increased non-native invasive species of increasing in the area as a result of nutrient increases. Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer. Since the San Bernardino National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually, there is increased potential for unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect** determination is warranted for each of these species.

Critical Habitats are designated for four of the species in this group, with discussion and effects as follows:

Astragalus albens
Critical habitat designated on 3020 acres in Forest Service Region 5, on the San Bernardino National Forest. Primary constituent elements are: (1) Soils derived primarily from the upper and middle members of the Bird Spring Formation and Undivided Cambrian parent materials that occur on dry flats and slopes or along rocky washes with limestone outwash/ deposits at elevations between 1,171 and 2,013 meters (3,864 and 6,604 feet); (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and (3) Associated plant communities that have areas with an open canopy cover and little accumulation of organic material (leaf litter) on the surface of the soil (http://www.gpo.gov/fdsys/pkg/FR-2002-12-24/pdf/02-31631.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Erigeron parishii
Critical Habitat is designated on 2320 acres in Region 5, on the San Bernardino National Forest. Primary constituent elements are: (1) Soils derived primarily from upstream or upslope limestone, dolomite, or quartz monzonite parent materials that occur on dry, rocky hillsides, shallow drainages, or outwash plains at elevations between 1,171 and 1,950 meters (3,842 and 6,400 feet); (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and (3) Associated plant communities that have areas with an open canopy cover (http://www.gpo.gov/fdsys/pkg/FR-2002-12-24/pdf/02-31631.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Eriogonum ovalifolium* var. *vineum
Critical habitat is designated on 5595 acres in Forest Service Region 5, on the San Bernardino National Forest. Primary constituent elements are: 1) Soils derived primarily from the upper and middle members of the Bird Spring Formation and Bonanza King Formation parent materials that occur on hillsides at elevations between 1,400 and 2,400 meters (4,600 and 7,900 feet); (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and (3) Associated plant communities that have areas with an open canopy cover (generally less than 15 percent cover) and little accumulation of organic material (leaf litter) on the surface of the soil (http://www.gpo.gov/fdsys/pkg/FR-2002-12-24/pdf/02-31631.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

***Physaria kingii* ssp. *bernardina* (*Lesquerella kingii* ssp. bernardina)**
Critical habitat is designated on 2,005 acres in Forest Service Region 5, on the San Bernardino National Forest. Primary constituent elements are: 1) Soils derived primarily from Bonanza King

Formation and Undivided Cambrian parent materials that occur on hillsides or on large rock outcrops at elevations between 2,098 and 2,700 meters (6,883 and 8,800 feet); (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and (3) Associated plant communities that have areas with an open canopy cover and little accumulation of organic material (e.g., leaf litter) on the surface of the soil (http://www.gpo.gov/fdsys/pkg/FR-2002-12-24/pdf/02-31631.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Allium munzii - Munz's onion

Munz's onion occurs in small and isolated populations only within Western Riverside County, California. A population of over 5,000 plants occurs on the Cleveland National Forest and is designated critical habitat. This population occurs on Elsinore Peak and is considered to be the most undisturbed and pristine of any of the known occurrences of this species (USDI Fish and Wildlife Service 2008). This site represents the southwestern-most extent of the range for Munz's onion.

The forest has mapped known and would map newly discovered populations for avoidance with a 300-foot buffer. Since the Cleveland National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 176 acres in Region 5, on the Cleveland National Forest. Primary constituent elements are: (1) Clay soil series of sedimentary origin (such as Altamont, Auld, Bosanko, Claypit, Porterville), or clay lenses (pockets of clay soils) of such that may be found as unmapped inclusions in other soil series, or soil series of sedimentary or igneous origin with a clay subsoil (Cajalco, Las Posas,Vallecitos), found on level or slightly sloping landscapes; generally between the elevations of 985 feet and 3,500 feet (300 meter and 1,068 meter) above mean sea level, and as part of open native or non-native grassland plant communities and "clay soil flora" which can occur in a mosaic with Riversidean sage scrub, chamise chaparral, scrub oak chaparral, coast live oak woodland, and peninsular juniper woodland and scrub; or (2) Alluvial soil series of sedimentary or igneous origin (Greenfield, Ramona, Placentia, Temescal) and terrace escarpment soils found as part of alluvial fans underlying open native or non-native grassland plant communities that can occur in a mosaic with Riversidean sage scrub generally between the elevations of 985 feet and 3,500 feet (300 meters and 1,068 meters) above mean sea level, or Pyroxenite deposits of igneous origin found on Bachelor Mountain as part of non-native grassland and Riversidean sage scrub generally between the elevations of 985 feet and 3,500 feet (300 meters and 1,068 meters) above mean sea level; and (3) Clay soils or other soil substrate as described above with intact, natural surface and subsurface structure that have been minimally altered or unaltered by ground-disturbing activities (disked, graded, excavated, re-contoured); and, (4) Within areas of suitable clay soils, microhabitats that are moister than surrounding areas because of (A) north or northeast exposure or (B) seasonally available moisture from surface or subsurface runoff.

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Arabis mcdonaldiana - McDonald's rockcress

This wide-ranging species occurs in Oregon and California. Four to five populations are known to occur in Oregon on Forest Service lands (Rogue River-Siskiyou National Forest in Forest Service Region 6). In Oregon, the populations are at least three miles apart. Within California, this plant occurs in 27 populations in Del Norte County and several in Mendocino County. The species occurs on the Six Rivers and Klamath National Forests and is suspected to occur on the Shasta-Trinity National Forest. *Arabis macdonaldiana* habitat is often discontinuous, rocky islands surrounded by shrub dominated forest types. Nutrient poor ultramafic soils underlying the Jeffrey pine stands are not productive and thus growth of woody material is slow. The short term effects of fire retardant are unlikely to increase forage within serpentine barrens to a level that would attract herbivores.

The geographic range of *Arabis macdonaldiana* is approximately 1,151,000 acres containing 45 to 55 Element Occurrences. The total count of ramets across this geographic range is approximately 9,600 to 13,700. The occurrences are isolated due to the species' preference for a naturally fragmented habitat type (ultramafic barrens).

Due to relatively early dormancy, it is likely that *Arabis macdonaldiana* would be dormant when it comes into contact with fire retardant. *Arabis macdonaldiana* flowers in May through June (USDI Fish and Wildlife Service 2008). Fruiting occurs June through July. After fruiting, above ground portion of plants shrivel and die back in late July - early August, and the plants persist in a dormant state underground until revived by ground soaking rains the following spring. Fire history data from 2000 through 2019 indicate that in Forest Service Region 6 (includes the Rogue River-Siskiyou National Forest), 44 percent of fire starts occur in July, and 51 percent of fire starts occur after August 1. In Forest Service Region 5 (Six Rivers, Klamath, and Shasta-Trinity National Forests), 60 to 90 percent (depending on the National Forest) of fire starts occur in July, and 19 to 57 percent of fire starts occur after August 1 (refer to USDA Forest Service 2020d). These data indicate that the majority of fires and the resultant use of retardant occur when *Arabis macdonaldiana* is dormant and in a state that affords protection from both fire and potential retardant toxicity.

Additionally, some protection of *Arabis macdonaldiana* is afforded by habitat elements, particularly permeable soils and high rainfall. The species occurs on serpentine soils that are well-drained, shallow loams, gravelly loams and very gravelly sandy loams, with very low water holding capacity (USDI Fish and Wildlife Service 2008). Rainfall in the heart of the species range in Del Norte County, where 29 of the 45 to 55 Element Occurrences are found, exceeds 90 inches per year. This increases the likelihood that water soluble compounds in fire retardant would be flushed from serpentine topsoils by this substantial rainfall and not persist into the following growing season, resulting in only short term effects.

Monitoring results performed by the Six Rivers National Forest across Del Norte County, California indicate that the species is stable throughout this portion of its range, which includes 29 Element Occurrences. Monitoring was performed in 2003, one year after the Biscuit Fire burned 29,000 acres in the heart of the species' range. Eight Element Occurrences were visited when the species was in bloom and most easily recognizable. Five of the Element Occurrences visited were within the range of the Biscuit Fire. In general, fire severity was high throughout areas visited, resulting in the death of all trees and the charring of shrubs to their bases although a high percentage of shrubs were vigorously re-sprouting by May of 2003. Effects of the fire on this species varied, but in all areas sampled within the fire, mortality of *Arabis macdonaldiana* was low and few individuals appeared to have burned. Fire effects were likely benign due to the scarcity of fuels within the barren habitat and the late season timing of the fire when *Arabis macdonaldiana* was dormant. It is possible that fire suppression efforts also contributed to low mortality. Aside from the fire, habitat appeared undisturbed in all but Diamond Creek. In this area shrub cover had apparently increased substantially since former 1983 inventories, perhaps due to fire suppression. Although retardant was used numerous times (number of drops unknown) it is unknown if any *Arabis macdonaldiana* came into contact with retardant.

No critical habitat has been designated for this species. The Forests have mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer. Retardant use has increased since the last analysis on the three forests where this species is known to occur. Because the Rogue River-Siskiyou, Six Rivers, Klamath and Shasta-Trinity National Forests apply retardant on average, to 0.01 percent of its land base annually, there is potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Arenaria ursina - Bear Valley sandwort, *Castilleja cinerea* - ash-grey paintbrush, and *Eriogonum kennedyi* var. austromontanum - southern mountain buckwheat

These species (Pebble Plains Plants) are all narrowly-distributed endemics in the San Bernardino Mountains and occur primarily on the San Bernardino National Forest. Forest Service management actions are vital to the conservation and recovery of these species. While no fire retardant has been applied to these species in recent years, many of the occurrences exist in open areas proximal to wildland urban interface where fire retardant has a high likelihood of placement.

The open nature of the habitat for these mountain meadow species are sought after anchor points for retardant lines. Effects to these species are unclear. Avoidance mapping would reduce any potential for increased non-native invasive species of increasing in the area as a result of nutrient increases. Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer. Since the San Bernardino National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect** determination is warranted.

Critical Habitats are designated for three of the species in this group, with discussion and effects as follows:

Arenaria ursina and *Eriogonum kennedyi* var. *austromontanum*

Critical habitat is designated in Forest Service Region 5, on the San Bernardino National Forest. Primary constituent elements are: (1) Pebble plains in dry meadow-like openings within upper montane coniferous forest, pinyon-juniper woodlands, or Great Basin sagebrush in the San Bernardino Mountains of San Bernardino County, California; at elevations between 5,900 to 9,800 feet (1,830 to 2,990 meters) that provide space for individual and population growth, reproduction and dispersal; and (2) Seasonally wet clay, or sandy clay soils, generally containing quartzite pebbles, subject to natural hydrological processes that include water hydrating the soil and freezing in winter and drying in summer causing lifting and churning of included pebbles, that provide space for individual and population growth, reproduction and dispersal, adequate water, air, minerals, and other nutritional or physiological requirements to the species (http://www.gpo.gov/fdsys/pkg/FR-2007-12-26/pdf/07-6137.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Castilleja cinerea

Critical habitat is designated on 1603 acres in Forest Service Region 5, on the San Bernardino National Forest. The primary constituent elements are: (1) Pebble plains in dry meadow-like openings, or non-pebble plain dry meadow margin areas, within upper montane coniferous forest, pinyon juniper woodlands, or Great Basin sagebrush in the San Bernardino Mountains of San Bernardino County, California; at elevations between 5,900 to 9,800 feet (1,830 to 2,990 meters) that provide space for individual and population growth, reproduction and dispersal;(2) Seasonally wet clay, or sandy clay soils, generally containing quartzite pebbles, subject to natural hydrological processes that include water hydrating the soil and freezing in winter and drying in summer causing lifting and churning of included pebbles, or seasonally wet silt or saline clay soils in non-pebble plain dry meadow margin areas that provide space for individual and population growth, reproduction and dispersal, adequate water, air, minerals, and other nutritional or physiological requirements to the species; and (3) The presence of one or more of its known host species, such as *Eriogonum kennedyi* var. *austromontanum*, *E. kennedyi*. var. *kennedyi*, and *E. wrightii* var. *subscaposumon* in pebble plain habitat and species such as *Artemisia tridentata*, *A. nova*, and *E. wrightii* var. *subscaposumon* in pebble plain and non-pebble plain meadow margin habitat that provide some of the physiological requirements for this species (http://www.gpo.gov/fdsys/pkg/FR-2007-12-26/pdf/07-6137.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and may be affected but not likely to be adversely affected.

Argemone pleiacantha ssp. *pinnatisecta* - Sacramento prickly poppy

Sacramento prickly poppy grows in steep rocky canyons in habitats that may include arid canyon bottoms, dry terraces above riparian areas, and along streams, springs, and seep areas. Plants also occur in areas of human disturbance such as roadsides, pipeline rights-of- way, and old fields. Sites that collect surface water are considered favorable for seedling establishment. The surrounding plant communities vary from desert scrub up to ponderosa pine forest; the elevation range is 1,280-2,150 meters (4,200-7,100 feet).

Sacramento prickly poppy historically occurred in 10 canyons on the western slope of the Sacramento Mountains. The entire range is estimated to be about 230 square kilometers (90 square miles). The plant has declined in recent years due to drought. There were 425 plants in 6 canyons in 2004 with 90 percent of the plants in the connecting Alamo/Caballero canyon system (USDI Fish and Wildlife Service 2008). This species has been documented to occur on the Lincoln National Forest.

No non-native invasive plants have been identified as a problem in the Sacramento prickly poppy's habitat. Most of the habitat of Sacramento prickly poppy is in an area with low probability for use of fire retardants. The vegetation is desert scrub, grassland, and sparse pinyon-juniper woodland. However, plants at the upper end of Alamo Canyon are in Ponderosa pine forest and due to the risk to the Town of Cloudcroft and other private-land developments, any fire in this area will be fought aggressively with retardants. Most retardant use would be in forests at the upper end of the Alamo Canyon watershed above the area occupied by Sacramento prickly poppy (USDI Fish and Wildlife Service 2008).

No critical habitat has been designated for this species. The Lincoln National Forest is estimated to apply higher amounts of retardant to its landbase (0.01 percent or more, 100 acres annually). All known populations of this species are avoidance mapped with a 300-foot buffer. Due to the fact that historical use of retardant in the past has been 0.01 percent annually on this forest, there is the potential for a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Astragalus albens - Cushenbury milk-vetch

Refer to the discussion of *Acanthoscyphus parishii* var. *goodmaniana* above for analysis of this and other plants within the carbonate plants group.

Astragalus brauntonii - Braunton's milk-vetch

This species has been documented to occur adjacent to the Angeles and historically on the Cleveland National Forests and is suspected to occur on the San Bernardino National Forest. The habitat of this species includes brush and chaparral communities. The plants may be restricted to limestone substrates. Known populations on the Cleveland are historic, not known to be extant. Populations on the Angeles are predominately on County or private lands adjacent to National Forest lands. They are within the cooperative area or mutual aid boundary and would be mapped for avoidance with a 300-foot buffer.

Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer. Since the Angeles, Cleveland, and San Bernardino National Forests have applied fire retardant, on average, to 0.01 percent or more of their land bases annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, **a may affect likely to adversely affect determination** is warranted.

Critical habitat is designated adjacent to the Cleveland National Forest (282 acres on local agency and private lands within a half mile of the national forest boundary) and the Angeles National Forest (832 acres of state and private land within a quarter mile of the national forest boundary). Because of the proximity of designated critical habitat, it is addressed here. Primary constituent elements are: (1) Calcium carbonate soils derived from marine sediment; (2) Low proportion (less than 10 percent) of shrub cover directly around the plant; (3) Chaparral and coastal sage scrub communities characterized by periodic disturbances that stimulate seed germination (fire, flooding, erosion) and reduce vegetative cover (CFR 71 66373).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**

Astragalus limnocharis var. *montii* (*Astragalus montii*) - Heliotrope milk-vetch

Heliotrope milkvetch occurs in high elevation (10,500 to 11,000 feet) limestone barrens derived from the Flagstaff Geological Formation. This taxon is endemic to the southern Wasatch Plateau on Ferron, Heliotrope and White Mountains in Sanpete and Sevier counties.

The entire distribution consists of three populations totaling approximately 15,000 plants within an eight mile range managed by the Manti-La Sal National Forest in Sanpete and Sevier Counties. The three populations are estimated to have approximately 145 acres of occupied habitat with 65 percent of the individuals occurring in one population. All populations are located within the boundaries of the Manti-La Sal National Forest (Tilley et al. 2011). In 1989 the last remaining area of what the forest personnel thought could be potential habitat was surveyed; no new locations were discovered.

The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer. Since the Manti-La Sal National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Additionally, this species is considered a small isolated population, and accidental drop or an exception for retardant use could have more significant impacts. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 65 acres in Forest Service Region 4 on the Manti-La Sal National Forest. Primary constituent elements are: White Limestone barrens of the Flagstaff formation. Critical habitat for this species is completely mapped as an avoidance area. Aerial fire retardant would not impact the primary constituent elements; thus a **no effect determination is warranted for critical habitat**.

Astragalus tricarinatus - tripled-ribbed milk-vetch

Only one source population of this highly restricted endemic plant is known. It is located on private and BLM lands adjacent to the San Bernardino National Forest boundary in the upper Mission Creek watershed.

No critical habitat has been designated. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer*** to protect against retardant effects. Since the San Bernardino National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. This species is also an isolated population. Therefore, a **may affect likely to adversely affect determination** is warranted.

Baccharis vanessae - Encinitas baccharis

A single population of this plant is known from the Cleveland National Forest in the Santa Margarita Mountains. This population represents less than 10 percent of the known populations of this species. The other populations are covered under the San Diego Multi- Species Conservation Plan, quite distant from National Forest System lands.

No critical habitat has been designated. ***Known populations would be mapped for avoidance with a 300-foot buffer***. Since the Cleveland National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked, therefore a **may affect likely to adversely affect determination** is warranted.

Berberis nevinii (*Mahonia nevinii*) - Nevin's Barberry

The total number of individuals for Nevin's barberry is reportedly fewer than 1,000 plants (63 FR 54956) but may be fewer than 500. One large population, which collectively contains about 200 individuals, occurs in the Vail Lake/Oak Mountain area on private lands in the Vail Lake region adjacent to the Cleveland National Forest. The other large population of Nevin's barberry, thought to contain between 130 to 250 individuals, is in San Francisquito Canyon on the Angeles National Forest in Los Angeles County (63 FR 54956). It is also suspected to occur on the San Bernardino National Forest.

Effects to this species are unclear. Avoidance mapping would reduce any potential for increased non-native invasive species of increasing in the area as a result of nutrient increases. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer***. Since the Angeles, Cleveland, and San Bernardino National Forests have applied fire retardant, on average, to 0.01 percent or more of their land bases annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a ***may affect likely to adversely affect determination*** is warranted.

Critical habitat has been designated on approximately 1 acre on the Cleveland National Forest. Primary constituent elements are: (1) Low-gradient (i.e., nearly flat) canyon floors, washes and adjacent terraces, and mountain ridge/summits, or eroded, generally northeast- to northwest-facing mountain slopes and banks of dry washes typically of less than 70 percent slope that provide space for plant establishment and growth; (2) Well-drained alluvial soils primarily of non-marine sedimentary origin, such as Temecula or sandy arkose soils; soils of the CajalcoTemescal-Las Posas soil association formed on gabbro (igneous) or latite (volcanic) bedrock; metasedimentary substrates associated with springs or seeps; and heavy adobe/gabbro-type soils derived from metavolcanic geology (Mesozoic basic intrusive rock) that provide the appropriate nutrients and space for growth and reproduction; and (3) Scrub (chaparral, coastal sage, alluvial, riparian) and woodland (oak, riparian) vegetation communities between 900 and 3,000 feet (275 and 915 meters) in elevation that provide the appropriate cover for growth and reproduction.

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Brodiaea filifolia - Three leaved brodiaea

Three leaved brodiaea is known or documented to occur in California (Los Angeles, Orange, Riverside, San Bernardino and San Diego Counties). This species occurs on the Angeles and Cleveland National Forests and is suspected to occur on the San Bernardino. Three leaved brodiaea is associated with grasslands and often with vernal pools and floodplains at 295 to 984 feet (90-300 meter) elevation.

Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer. Since the Angeles, Cleveland, and San Bernardino National Forests have applied fire retardant, on average, to 0.01 percent or more of their land bases annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 20 acres in Forest Service Region 5, on the Angeles National Forest. Primary constituent elements are: (1) Appropriate soil series and associated vegetation at suitable elevations of either: (A) Clay soil series of various origins (Alo, Altamont, Auld, Diablo), clay lenses found as unmapped inclusions in other soils series, or within loamy soils underlain by a clay subsoil (Fallbrook, Huerhuero, Las Flores) that generally occur on mesas and gentle to moderate slopes, or in association with vernal pools, between the elevations of 100 feet (30 meters) and 2,500 feet (765 meters) and support open native or annual grassland communities, within open coastal sage scrub or coastal sage scrub-chaparral communities; or (B) Silty loam soil series underlain by a clay subsoil or caliche that are generally poorly drained, moderately to strongly alkaline, granitic in origin (Domino, Grangeville, Waukena, Willows), that generally occur in low lying areas and floodplains, often in association with vernal pool or playa complexes, between the elevations of 600 feet (180 meters) and 1,800 feet (550 meters) and support native, annual, or alkali grassland or scrub communities; or (C) Clay loam soil series (Murrieta) underlain by heavy clay loams or clays derived from olivine basalt lava flows that generally occur on mesas and gentle to moderate slopes between the elevations of 1,700 feet (520 meters) and 2,500 feet (765 meters) and support native or annual grassland or oak woodland savannah communities associated with basalt vernal pools; or (D) Sandy loam soils derived from basalt and granodiorite parent materials, deposits of gravel, cobble, and boulders, or hydrologically fractured weathered granite in intermittent streams and seeps that support open riparian and freshwater marsh communities associated with intermittent drainages, floodplains, and seeps generally between 1,800 feet (550 meters) and 2,500 feet (765 meters). (2) Areas with an intact surface and subsurface structure not permanently altered by anthropogenic land use activities (deep, repetitive disking; grading). These features as well as associated physical processes (full sunlight exposure) are essential to maintain those substrate and vegetation types where three leaved brodiaea is found and to support pollinator assemblages necessary to facilitate gene flow within and among populations of three leaved brodiaea http://www.gpo.gov/fdsys/pkg/FR-2005-12-13/pdf/05-23693.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Calyptridium pulchellum - Mariposa pussypaws

The Fish and Wildlife Service Environmental Conservation Online System was consulted, but no information is available that is more up to date than the information presented in the 2011 analysis. As of 2007, the California Natural Diversity Data Base shows eight occurrences of Mariposa pussypaws and indicates that all known occurrences are extant because there is no documentation of extirpation. However, only five of the eight occurrences have been confirmed to be present within the past decade (USDI Fish and Wildlife Service 2008). The five remaining occurrences are spread over a range of approximately 40 miles but are not evenly spaced within that range, with two occurrences being located in Mariposa County, two in Madera County, and one in Fresno County. The Fresno County occurrence is on public land managed by the Sierra National Forest, while the other occurrences are located on private land (USDI Fish and Wildlife Service 2008).

Of the original five Mariposa pussypaws occurrences in Madera County, one has not contained any plants since 1983; a second has declined from fewer than 100 plants in 1988 and 1989 to one plant in 1990, with none found since; and a third population dropped from 576 plants in 1993 to 89 in 1995 and contained only 3 plants in 1998 (USDI Fish and Wildlife Service 2008). As a result of the declines and lack of detections in these three Madera County populations, they are considered to have been extirpated (USDI Fish and Wildlife Service 2008), therefore they are not being considered.

The Fish and Wildlife Service's 2004 Draft Recovery Plan for Fifteen Plants of the Southern Sierra Nevada Foothills, California, states, in regard to the Fresno County occurrence, that in order to consider Mariposa pussypaws for delisting, this occurrence is protected, and the population is self-sustaining. The Fresno County occurrence is located approximately 20 miles from the next nearest known occurrence, found in Madera County. Additionally, the Fresno County population occurs in a unique ecological setting that is substantially different from all other occurrences (USDI Fish and Wildlife Service 2008). Species that occupy a restricted ecological niche and geographic range are likely to be extirpated by any single random event (USDI-Fish and Wildlife Service 2008). In order to assist in the recovery of this species, it is necessary to have Mariposa pussypaws distributed over as wide of a geographic area as possible and occupying a wide variety of ecological niches. As such, it is necessary to maintain the Fresno population in order to preserve species distribution, both geographically and ecologically, in order to allow for the recovery of Mariposa pussypaws. Known occurrences are avoidance mapped to protect from retardant effects.

No critical habitat has been designated for this species. The forests ***have mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer***. Retardant use has increased on the forest where this species is known to occur since the last analysis. Because the Sierra National Forest applies retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. The fact that this is a small isolated population increases the potential for population effects from an intrusion or invoking of an exception for retardant use. Therefore, a **may affect likely to adversely affect determination** is warranted.

Calystegia stebbinsii - Stebbins' morning-glory

Stebbins' morning-glory is a leafy herbaceous perennial vine in the morning-glory family (Convolvulaceae) that occurs on gabbro soils in chaparral and foothill woodlands vegetation communities. The species is restricted to the Pine Hill Preserve and immediate vicinity in El Dorado County and two sites near Grass Valley in Nevada County.

No critical habitat has been designated for this species. ***The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer***. The Tahoe National Forest has applied fire retardant, on average, to 0.01 percent or more of their land bases annually. Therefore, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Castilleja cinerea - Ash-grey paintbrush

Refer to the discussion of *Arenaria ursina* above for analysis of this and other plants within the pebble plains plants group.

Caulanthus californicus - California jewelflower

The habitat for California jewelflower includes slightly alkaline sandy loam in native grassland or shrub-land. Currently 34 occurrences are presumed to be extant based on an examination of the California Natural Diversity Database. Of the occurrences now described as "presumed extant", there are 19 occurrences entirely on public and Center for Natural Land Management land, 3 occurrences that are on both BLM lands and private lands, and 2 occurrences that are unknown. The remaining 10 occur entirely on private land. Two of these occurrences are on National Forest System lands (Los Padres National Forest) and two are adjacent to Forest System lands. This species is also suspected to occur on the Sequoia National Forest.

No critical habitat has been designated. Fire history data from 2000 through 2019 indicate that 79 percent of fire starts on the Los Padres National Forest occur from June through October, with another 20 percent in December. This species is an annual herb that blooms from February to late May (USDI Fish and Wildlife Service 2008); the reproductive period is complete before the typical fire season begins. There are no specific data on potential effects of fire retardants to this species. The primary threat to this species is loss of habitat, but competition from non-native plants is listed as a secondary threat. California jewelflower seems to occur in soils with low nitrogen levels in situations where little other plant can do well, because of the lack of nitrogen (USDI Fish and Wildlife Service 2008). Non-native grasses in are known to have invaded jewelflower habitat (USDI Fish and Wildlife Service 2008). Avoidance mapping would reduce potential for soil changes and increased potential for non-native invasive species as a result of nutrient increase. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer***. Since the Los Padres National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore**, a may affect likely to adversely affect determination** is warranted.

Ceanothus ophiochilus- Vail Lake ceanothus

Vail lake ceanothus is considered a narrow endemic and is currently restricted to three locations in chamise chaparral communities on north-facing slopes and on soils derived from an unusual pyroxenite-rich rock outcrop that may be gabbroic in origin. Soil on the outcrop is nutrient poor and constitutes harsh growing conditions for most plants (USDI Fish and Wildlife Service 2008). Two of the three populations, which constitute 50 percent of the species known occupied habitat, occur on the Cleveland National Forest and are subject to applications of fire retardant.

Effects to these species are unclear as are site specific retardant impacts to soils (Napper 2011). Avoidance mapping would reduce potential for soil changes and increased potential for non-native invasive species as a result of nutrient increases. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer***. Since the Cleveland National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, **a may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 203 acres in Forest Service Region 5, on the Cleveland National Forest. Primary constituent elements are: (1) Flat to gently sloping north to northeast facing ridge tops with slopes in the range of 0 to 40 percent slope that provide the appropriate solar exposure for seedling establishment and growth; (2) Soils formed from metavolcanic and ultra-basic parent materials and deeply weathered gabbro or pyroxeniterich outcrops that provide nutrients and space for growth and reproduction. Specifically, in the areas that Vail Lake ceanothus is found, the soils are: (a) Ramona, Cienaba, Las Posas, andVista series in the Agua Tibia Wilderness; (b) Cajalco series in the vicinity of Vail Lake; and (3) Chamise chaparral or mixed chamise-ceanothus-arctostaphylos chaparral at elevations of 2,000 feet to 3,000 feet (610 meters to 914 meters) that provide the appropriate canopy cover and elevation requirements for growth and reproduction (http://www.gpo.gov/fdsys/pkg/FR-2007-09-27/pdf/07-4723.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected.**

Chlorogalum purpureum var. *reductum* (*Chlorogalum purpureum*) - Camatta Canyon amole

The Camatta Canyon amole (also known as the purple amole) is endemic to the La Panza Range in central San Luis Obispo County. Most of the population occurs on the Los Padres National Forest; however, it also extends onto the adjacent right-of-way of State Highway 58 managed by the California Department of Transportation and nearby privately-owned lands. Because surveys have not been conducted, the precise extent of the population across the several properties is not known. The California Department of Fish and Game reports the total area inhabited by the Camatta Canyon amole to comprise 127 acres. Of these 127 acres, approximately 90 percent are on National Forest System lands (USDI Fish and Wildlife Service 2008). The species in the Los Padres National Forest grows in blue oak savannah and annual grassland where invasive plant species are also present.

Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer. These avoidance areas would protect against retardant effects associated with invasive species increases. Since the Los Padres National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 4770 acres in Forest Service Region 5 on the Los Padres National Forest. Primary constituent elements are: (1) Well-drained, red clay soils with a large component of gravel and pebbles on the upper soil surface; and, (2) Plant communities in functioning ecosystems that support associated plant and animal species (pollinators, predator-prey species, etc.), including grassland (most similar to the California annual grassland series in Sawyer and Keeler-Wolf (1995) or the pine bluegrass grassland, non-native grassland and wildflower field descriptions in Holland (1986)), blue oak woodland or oak savannahs (Holland 1986), oak woodland, and open areas within shrubland communities (most similar to the Chamise series in Sawyer and Keeler- Wolf (1995), although percent cover of chamise at known *Chlorogalum purpureum* var. *reductum* areas is unknown). Within these vegetation communities *Chlorogalum purpureum* var. *reductum* appears where there is little cover of other species which compete for resources available for growth and reproduction (http://www.gpo.gov/fdsys/pkg/FR-2002-10-24/pdf/02-26768.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Cirsium vinaceum - Sacramento Mountains thistle

Sacramento Mountains thistle is an obligate riparian species that is restricted to travertine springs and their outflow creeks at elevations of 2,300-2,900 meters (7,500-9,500 feet) in the Sacramento Mountains. The springs are in meadows or at the edges of mixed conifer forests. Plants occur at about 90 sites, but these are small with perhaps not more than 40 hectares (100 acres) of total occupied habitat (USDI Fish and Wildlife Service 2008).

The total number of plants is about 350,000 to 400,000 with many of these plants in small dense colonies. The range of Sacramento Mountains thistle is about 37 kilometers (23 miles) north-south and about 10.5 kilometers (6.5 miles) east west for a total area of about 390 square kilometers (150 square miles). This species has been documented to occur on the Lincoln National Forest.

Non-native invasive plants are a threat to Sacramento Mountains thistle. Teasel (*Dipsacus sylvestris*) and musk thistle (*Carduus nutans*) have invaded some Sacramento Mountains thistle sites. These weeds occupy slightly drier sites than Sacramento Mountains thistle, so they have not invaded Sacramento Mountains thistle's core wetland habitat at spring sources. The likelihood of fire retardant use in or near Sacramento Mountains thistle habitat is high. The Sacramento Mountains are a matrix of private and public lands with numerous developments.

No critical habitat has been designated for this species. Avoidance mapping would reduce potential for soil changes and increased potential for non-native invasive species as a result of nutrient increase. The Lincoln National Forest is estimated to apply higher amounts of retardant to its landbase (0.01 percent). ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer.*** Due to the fact that historical use of retardant in the past has been 0.01 percent annually on this forest, there is a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Cirsium wrightii – Wright's Marsh Thistle

Wright's marsh thistle is an obligate riparian species that is restricted to marshy wetlands (cienegas) near springs otherwise semi-arid to arid areas. The springs are in meadows or at the edges of mixed conifer forests. It is known from New Mexico at Alamosa Springs, Blue Spring, Bitter Lake, Santa Rosa Basin and scattered locations in the Sacramento Mountains (Sivinski 2012). Arizona populations are believed to be extirpated while populations in Texas were determined to be misidentifications.

There are currently twelve extant populations of this species, and it has been documented to occur on the Lincoln National Forest. It is threatened by activities that alter the hydrology of its habitat along with long term drought. Other threats include the invasion of the non-native common reed (*Phragmites australis*) in sites, species of insects introduced for biological control of other thistle species and cattle grazing.

Avoidance mapping would reduce potential for soil changes and increased potential for non-native invasive species as a result of nutrient increase. The Lincoln National Forest is estimated to apply higher amounts of retardant to its landbase (0.01 percent). ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer.*** Due to the fact that historical use of retardant in the past has been 0.01 percent annually on this forest, there is a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Critical habitat is proposed on 0.98 acres in Forest Service Region 3, on the Lincoln National Forest. Physical or biological features essential to the conservation of Wright's marsh thistle are:

- Water-saturated soils with surface or subsurface water flow that allows permanent root saturation and seed germination;
- Alkaline soils;
- Full sunlight; and
- Diverse floral communities to attract pollinators

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to essential physical and biological features are expected to be minor and **may be affected but not likely to be adversely affected**.

Clarkia springvillensis - Springville clarkia

As of 2007, the California Natural Diversity Database showed 18 occurrences for this species in Tulare County: 17 in the Tule Watershed and one in the Kaweah River Watershed (USDI Fish and Wildlife Service 2008). Springville clarkia is known to occur on the Sequoia National Forest and tends to grow in open, relatively unvegetated areas. Several of these populations cover long, linear areas (approximately 0.25 to 1 mile in length and 300 feet wide), parallel and adjacent to streams.

No critical habitat has been designated. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer in addition to existing 300 foot aquatic buffers*** designated for protection of aquatic species. Since the Sequoia National Forest has applied fire retardant, on average, to 0.01 percent or more of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Coryphantha sneedii var. *leei* - Lee pincushion cactus

This species is known only from the Guadalupe Mountains within, and immediately adjacent to, Carlsbad Caverns National Park and on the Lincoln National Forest. It occurs in six canyons scattered over approximately 14 miles. Although NatureServe notes that 'less than 15 sites are known' the recent recovery plan notes the grouping of only two populations of this species. This plant grows only on north-facing limestone ledges, steep slopes and ridgetops, at 4,000 to 5,000 feet elevation; interior chaparral communities with sparse vegetation. Currently, the main threats are wildfires and climate change.

No critical habitat has been designated for this species. Avoidance mapping would reduce potential for soil changes and increased potential for non-native invasive species as a result of nutrient increase. Use of retardant in the vicinity of known occurrences of this species could be beneficial by limiting fire damage to habitat components and reducing the potential for fire to directly impact populations. The Lincoln National Forest is estimated to apply higher amounts of retardant to its landbase (0.01 percent). ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer.*** Due to the fact that historical use of retardant in the past has been 0.01 percent annually on this forest, there is a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Coryphantha sneedii var. *sneedii* - Sneed pincushion cactus

This species' major populations (populations of more than 50 individuals) occur in Doña Ana County, New Mexico; El Paso County, Texas; and the Guadalupe Mountains on National Park Service, Forest Service (Lincoln National Forest), BLM, and private lands. The cactus is restricted to limestone and grows in cracks on vertical cliffs or ledges in Chihuahuan desert scrub at elevations of 3,900 to 7,700 feet. Currently, the main threats are climate change and poaching.

No critical habitat has been designated for this species. Avoidance mapping would reduce potential for soil changes and increased potential for non-native invasive species as a result of nutrient increase. The Lincoln National Forest is estimated to apply higher amounts of retardant to its landbase (0.01 percent). ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer.*** Due to the fact that historical use of retardant in the past has been 0.01 percent annually on this forest, there is a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Dodecahema leptoceras - slender-horned spineflower

There are only eight populations of this species rangewide, and six of these occur on or near Forest Service lands. One population occurs on the San Bernardino National Forest, one occurs partially on the Cleveland National Forest, and three other populations occur in Lytle Creek and Cajon Creek adjacent to the San Bernardino National Forest and in Big Tujunga Canyon adjacent to the Angeles National Forest. This species is a prostrate annual, and the more robust populations of this species occur with other native annual forb species on floodplain terraces in areas without perennial vegetation. Occurrences of slender-horned spineflower are typically found in areas with no ground disturbance or exotic species invasions and occur in nutrient-poor alluvial soils.

An increase in exotic annual grasses has been shown to eventually preclude slender-horned spineflower from previously occupied habitat. Based on the general effects of the action described above for plant species, a fire retardant drop could result in the enhancement of non-native weeds. Many occurrences are in proximity to weedy exotics (52 FR 36265) such that they are vulnerable to their invasion should they become enhanced by fire retardant drops.

No critical habitat has been designated for this species therefore no impacts would occur. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer***. Avoidance mapping would reduce any potential for increased non-native invasive species of increasing in the area as a result of nutrient increases. Since the Cleveland and San Bernardino National Forests have applied fire retardant, on average, to 0.01 percent or more of their land bases annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Eriastrum densifolium ssp. *sanctorum* – Santa Ana River woolystar

There are no known populations of the giant woolystar on National Forest System lands. It is known to occur downstream from the San Bernardino National Forest and is suspected to occur on the San Bernardino National Forest although surveys have not yet documented occurrences there. Habitat includes alluvial fan scrub communities on higher floodplain terraces, juniper, and mountain mahogany.

No critical habitat has been designated. ***Populations downstream from the San Bernardino National Forest occur in cooperative areas or mutual aid boundaries and would be mapped for avoidance.*** Due to the fact that use of retardant in the past has occurred, on average, on more than 0.01 percent of the land base annually on the San Bernardino, there is the potential for a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Erigeron parishii - Parish's daisy

Refer to the discussion of *Acanthoscyphus parishii* var. *goodmaniana* above for analysis of this and other plants within the carbonate plants group.

Eriogonum kennedyi var. *austromontanum* - Southern Mountain buckwheat

Refer to the discussion of *Arenaria ursina* bove for analysis of this and other plants within the pebble plains plants group.

Eriogonum ovalifolium var. *vineum* - Cushenbury buckwheat

Refer to the discussion of *Acanthoscyphus parishii* var. *goodmaniana* above for analysis of this and other plants within the carbonate plants group.

Graptopetalum bartramii - Bartram stonecrop

Bartram stonecrop, also known as Patagonia mountain leather-petal, was listed as threatened effective in September 2021 (FR 48545). Currently, there are 50 extant populations across 12 mountain ranges in the southern Arizona and northern Mexico, although most of those populations have fewer than 150 individual plants. There are fewer than 4,000 adult plants known. Threats to these populations remain high, and include various effects related to drought and wildfire (NatureServe 2021). Plants are known to occur between 3,500 to 6,700 feet in elevation. Bartram stonecrop typically occurs on rocky outcrops in deep, narrow canyons in heavy cover of litter and shade; and typically within 10 meters of streambeds, springs, seeps, or intermittent streams.

This species is protected by the avoidance of water bodies and their associated 300-foot avoidance areas. ***Any known and newly discovered occurrences would be mapped for avoidance if necessary, to provide a 300-foot buffer***. This species has been mapped for avoidance on the Coronado National Forest in previous years. The species is very limited in distribution on National Forest System lands.

No critical habitat has been designated for this species. Retardant use has been more than 0.01 percent of the land base annually on the Coronado National Forest, so there is the potential for currently unknown occurrences to be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Hackelia venusta - showy stickseed

The showy stickseed is a narrow endemic plant known from one location in Chelan County, Washington. The only known population consists of about 600 plants that are scattered over approximately 12 acres of unstable, granitic sand and granite cliffs on the middle to lower slopes of Tumwater Canyon (USDI Fish and Wildlife Service 2008). The steepness of the slopes on which this plant is found exceeds 100 percent (45 degrees) inclination in many places. Clusters of showy stickseed plants are concentrated in open, unstable areas of granitic sand and talus, and on ledges and cracks of vertical granite cliffs (USDI Fish and Wildlife Service 2008). This plant is found in areas with relatively sparse cover of other vascular plants and low canopy cover. The majority of showy stickseed plants occur on Forest Service land (Okanagan-Wenatchee National Forest) with a small number of plants on private land.

Six major threats to this species have been identified: (1) physical disturbance to the plants and habitat by humans; (2) mass wasting (landslides); (3) encroachment by invasive plant species; (4) low seedling establishment; (5) fire suppression activities; and (6) wildfire. A single natural or human-caused environmental disturbance could destroy a significant percentage of the population or the entire population, leading to the extinction of the species (USDI Fish and Wildlife Service 2008).

From the perspective of fire management and strategic uses of fire retardant, an aerial retardant drop at this particular location is extremely unlikely given its location on the lower to middle slopes of a steep river canyon. In addition, the area containing the showy stickseed population is not currently at risk of supporting a high intensity wildfire or of being the point of origin for a fire (USDI Fish and Wildlife Service 2008). The terrain where showy stickseed is found is very unlikely to receive aerial applications of retardant if a fire were to occur in this area.

No critical habitat has been designated for this species; therefore, none will be affected. The single occurrence is avoidance mapped with a 300-foot buffer. Due to the fact that retardant use is more than 0.01 percent annually on the Okanagan-Wenatchee, combined with the fact that this is a small, isolated population, there is the potential for a higher likelihood that unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a may affect likely to adversely affect determination is warranted.

Hedeoma todsenii - Todsen’s pennyroyal

Todsen's pennyroyal grows in loose, gypseous-limestone soils associated with or positioned immediately below the Permian Yeso Formation; usually on steep north or east-facing slopes. It grows in pinyon-juniper woodlands at 1,900 to 2,300 meters (6,200 to 7,400 feet). Populations occur in two mountain ranges separated by about 75 kilometers (45 miles). There are five populations, with three on White Sands Missile Range and two on the Lincoln National Forest. The national forest populations encompass about 390 hectares (960 acres) each. Todsen’s pennyroyal populations have hundreds to thousands of separate clumps of plants with slender unbranched rhizomes connecting many of these clumps. This plant appears to be secure within its suitable habitat, but very low sexual reproduction reduces the potential to disperse to other suitable habitats. As a result, catastrophic fire that destroys a population is considered to be a serious threat to this species because once a population is extirpated it has little potential for recolonization. ***Due to the threat of fire, the Lincoln National Forest prefers not to map this species with avoidance areas*** (USDI Fish and Wildlife Service 2011). No non-native invasive plants have been identified as a problem in the Todsen's pennyroyal’s habitat.

No critical habitat has been designated for this species. Since the Lincoln National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Ipomopsis sancti-spiritus - Holy Ghost ipomopsis

Holy Ghost ipomopsis grows in openings in Rocky Mountain montane conifer forest at elevations of 2,350 to 2,500 meters (7,730 to 8,220 feet). It is known from a single natural population. Plants are relatively continuous in scattered patches for about 3.5 kilometers (2.2 miles) of Holy Ghost Canyon on the Santa Fe National Forest. There are about 80 hectares (200 acres) of occupied habitat. Counts of flowering plants in Holy Ghost Canyon have ranged from 150 to 650 during various years. A demographic study estimated young plants outnumber flowering plants three to one, which gives a minimum population estimate of about 600 plants and a maximum of about 2,600 plants.

The surrounding area is heavily developed for recreational use including a paved forest road, summer homes, and developed campgrounds. As a result, the area is not grazed by domestic livestock and has had full fire suppression for many decades.

Threats to Holy Ghost ipomopsis include competition from non-native plants such as orchard grass (*Dactylis glomerata*) and smooth brome (*Bromus inermis*) introduced for soil stabilization and forage. Scotch thistle (*Onopordum acanthium*) is established in the area and may pose a future threat. The recovery plan for this species identified fire as a primary threat. ***It is felt that the threat of fire outweighs the potential adverse effects from the application of fire retardants (USDI Fish and Wildlife Service 2011). Therefore, no avoidance mapping is desired for these occurrences***.

Efforts began in 2006 to establish three new populations of Holy Ghost ipomopsis in nearby canyons. A population in Indian Creek Canyon is about 4 kilometers (2.5 miles) south of Holy Ghost Canyon. Populations near Panchuela Campground and in Winsor Creek Canyon are about 8 kilometers (5 miles) north of Holy Ghost Canyon. The total size of the three introduced populations is about 6 hectares (15 acres). It is still uncertain if the introduced populations will become self-sustaining.

No critical habitat has been designated for this species. The forest has not mapped the species for avoidance. Use of retardant in the vicinity of known occurrences of this species could be beneficial by limiting fire damage to habitat components and reducing the potential for fire to directly impact populations. Since the Santa Fe National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Additionally, this is a small isolated population. Therefore, a **may affect likely to adversely affect determination** is warranted.

Ivesia webberi- Webber ivesia

This species is known from seventeen extant occurrences in a small region of northeastern California and western Nevada. There are known occurrences on the Humboldt-Toiyabe National Forest and there is potential for occurrence on the Plumas and Tahoe National Forests as well. This species occurs between 4,475 to 6,237 feet in rocky clay in sagebrush flats, benches, or terraces above and adjacent to large valleys. Nearly all occurrences are threatened by more frequent and intense fires that can cause mortality and loss of the seedbank. Invasive species, which fuel these fires, quickly recolonize after fire, and outcompete species such as Webber ivesia.

Newly discovered occurrences would be mapped with a 300-foot avoidance buffer. Since the Humboldt-Toiyabe National Forest (and the Plumas and Tahoe National Forests) has applied fire retardant, on average, to more than 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat has been designated on approximately 1220 acres of National Forest System lands on the Humboldt-Toiyabe National Forest (roughly 822 acres) and the Tahoe National Forest (roughly 398 acres); approximately 228 acres of critical habitat are also designated on adjoining private lands. Primary constituent elements are:

- Plant community.
    - ♦ Open to sparsely vegetated areas composed of generally short-statured associated plant species.
    - ♦ Presence of appropriate associated species that can include (but are not limited to): *Antennaria dimorpha, Artemisia arbuscula, Balsamorhiza hookeri, Elymus elymoides, Erigeron bloomeri, Lewisia rediviva, Poa secunda,* and *Viola beckwithii*.
    - ♦ An intact assemblage of appropriate associated species to attract the floral visitors that may be acting as pollinators of *Ivesia webberi*.
- Topography. Flats, benches, or terraces that are generally above or adjacent to large valleys. Occupied sites vary from slightly concave to slightly convex or gently sloped (0 to 15°) and occur on all aspects.
- Elevation. Elevations between 4,475 and 6,237 feet (1,364 and 1,901 meters).
- Suitable soils and hydrology.
    - ♦ Vernally moist soils with an argillic horizon that shrink and swell upon drying and wetting; these soil conditions are characteristic of known *Ivesia webberi* populations and are likely important in the maintenance of the seedbank and population recruitment.
    - ♦ Suitable soils that can include (but are not limited to): Reno—a fine, smectitic, mesic Abruptic Xeric Argidurid; Xman—a clayey, smectitic, mesic, shallow Xeric Haplargids; Aldi— a clayey, smectitic, frigid Lithic Ultic Argixerolls; and Barshaad—a fine, smectitic, mesic Aridic Palexeroll.

All critical habitat is avoidance mapped. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Lilaeopsis schaffneriana ssp. *recurva* - Huachuca water umbel

The Huachuca water umbel grows in cienegas (marshy wetlands) and along streams and rivers. It can grow in saturated soils or as an emergent in water depths up to about 25 cm (10 in). High quality Huachuca water umbel sites have stable perennial stream flow and herbaceous vegetation that stabilizes the banks and channel. The surrounding non-wetland vegetation can be desert scrub, grassland, oak woodland, or conifer forest.

The four populations on Coronado National Forest are in small streams with a conifer overstory in the Huachuca Mountains. This plant has been documented from 16 extant sites in four watersheds in southeastern Arizona and adjacent Sonora, Mexico. Some of the sites are widely separated from one another, but the four sites on National Forest System lands and one site on adjacent Fort Huachuca are in relatively close proximity at the southern end of the Huachuca Mountains. The Huachuca Mountains sites have the greatest plant density of the known populations. For instance, Scotia Canyon contains one of the largest populations occupying about 57 percent of the 1,500 meters (4,800 feet) perennial reach of the stream. The occupied streams in the Huachuca Mountains are so small that they will be difficult to observe and avoid if retardant drops are needed to suppress a nearby fire.

No invasive non-native weeds have been identified as threats in the general area of the Huachuca Mountains. No non-native aquatic plants have been identified as threats to Huachuca water umbel.

This species is protected by the avoidance of water bodies and their associated 300-foot avoidance areas. ***Any known and newly discovered occurrences would be mapped for avoidance if necessary, to provide a 300-foot buffer***. The species is very limited in distribution on National Forest System lands. Therefore, avoidance areas would be highlighted in occupied areas to avoid to the greatest extent possible without compromising the protection for values-at-risk (USDI Fish and Wildlife Service 2011). Retardant use has been more than 0.01 percent annually on the Coronado National Forest, so there is the potential for a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated in Region 3 on the Coronado National Forest. Primary constituent elements are: (1) Sufficient perennial base flows to provide a permanently or nearly permanently wetted substrate for growth and reproduction of Huachuca water umbel; (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; (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 (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 population to survive catastrophic floods and recolonize larger areas. (http://www.gpo.gov/fdsys/pkg/CFR-2006-title50-vol4/pdf/CFR-2006-title50-vol4-sec17-96.pdf).

The proposed action is likely to affect critical habitat because the probability of an intrusion or invoking of an exception may be higher on forests that use more retardant, but the action is not likely to appreciably diminish the value of primary constituent elements essential to the species' conservation. This conclusion is based on the following: 1) fire retardant applications in or near critical habitat areas will not change stream base flows; 2) fire retardant applications in or near critical habitat areas will not alter stream channel stability; 3) any increase in vegetation growth from fire retardants is likely temporary (there is no measurable increase in growth for the growing season following the retardant application), therefore, fire retardant applications in or near critical habitat areas will not change the stability of the riparian plant community over time, and 4) fire retardant applications in or near critical habitat areas will not change the presence of refugial sites.

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be **minor and may be affected but not likely to be adversely affected**.

Mirabilis macfarlanei - MacFarlane's Four-O'clock

Thirteen populations of MacFarlane's four-o'clock are currently known. The latest five-year review (USDI Fish and Wildlife Service 2015) for McFarlane's four-o'clock states that no new threats and no significant new information regarding the species' biological status have become available since the last five-year review conducted in January 2009 (USDI Fish and Wildlife Service 2009). It also states that no new species biology or life history information has been determined since the revised recovery plan was finalized in 2000. Three of these populations are found in the Snake River Canyon area (Idaho County, Idaho and Wallowa County, Oregon), seven in the Salmon River area (Idaho County, Idaho), and three in the Imnaha River area (Wallowa County, Oregon). It is documented to occur on the Wallowa-Whitman National Forest in Forest Service Region 6. The total geographic range of the species is an area of approximately 29 by 18 miles. The habitat includes river canyon habitats characterized by regionally warm and dry conditions. Precipitation occurs mostly as rain during the winter and spring. Sites are dry and open, or with scattered shrubs. Plants can be found on all aspects, but most often on southeast to western exposures. Slopes are often steep, but range to nearly flat. Plants can occur along any slope position. Fire retardant drops are considered likely in the grassland habitat of the Hells Canyon Natural Recreation Area, where this plant grows.

No critical habitat has been designated for this species. ***The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer***. Since the Wallowa-Whitman National Forests applies fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect** determination is warranted.

Nolina brittonia - Britton's Beargrass

Britton's beargrass is a fire-dependent Florida endemic species. On the National Forests in Florida, it is only known from a very small population (around 20 individuals) in fire-maintained sandhill (longleaf pine- wiregrass) of the Ocala National Forest. The stand it occurs in and an adjacent buffering stand were included in the aerial retardant avoidance areas. Further south in Florida, the species occurs in sandhill and oak- sand pine scrub. This species is known or believed to occur in the following counties: Highlands, Lake, Marion, Orange, Osceola, and Polk as well as documented on the Lake Wales Ridge National Wildlife Refuge and several other public/ private conservation lands.

No critical habitat has been designated for this species. The National Forests of Florida are estimated to apply aerial fire retardant to its 0.01 percent or more of its landbase. Due to the fact that historical use of retardant in the past has been 0.01 percent annually on this forest, there is the potential for a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely adversely affect determination** is warranted.

Opuntia treleasei - Bakersfield cactus

As of 2013 there were 37 known or presumed extant occurrences for this species in central Kern County California; those occurrences are presumed to still exist. Of these occurrences, one is on National Forest System land on the Sequoia National Forest, and another is adjacent to National Forest System land.

Bakersfield cactus grows in sparsely vegetated low shrub-grasslands. The primary threat to the species is habitat loss associated with human activities such as development, agricultural conversion of land, overgrazing, and oil field development. Other threats include off-road vehicle use, dumping, competition with non-native, invasive species such as annual grasses, air pollution, and maintenance of roads and other infrastructure (https://wildlife.ca.gov/Conservation/Plants/Endangered/Opuntia-basilaris-var-treleasei).

No critical habitat has been designated for this species. Fertilizing effects of retardant use could increase growth of non-native invasive species. ***Known occurrences are not mapped with avoidance areas***. The Sequoia National Forests use of retardant has increased since the 2011 analysis; the Forest applies retardant on average to more than 0.01 percent of its land base annually. Although there is only one known occurrence on National Forest System lands, the potential exists for currently unknown occurrences to be directly affected by retardant. Therefore, a **may affect, is likely to adversely affect determination** is warranted.

Orcuttia tenuis - Slender Orcutt Grass

Slender Orcutt grass is known or believed to occur in Lassen, Modoc, Shasta and Siskiyou Counties in California. It is documented to occur on the Lassen, Modoc, and Plumas, and is suspected to occur on the Shasta Trinity National Forests. The habitat consists of vernal pools with a very well developed soil profile. Slender Orcutt grass prefers clay soils which shrink and swell. As they dry, large cracks develop which allow seeds trapped deeply in the soil to float to the surface with the first inundation.

Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer. Since the Lassen, Modoc, Plumas and Shasta Trinity National Forests have applied fire retardant, on average, to more than 0.01 percent of their land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 21,885 acres in Forest Service Region 5 on the Lassen National Forest. Primary constituent elements are: Topographic features characterized by isolated mount and intermound complexes, vernal pool habitats, that promote germination, flowering and seed production of predominantly annual native wetland species and typically exclude both native and non-native upland plant species in all but the driest years. (http://www.gpo.gov/fdsys/pkg/FR-2006-02-10/pdf/06-1080.pdf 71FR 28 – 7279).

Critical habitat is not avoidance mapped. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Phacelia argillacea - Clay Phacelia

Clay phacelia is found on xeric (dry) sites dominated by Green River shale. In 1977, only 1 population of 9 plants (bisected by a railway) was known (43 FR 44811). A 1980 survey of the site found an estimated 200 individuals along a railroad cut and a four-lane state highway. In

1999, an additional population was found approximately 8 kilometers (5 miles) downstream from the prior known population (USDI Fish and Wildlife Service 2008). Neither of these locations is on National Forest System lands and is only suspected. Even though majority of the preferred habitat (Green River Shale) of clay phacelia is on Forest Service land it is still very narrow in scope. Much of the habitat is low in the Spanish Fork Canyon and has been extensively surveyed with negative results. Most of the suitable, but unoccupied habitat is on the Uinta-Wasatch-Cache and Manti-La Sal National Forests. In 2004, the Uinta National Forest agreed to introduce the clay phacelia on suitable lands in order to advance recovery goals of establishing at least one new population of 2,000 individuals. In 2007, seeds from greenhouse grown plants were introduced to two sites on Uinta National Forest lands. To date, these efforts have not been successful. The introduction sites are located on sparsely vegetated, fragmented, steep shale outcroppings within approximately 1,000 feet (305 meters) of large, high voltage power transmission lines. In addition, natural (exposed rock) and man-made (railroad tracks and highway) breaks exist within ¼ to ¾ miles of the introduction sites. These areas are not likely to carry a fire initiating an aerial fire retardant drop, nor are either likely to receive a fire retardant drop due to the proximity of large, high voltage power transmission and risk to the aircraft.

No critical habitat has been designated for this species. ***The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer***. Additionally, in consultation with the Utah Office of the Fish and Wildlife Service, ***an avoidance area was mapped to include suitable habitat within areas identified for reintroduction of the species***. Since the Uinta-Wasatch-Cache and Manti-La Sal National Forests have applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Phlox hirsuta - Yreka phlox

The federally listed endangered plant, *Phlox hirsuta* (Yreka phlox) is a serpentine endemic known from five locations in the vicinity of Yreka, California. Approximately 8,015 to 15,865 plants are found over a total of more than 665 acres (269 hectares), 26 percent of which are Federal lands managed by the Klamath National Forest on Soap Creek Ridge. The Soap Creek Ridge occurrence is comprised of at least 14 discrete sub occurrences containing 5,000 to 10,000 plants over a 236-hectare (584-acre) area.

Yreka phlox habitat is generally rocky and occurs on rounded ridge tops and steeper side slopes that are sparsely vegetated with scattered *Pinus jeffreyi* (Jeffrey pine), an assortment of drought tolerant shrubs, including *Ceanothus cuneatus* (buckbrush) and *Cercocarpus betuloides* (birch-leaf mountain mahogany), and perennial native grasses and forbs. Fire retardant drop or anchors may be used in this type of habitat and the potential for an accidental drop could occur.

No critical habitat has been designated for this species. ***The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer***. Since the Klamath National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Physaria kingii **ssp.** ***bernardina*** **(*****Lesquerella kingii*** **ssp.** ***bernardina*****) - San Bernardino Mountains bladderpod**

Refer to the discussion of *Acanthoscyphus parishii* var. *goodmaniana* above for analysis of this and other plants within the carbonate plants group.

Poa atropurpurea **- San Bernardino bluegrass**

This endemic bluegrass species is found in montane meadow habitat in Big Bear Valley in the San Bernardino Mountain range and at six meadow locations in the Laguna and Palomar Mountains in San Diego County. It is an upper elevation plant 6,000 to 7,500 feet (1,800 to 2,300 meters) commonly found in the drier margins of vernally moist meadows. Most of these occurrences lie on National Forest System lands on the Cleveland and San Bernardino National Forests. Due to limited survey effort, data are not available to know the relative abundance of the bluegrass or importance of these occurrences; therefore, this analysis assumes they are of approximately equal value. At many of the known sites, the bluegrass has become so sparse that the species has not been detected for many years. As a result, the Forest Service has been using the phenology of Kentucky bluegrass as a management indicator for releasing cattle onto Forest Service grazing allotments that support San Bernardino bluegrass. Many of these populations appear vulnerable to extirpation and stimulation of non-native plants.

Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer. Since the San Bernardino and Cleveland National Forests have applied fire retardant, on average, to 0.01 percent or more of their land bases annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated in Forest Service Region 5, with 115 acres on the Cleveland National Forest and 804 acres on the San Bernardino National Forest. Primary constituent elements are: (1) Wet meadows subject to flooding during wet years in the San Bernardino Mountains in San Bernardino County at elevations of 6,700 to 8,100 feet (2,000 to 2,469 meters), and in the Laguna and Palomar Mountains of San Diego County at elevations of 6,000 to 7,500 feet (1,800 to 2,300 meters), that provide space for individual and population growth, reproduction, and dispersal; and (2) Well-drained, loamy alluvial to sandy loam soils occurring in the wet meadow system, with a 0 to 16 percent slope, to provide water, air, minerals, and other nutritional or physiological requirements to the species (http://www.gpo.gov/fdsys/pkg/FR-2008-08-14/pdf/E8-17522.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Senecio layneae **- Layne's butterweed**

Layne's butterweed is known to occur on the Eldorado, Plumas, and Tahoe National Forests. The habitat of Layne's butterweed consists of chaparral communities primarily on gabbro-derived soils, occasionally on serpentine.

No critical habitat has been designated for this species. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer***. Since the Eldorado, Plumas, and Tahoe National Forests has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination is warranted**.

Sidalcea oregana var. *calva* -Wenatchee Mountains checker-mallow

Wenatchee Mountains checkermallow is geographically restricted to the east side of the Cascades in the Wenatchee Mountains of central Washington. This species is found in wet meadows and wetlands at elevations ranging from 488 meters to 1,000 meters (1,600 feet to 3,300 feet). Populations of Wenatchee Mountains checkermallow are generally concentrated in the wetter portions of open forest - moist meadow habitats, in slight topographic depressions. The plant may also be found in open conifer forests, on the perimeter of shrub and hardwood thickets, along permanent or intermittent streams in sparsely forested draws, and near seeps, springs, or small drainages. The Fish and Wildlife Service (USDI Fish and Wildlife Service 2020) indicates that there are seven known sites where this perennial forb occurs. Three of these sites occur either wholly (Poison Canyon, Forest Service) or partially (Camas Meadows) on the Wenatchee National Forest.

All known locations are avoidance mapped. Due to the fact that historical use of retardant in the past has been more than 0.01 percent annually on Okanagan-Wenatchee combined with the fact that this is a small isolated population there is a higher likelihood that currently unknown occurrences may be hit with retardant or that invoking an exception to the guidelines could occur, therefore a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 2280 acres in Forest Service Region 6, on the Wenatchee National Forest. Primary constituent elements are surface water or saturated upper soil profiles; a wetland plant community dominated by native grasses and forbs, and generally free of woody shrubs and conifers that would produce shade and competition for *Sidalcea oregana* var. calva; seeps and springs on fine textured soils (clay loams and silt loams), which contribute to the maintenance of hydrologic processes necessary to support meadows which remain moist into the early summer; and elevations of 488 to 1,000 meters (1,600 to 3,300 feet) http://www.gpo.gov/fdsys/pkg/FR-2001-09-06/pdf/01-22341.pdf.

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Sidalcea pedata - pedate checker-mallow (also known as bird-footed checkerbloom), *Taraxacum californicum* - California dandelion, and *Thelypodium stenopetalum* - slender-petaled mustard

Occurrences of these mountain meadow species are small and isolated. The occurrences of pedate checkermallow range in size from 0.1 to 3.3 acres (USDI Fish and Wildlife Service 1998); California dandelion occurrences contain from 2 to 300 individuals (63 FR 49006); and slender-petaled mustard exists at only at 6 to 8 locations (USDI Fish and Wildlife Service 1998). For California dandelion, there are about 20 occurrences (63 FR 49006) with 11 on the San Bernardino National Forest. The Forest Service has identified 73 site-specific localities of California dandelion with 53 of these on the San Bernardino National Forest. For slender-petaled mustard, there are 6 (possibly 8) occurrences with 2 on the San Bernardino National Forest.

Many of the occurrences of these species are in open areas near the urbanized areas of Big Bear City and Big Bear Lake Village where fire retardant has a high likelihood of placement. The open nature of the habitat for these mountain meadow species are sough-after anchor points for retardant lines. Effects to these species are unclear. Avoidance mapping would reduce any potential for increased non-native invasive species of increasing in the area as a result of nutrient increases. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer.*** Since the San Bernardino National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted for these species.

Critical habitat is designated for one species in this group, with discussion and effects as follows:

Taraxacum californicum

Critical habitat is designated on 1344 acres in Forest Service Region 5, on the San Bernardino National Forest. Primary constituent elements are: (1) Wet meadows subject to flooding during wet years and forest openings with seeps, springs, or creeks in the San Bernardino Mountains in San Bernardino County located at elevations of 6,700 to 9,000 feet (2,000 to 2,800 meters), that provide space for individual and population growth, reproduction, and dispersal; and (2) Well-drained, loamy alluvial to sandy loam soils occurring in the wet meadow system or forest openings with seeps, springs, or creeks, with a 0 to 46 percent slope, to provide water, air, minerals, and other nutritional or physiological requirements to the species (http://www.gpo.gov/fdsys/pkg/FR-2008-08-14/pdf/E8-17522.pdf).

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to California dandelion critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Silene spaldingii - Spalding's catchfly

Spalding's catchfly is known to occur in Idaho, Montana, Oregon and Washington. It is documented to occur on the Nez Perce, Umatilla, and Wallowa-Whitman National Forests (Forest Service Regions 1, and 6). It is also suspected to occur on the Lolo, Kootenai, and Idaho Panhandle National Forests. Spalding's catchfly is a regional endemic found predominantly in bunchgrass grasslands and sagebrush – steppe, and occasionally in open pine communities. The plant is found at elevations ranging from 365 meters to 1,615 meters (1,200 feet to 5,300 feet), usually in deep, productive loess (fine, windblown) soils and glacial soils (such as at the Dancing Prairie Preserve in Montana) (USDI Fish and Wildlife Service 2020). Plants are generally found in swales or on northwest- to northeast-facing slopes where soil moisture is relatively higher, but they can be found occasionally on any aspect.

The five-year review (USDI Fish and Wildlife Service 2020) states, "Identified threats at the time of listing included invasive non-native plants, problems associated with small geographically isolated populations, changes in the wildfire regime and wildfire effects, land conversion associated with urban and agricultural development, adverse grazing and trampling by domestic livestock and native herbivores, herbicide and insecticide spraying, off-road vehicle use, insect damage and disease, impacts from prolonged drought and climate change, and inadequacy of existing regulatory mechanisms. No new threats and no significant new information regarding the species' biological status have become available since the last five-year review conducted in January 2009." (USDI Fish and Wildlife Service 2009).

No critical habitat has been designated for this species. ***The forests have mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer***. Retardant use has increased on the three forests where this species is known to occur since the last analysis. Since the Umatilla, Wallowa-Whitman, and Lolo National Forests apply retardant on average, to 0.01 percent of their land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Additionally, the grasslands and lower montane grassland openings in ponderosa pine/Douglas-fir forest are considered in these regions to have a higher potential for retardant use and undetected or undocumented populations are at risk. Therefore, a **may affect likely to adversely affect determination** is warranted.

Spiranthes delitescens - Canelo Hills ladies-tresses

Canelo Hills ladies-tresses is known from five populations. One of these populations occurs on the Coronado National Forest, and it is the smallest of the known populations (four flowering plants when discovered in 1996). The other four populations are on private land. The populations are geographically isolated from one another.

Canelo Hills ladies-tresses grows in cienega wetlands that do not burn. These areas would be sufficiently protected by the aquatic buffer areas of 300 feet, however, because this species is very limited in distribution, occupied areas would be identified to avoid to the greatest extent possible without compromising the protection of values-at-risk.

No critical habitat has been designated for this species. **The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer**. Since the Coronado National Forest has applied fire retardant, on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Taraxacum californicum - California Dandelion

Refer to the discussion of *Sidalcea pedata* (pedate checkermallow) above for analysis of this and other plants within the mountain meadow plants group.

Thelypodium stenopetalum - slender-petaled mustard

Refer to the discussion of Sidalcea pedata (pedate checkermallow) above for analysis of this and other plants within the mountain meadow plants group.

Townsendia aprica - Last Chance townsendia

Currently, 20 populations (2 historic, last observed in 1986) comprised of approximately 21,000 individuals in roughly 160 square miles (414.4 square kilometers) of habitat (USDI Fish and Wildlife Service 2008) are known. Less than one third of all known sites occur on National Forest System lands, on the Fishlake and Dixie National Forests. (USDI Fish and Wildlife Service 2008).

Habitat for the Last Chance townsendia occurs in pinyon-juniper woodland openings on soils derived from shale lenses (USDI Fish and Wildlife Service 2008). Forest Service lands containing Last Chance townsendia habitat are not likely to carry a fire needing fire suppression, nor are there any known resources at risk within or nearby Last Chance townsendia habitat that would require an aggressive initial attack using fire retardant (USDI Fish and Wildlife Service 2008).

No critical habitat has been designated for this species. Avoidance mapping was completed using a 1-mile buffer to provide for any individuals or potential habitat that may have been missed in previous surveys. Retardant use has stayed below the 0.01 percent threshold on the Fishlake National Forest but has increased on the Dixie National Forest to above the 0.01 percent threshold since the last analysis. Since the Dixie National Forests apply retardant on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Tuctoria greenei - Greene's tuctoria

This species is endemic to the Central Valley of California. It occurs in three Vernal Pool Regions: the Northeastern Sacramento Valley Vernal Pool Region (Tehama County and Butte County), particularly in the Vina Plains; the Modoc Plateau Vernal Pool Region to the north (Shasta County); and the Southern Sierra Foothills Vernal Pool Region some distance to the south (eastern Merced County, with one historical occurrence in Madera County). It is considered historical in Tulare, Fresno, San Joaquin, and Stanislaus Counties, and extirpated from Glenn County Current range is estimated to be about 17,000 square kilometers. Orcutt grass is known or believed to occur on the Colusa national wildlife refuge, Delevan national wildlife refuge, and the Sacramento national wildlife refuge. It has been documented to occur on the Modoc National Forest. Orcutt grass grows in dried vernal pools on the eastern side of the Sacramento and San Joaquin Valleys, occurring in Northern Basalt Flow, Northern Claypan, and Northern Hardpan vernal pools on both low and high terraces within grassland communities, or, rarely, pine forest (one Shasta County occurrence) (USDI Fish and Wildlife Service 2008). Plants have been documented on clay, loam, and stony clay loam soils, and pools are underlain by iron-silica cemented hardpan, tuffaceous alluvium, or claypan. Occupied pools range in size from 50 square meters to 3.4 hectares (median size 0.6 hectares).

Retardant use has increased on the Modoc National Forest to above the 0.01 percent threshold since the last analysis. ***All existing and future documented occurrences would be protected with avoidance mapping*** Since the Modoc National Forests apply retardant on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect likely to adversely affect determination** is warranted.

Critical habitat is designated on 1551 acres in Forest Service Region 5, on the Lassen National Forest. Primary constituent elements are: Topographic features characterized by isolated mount and intermound complexes, vernal pool habitats, that promote germination, flowering and seed production of predominantly annual native wetland species and typically exclude both native and non-native upland plant species in all but the driest years https://www.govinfo.gov/content/pkg/FR-2006-02-10/pdf/06-1080.pdf#page=2

Critical habitat is not avoidance mapped. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Plant Species Not Likely to Be Adversely Affected

Plant species that are not likely to be adversely affected by use of aerially delivered retardant include known or suspected occurrence on a forests where retardant use is considered to be low (less than 0.01 percent of its land base annually), or if the species documented or suspected on a forest that applies more retardant (0.01 percent or more of land base annually) but the species occurs in specific habitats that have a low probability of retardant application (aquatic species, wet cliff sides, dunes, etc.). Most occurrences of these plants are protected from retardant effects through use of avoidance areass, unless specific site conditions exist where aerial retardant delivery is not possible due to terrain conditions, or the probability of retardant application is extremely low (e.g., some forests in the eastern U.S.). Species specific information can be found in the individual species determination section.

National Forests where retardant use is less than 0.01 percent of their land base annually include: Beaverhead-Deerlodge, Custer Gallatin, Dakota Prairie grasslands, Flathead, Arapaho & Roosevelt, Bighorn, Black Hills, Grand Mesa Uncompahgre and Gunnison, Nebraska, Pike and San Isabel, Rio Grande, Shoshone, Apache-Sitgreaves, Carson, Kaibab, Ashley, Caribou-Targhee, Fishlake, Payette, Salmon-Challis, Lake Tahoe Basin Management Unit, Columbia River Gorge, Fremont-Winema, Gifford Pinchot, Mt Hood, Willamette, Chattahoochee-Oconee, Cherokee, National Forests in Texas, National Forests in North Carolina, Chippewa, Mark Twain, and Superior.

Table 39. Summary of analyses for plant species not likely to be adversely affected by use of aerially delivered fire retardant

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Arabis (Boechera) serotina	E	Shale barren rock-cress	8, 9	George Washington-Jefferson, Monongahela	N	N	N	LRUF
Asclepias meadii	T	Mead's milkweed	9	Mark Twain, Midewin, Shawnee	N	N	Y	LRUF
Astragalus osterhoutii	E	Osterhout milkvetch	2	Suspected on Arapahoe, Medicine Bow-Routt	N	N	N- only suspected	LRUF
Bonamia grandiflora	T	Florida bonamia	8	National Forests in Florida	N	N	Y	LRUF
Coryphantha scheeri var. robustispina	E	Pima pineapple cactus	3	Coronado	N	Y	N	Habitat
Echinacea laevigata	E	Smooth purple coneflower	8	George Washington-Jefferson, Chattahoochee - Oconee, Francis-Marion-Sumter National Forests and suspected on the National Forests in North Carolina	N	N	Y (Francis-Marion only)	LRUF/Habitat

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Echinocereus fendleri var. kuenzleri	E	Kuenzler hedgehog cactus	3	Lincoln	N	Y	Y	Habitat
Echinocereus triglochidiatus var. arizonicus	E	Arizona hedgehog cactus	3	Tonto	N	N	N	Habitat
Eriogonum longifolium var. gnaphalifolium	T	Scrub buckwheat	8	National Forests in Florida	N	N	Y	LRUF
Erigeron rhizomatus	T	Zuni fleabane	3	Cibola	N	Y	N	Habitat
Eutrema penlandii	T	Penland alpine fen mustard	2	Pike San Isabel, White River	N	N	Y	LRUF
Fritillaria gentneri	E	Gentner mission-bells	5, 6	Rogue River Siskiyou, suspected Klamath	N	Y	N	Habitat
Geum radiatum	E	Spreading avens	8	Cherokee, National Forests in North Carolina	N	N	Y	LRUF/Habitat
Gymnoderma lineare	E	Rock gnome lichen	8	Chattahoochee-Oconee, Cherokee, George Washington-Jefferson, National Forests in North Carolina	N	N	Y	LRUF/Habitat

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Harperocallis flava	E	Harper's beauty	8	National Forests in Florida	N	N	Y	LRUF
Helenium virginicum	T	Virginia sneezeweed	8, 9	George Washington-Jefferson, Mark Twain	N	N	N George Washington/Jefferson, Y Mark Twain	LRUF/Habitat
Helianthus schweinitzii	E	Schweinitz's sunflower	8	National Forests in North Carolina	N	N	Y	LRUF
Helonias bullata	T	Swamp pink	8	Chattahoochee-Oconee, George Washington-Jefferson, National Forests in North Carolina	N	N	Y	LRUF
Hisbiscus dasycalyx	T,CH	Neches River rose mallow	8	Davey Crockett National Forests in Texas	N	N	Y	LRUF
Houstonia montana	E	Mountain bluet	8	Nantahala-Pisgah	N	N	Y	LRUF
Houstonia purpurea var. montana (Hedyotis purpurea var. montana)	E	Roan Mountain bluet	8	National Forests in North Carolina, Cherokee	N	N	Y	LRUF/Habitat
Howellia aquatilis	T	Water howellia	1, 5, 6	Mendocino, Flathead, suspected on: Six Rivers, Lolo, Kootenai, Idaho Panhandle,	N	Y in R6 (Oregon_; Y in R5	Y	Habitat

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
				Colombia River Gorge, Gifford Pinchot, Okanogan-Wenatchee, Mount Hood		(California)		
Hudsonia montana	T, CH	mountain golden heather	8	National Forests in North Carolina	N	N	Y/Y	LRUF
Ipomopsis polyantha	E, CH	Pagosa skyrocket	2	Suspected on San Juan	N	Y	N	LRUF/Habitat
Isotria medeoloides	T	small whorled pogonia	8,9	White Mountain., Monongahela, suspected or known on Wayne, Allegheny, Chattahoochee-Oconee, Cherokee, George Washington-Jefferson, National Forests in North Carolina, Francis-Marion Sumter	N	N	Y	LRUF/Habitat
Lesquerella pallida	E	white bladderpod	8	National Forests in Texas	N	N	N	LRUF
Liatris helleri	T	Heller's blazing star	8	National Forests in North Carolina	N	N	Y	LRUF
Lupinus oreganus var. kincaidii (Lupinus	T, (CH)	Kincaid's lupine	6	Umpqua, suspected on Siuslaw	N	Y	Y/Y CH	Retardant use, habitat in

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
sulphureus ssp. kincaidii)								retardant prone area
Lysimachia asperulaefolia	E	rough-leaved loosestrife	8	National Forests in North Carolina	N	N	Y	LRUF
Macbridea alba	T	white birds-in-a-nest	8	National Forests in Florida	N	Y	Y	Retardant use
Pectis imberbis	E; CH	beardless chinchweed	3	Coronado	N	Y	N/N	Habitat
Pediocactus peeblesianus var. fickeisenii	E, CH	Fickeisen plains cactus	3	Kaibab	N	N	Y	LRUF
Penstemon haydenii	E	blowout penstemon	2	Nebraska (known), Medicine Bow-Routt (suspected)	N	N-Nebraska, Y-Medicine Bow-Routt	Y	LRUF
Phacelia scopulina var. submutica (Phacelia submutica)	T, CH	DeBeque phacelia	2	GrandMesa-Umcompahgre, White River	N	N	Y	LRUF
Pinguicula ionantha	T	Godfrey's butterwort	8	National Forests in Florida	N	N	Y	LRUF

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Pinus albicaulis	PT	whitebark pine	1,4 and 5	Many	N	Y	N	Widespread
Pityopsis ruthii	E	Ruth's golden-aster	8	Cherokee	2 water - sheds	Y	Y	Habitat
Platanthera integrilabia	T	white fringless orchid	8	National Forests in North Carolina, Chattahoochee, Alabama	N	N	N	LRUF
Polygala lewtonii	E	Lewton's polygala	8	National Forests in Florida	N	N	Y	LRUF
Platanthera praeclara	T	western prairie fringed orchid	1,2	Sheyenne National Grassland, in southeastern North Dakota, suspected in Nebraska National Forest, Samuel R McKelvie & Oglala, Buffalo Gap, or Fort Pierre National Grasslands Nebraska	N	N	N	LRUF/Habitat
Primula maguirei	T	Maguire primrose	4	Uinta-Wasatch-Cache	Y	Y	Y	Habitat – populations in area where retardant would not be applied

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Purshia (Cowania) subintegra	E	Arizona cliffrose	3	Coconino, Tonto	N	Y	N	Habitat
Rhodiola integrifolia ssp leedyi	T	Leedy's roseroot	2	Black Hills	N	N	Y	LRUF/Habitat
Rhododendron minus var. chapmanii (Rhododendron chapmanii)	E	Chapman's rhododendron	8	Suspected on National Forests in Florida	N	Y	N	LRUF/Habitat
Sclerocactus glaucus	T	Colorado hookless cactus	2	Grand Mesa-Uncompaghre, suspected on White River	N	N- Grand Mesa Uncompahgre, Y- White River	Y	LRUF
Scutellaria floridana	T	Florida skullcap	8	National Forests in Florida	N	N	Y	LRUF
Sencio franciscanus (Packera franciscana)	T, CH	San Francisco peaks groundsel (San Francisco ragwort)	3	Coconino	N	Y	N/N	Habitat
Solidago spithamaea	T	Blue Ridge goldenrod	8	Cherokee, National Forests in North Carolina	N	N	Y	LRUF/Habitat

Scientific Name	Federal Status and Critical Habitat[1]	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated area[2]	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[3]
Spiraea virginiana	T	Virginia spiraea	8, 9	Daniel Boone, Cherokee, George Washington-Jefferson, National Forests of North Carolina, Monongahela and suspected on the Wayne	N	N	Y	LRUF/Habitat
Spiranthes diluvialis	T	Ute ladies'-tresses orchid	2,4, 6	Uinta, Targhee, near border of Ashley Suspected: Medicine Bow-Routt, Pike San Isabel, White River, Okanogan, Boise, Caribou Targhee, Salmon, Sawtooth, Wasatch Cache, Challis, Fish Lake	N	Y	Y where occurs	Habitat
Spiranthes parksii	E	Navasota ladies'-tresses	8	National Forests in Texas	N	N	N	LRUF
Trifolium stoloniferum	E	running buffalo clover	8,9	Daniel Boone, Wayne, Mark Twain, Monongahela	N	N	Y on Mark Twain, N Wayne and Monongahela	LRUF
Trillium reliquum	E	Relict trillium	8	Oconee	N	N	N	LRUF

[1] Federal status and Critical Habitat codes are: T=Threatened, E=Endangered, PT=Proposed Threatened, CH= Designated Critical Habitat, PCH=Proposed Critical Habitat

[2] Populations of individuals in a single isolated area refers to a narrow endemic or isolated population occurring only in a single small geographic area, on a National Forest where it may experience an aerial retardant drop because of accidental intrusion or use of an exception, and would be most vulnerable to impacts
[3] Rationale is tied to the National Effects Screening Process section for terrestrial species, and relies on a combination of retardant application potential and vulnerability due to isolation/narrow endemic, habitat type, or other factors as displayed in the table. Codes used are: LRUF = low retardant use forest, Habitat = various specific conditions including species in habitats not likely to receive retardant, or protected within aquatic avoidance area, or suspected but not confirmed on National Forest System lands (see individual species discussions for details).

Arabis serotina – shale barren rock cress

This species is known to occur on the George Washington-Jefferson, Chattahoochee-Oconee and the Monongahela National Forests. Shale barren rock cress is an endemic of shale deposits, occurring only on sparsely vegetated xeric, south or west-facing shale slopes (barrens) at elevations from 400 to 600 meters. Populations are known from both the shale openings and shale woodlands adjacent to the shale openings. The term "shale barren" is a general reference to certain mid-Appalachian slopes that possess the following features: 1) southern exposures, 2) slopes of 20 to 70 degrees and 3) a covering of lithologically hard and weather-resistant shale or siltstone fragments. These barrens support sparse, scrubby growth.

No critical habitat has been designated for this species. The George Washington-Jefferson and Monongahela National Forests do not apply fire retardant and therefore no effects would occur to species located on that forest. The potential of retardant being applied on this species is extremely low to nonexistent on the Chattahoochee National Forest due to habitat where this species occurs (Croy 2011). This species **may be affected but not likely to be adversely affected** due to habitat characteristics in combination with the low amounts of retardant use where it occurs.

Asclepias meadii - Mead's milkweed

Historically, this species range included the tallgrass prairie region from northwestern Indiana, southwestern Wisconsin and southern Iowa to southern Illinois, southern Missouri and eastern Kansas. Currently it is extant in 27 counties in eastern Kansas, west-central Missouri, south-central Iowa and eastern Illinois. Mead’s milkweed is known to occur on the Mark Twain, Midewin, and the Shawnee National Forests. The habitat consists of dry-mesic to mesic tallgrass prairies.

No critical habitat has been designated for this species. The Mark Twain has only applied fire retardant, on average, to less than 0.01 percent of its land base annually and has identified avoidance areas around known locations. The Midewin and Shawnee National Forests do not use aerially applied retardant. Due to the extremely low probability of retardant being applied on this species, combined with avoidance mapping, there remains a very low possibility of this species to be affected by retardant therefore a **may affect but not likely adversely affect** determination is warranted.

Astragalus osterhoutii - Osterhout milkvetch

Osterhout milkvetch occurs in scattered populations across a 15-mile range in Grand County, Colorado. An estimated 25,000 to 50,000 Osterhout milk-vetch plants occur in two general areas: 90 percent occur in the vicinity of Muddy Creek, and the remaining 10 percent occur on the eastern and western extremities of the range at Troublesome and Red Dirt Creek (a tributary to Muddy Creek) (54 FR 29658; Service 1992). The majority of the two populations occur on land under Bureau of Land Management jurisdiction, but significant colonies also occur on private and State lands. This species is not known on National Forest System lands but is suspected to occur on the Arapaho-Roosevelt and the Medicine-Bow Routt National Forests (Forest Service Region 2). The closet known location is 1 to 2 miles away from the Arapahoe-Roosevelt National Forest. Although no populations occur on this forest, high quality potential habitat occurs in small discrete areas on the Arapahoe-Roosevelt National Forests in areas where aerial retardant may be used in the future. Surveys have yet to be completed in these areas (Popovich 2011).

No critical habitat has been designated for this species. The Arapaho-Roosevelt applies aerial retardant to less than 0.01 percent of its landbase annually, while the Medicine-Bow Routt National Forest exceeds the 0.01 percent annually. However, this species is only suspected to occur on these forests. Although the potential remains for a currently unknown individual or population to be impacted by a retardant drop, that probability is expected to be low. Therefore, Osterhout milkvetch **may be affected but is a not likely to be adversely affected**. If an occurrence is identified on National Forest System land it would be mapped with an avoidance area and coordination with the local Fish and Wildlife Service office would occur.

Bonamia grandiflora - Florida bonamia

Florida bonamia is a fire-dependent Florida endemic species. It is known to occur in Hardee, Highlands, Hillsborough, Lake, Manatee, Marion, Orange, Osceola, Polk, and Sarasota Counties. It is also documented to occur at Lake Wales Ridge National Wildlife Refuge and several other public or private conservation lands. This central Florida species occurs on the Ocala National Forest, where it is locally abundant and widespread in sand pine/oak scrub that is maintained by fire or by mechanical fire surrogates. Research is needed on the effectiveness of fire surrogates for long-term maintenance of this species. The greatest long-term threat may be the current insufficient capacity on the Forest to restore and maintain early successional scrub habitat needed by this species. Florida bonamia occurs on deep, excessively drained sands of ancient dunes, and ridges in clearings or openings of scrub and sandhill.

No critical habitat has been designated for this species. ***All occurrences of this species were included in aerial retardant avoidance areas.*** The National Forests of Florida have reduced use of retardant to less than 0.01 percent of their land base annually since the original analysis was done in 2011. Impacts to the species due to application of aerial retardant are expected to be minimal due to the low level of retardant use and to avoidance mapping of known occurrences of the species. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted.

Coryphantha scheeri var. *robustispina* - Pima pineapple cactus

The range of Pima pineapple cactus is from Tucson, Arizona, southward to northern Sonora, Mexico. The range extends about 70 kilometers (45 miles) east to west and 80 kilometers (50 miles) north to south. Plants are unevenly distributed within this range but exist in at least 21 somewhat poorly defined populations. Plants on National Forest System lands occur on the Nogales and Sierra Vista Ranger Districts of the Coronado National Forest. These populations are somewhat disjunct from the main distribution to the north and they represent only a minor part of the species' distribution and abundance. Pima pineapple cactus grows in desert grasslands and Sonoran desertscrub. The introduction of non-native grasses, principally Lehmann lovegrass (*Eragrostis lehmanniana*) and buffelgrass (*Pennisetum ciliare*), into these habitats has drastically altered fire regimes. These grasses produce abundant fine fuels that have greatly increased the frequency and intensity of fire, to the detriment of many non-fire adapted desert plants, including Pima pineapple cactus. Lehmann lovegrass and buffelgrass both regenerate vigorously under the fire regime they promote. It is estimated these grasses affect up to 75 percent of Pima pineapple cactus habitat.

No critical habitat has been designated for this species. This species grows in habitats with an altered fire regime due to the introduction of non-native Lehmann love grass that provides abundant fine fuels in a community that formerly had little potential to burn. The effect of fire in these communities is extremely detrimental to native species including Pima pineapple cactus.

Even though fire retardants are unlikely to be used in this habitat, the adverse effects from fire far outweigh the potential adverse effects from the application of fire retardant chemicals. Therefore, ***avoidance mapping has not occurred and is not desired*** (USDI Fish and Wildlife Service 2011).

The use of fire retardants may promote more vigorous growth of Lehmann lovegrass and buffelgrass, but it is unlikely to promote encroachment into more Pima pineapple cactus habitat because that habitat is largely already occupied by these grasses. Further, these two grasses will likely regenerate just as vigorously when burned as when treated with fire retardants. Additionally, fire retardants are seldom used to control fires in southern Arizona desert grasslands or desert scrub unless needed to protect resources such as urban interface, developments, or facilities. No such resources exist in the general vicinity of the Pima pineapple cactus populations on National Forest System lands, so the likelihood of fire retardant applications is low.

Fire retardant are unlikely to be used in the forest's Pima pineapple cactus habitats, even though the Coronado National Forest has the potential to apply fire retardant at an annual rate of 0.01 percent of the land base (or more). This species has a fairly wide distribution in southeastern Arizona and the abundance of the species on National Forest System lands where it could be affected by the proposed action is only a tiny fraction of the overall abundance of the species. Due to the small representation of Pima pineapple cactus on Forest Service lands and the low potential for fire retardant use, a **may affect but not likely to adversely affect** determination is warranted.

Echinacea laevigata – smooth purple coneflower

This species is known or suspected to occur in Georgia, Maryland, North Carolina, Pennsylvania, South Carolina and Virginia. The species is known to occur on the George Washington-Jefferson, Chattahoochee-Oconee, Francis-Marion-Sumter National Forests and is suspected to occur on the National Forests in North Carolina.

This species occurs in openings in woods, such as cedar barrens and clear cuts, along roadsides and utility line rights-of-way, and on dry limestone bluffs and is usually found in areas with magnesium- and calcium-rich soils. There are ten populations of smooth purple coneflower on the Francis Marion-Sumter National Forests, where it occurs in areas with a history of prescribed fire or mowing.

No critical habitat has been designated for this species. The George Washington-Jefferson and Francis-Marion-Sumter do not use aerial fire retardant., and therefore there would be no impacts to any occurrences these forests. Because the Chattahoochee-Oconee National Forests and Forests of North Carolina apply less than 0.01 percent aerial retardant to their land bases annually, there is low potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a **may affect but not likely to adversely affected determination** is warranted.

Echinocereus fendleri var. kuenzleri - Kuenzler hedgehog cactus

The range of Kuenzler hedgehog cactus extends about 185 kilometers (115 miles) from the Guadalupe Mountains around the eastern side of the Sacramento Mountains to the southern side of the Capitan Mountains. There are numerous populations in three concentrated areas. This species is known to occur on the Lincoln National Forest. Kuenzler hedgehog cactus grows in grasslands or pinyon-juniper woodlands at 1,600-2,210 meters (5,200-7,250 feet) in elevation. The plants grow in a fire adapted ecosystem and are not detrimentally affected by fire in the long term.

No non-native invasive plants have been identified as a problem in the Kuenzler hedgehog cactus' habitat. The likelihood of fire retardant use is low in Kuenzler hedgehog cactus habitat because prevailing winds during the fire season carry fires away from the forest and into desert grasslands that tend not to carry fire well.

No critical habitat has been designated for this species. The Lincoln National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually but fire retardants are unlikely to be used in Kuenzler hedgehog cactus habitat. ***Occurrences of this species are mapped with avoidance areas (300 feet)*** to protect against potential effects of fire retardant (USDI Fish and Wildlife Service 2011). Due to the small proportion of Kuenzler hedgehog cactus habitat that is likely to be affected by a fire, the fire adapted ecology of this species, and the general absence of invasive noxious weeds in the habitat, **a may affect not likely to adversely affect determination** is warranted.

Echinocereus triglochidiatus var. *arizonicus* - Arizona hedgehog cactus

Arizona hedgehog cactus has a relatively small distribution occupying only about 7,650 hectares (18,900 acres) in one main population and two small subpopulations; the cactus is relatively abundant within its range. This species has been documented on the Tonto National Forest. Surveys give a total population estimate of about 250,000 plants.

Arizona hedgehog cactus usually grows in clumps in the cracks of granite boulders. Few other plants are able to get established in those conditions, so the cactus often grows with no apparent competition. The surrounding vegetation is interior chaparral consisting of various evergreen shrubs and oaks. Herbaceous vegetation is usually sparse. The species distribution is limited by the density of the overstory shrub layer and the shortage of growing sites in boulder habitat. This is a fire adapted community where most of the vegetation regenerates from sprouts after burning. Arizona hedgehog cactus grows in rugged habitat with few roads or other developments. Non-native invasive plants have not been identified as a threat in this area.

No critical habitat has been designated for this species. The adverse effects from fire appear to outweigh the potential adverse effects from the application of fire retardants. Due to the threat of fire, the ***Tonto National Forest prefers not to map this species to avoid the application of retardant*** (USDI Fish and Wildlife Service 2011). The Tonto National Forest has applied fire retardant, on average, to more than 0.01 percent of its land base annually, but due to the low likelihood of retardant application in the Arizona hedgehog cactus habitat, this species **may be affected but not likely to be adversely affected**.

Erigeron rhizomatus - Zuni fleabane

The geographic range of Zuni fleabane is about 320 square kilometers (200 square miles) and most populations are widely separated. This species grows on nearly barren clay hillsides (up to 60 percent clay) in soils often high in selenium. These soils derived from the Chinle and Baca formations are found in limited areas in west-central New Mexico and east-central Arizona. Plants grow in open pinyon-juniper woodlands at elevations of 2,200 to 2,400 meters (7,300 to 8,000 feet). Zuni fleabane is known to occur on the Cibola National Forest.

No non-native invasive plants have been identified as a problem in Zuni fleabane habitat. In fact, few other plants are adapted to grow in these harsh soil conditions. The likelihood of fire retardant use is low in Zuni fleabane habitat. The vegetation is so sparse that the habitat generally will not carry a fire and most populations are in remote areas where fires in the surrounding pinyon-juniper woodlands are often not actively suppressed.

No critical habitat has been designated for this species. Although the Cibola National Forest historically has applied aerial retardant on over 0.01 percent of its landbase annually, the habitat in which this species occurs has a low potential for carrying fire and therefore low potential for retardant application. Avoidance mapping would provide this species no additional protection and therefore ***no avoidance maps would be completed*** (USDA Forest Service Region 3, USDI Fish and Wildlife Service 2011). Due to the low probability of retardant application and a habitat with low fuel loads that are unlikely to burn, this species **may be affected but not likely to be adversely affected**.

Eriogonum longifolium **var.** ***gnaphalifolium*** **– scrub buckwheat**

Scrub buckwheat is a fire-dependent Florida endemic species. This central Florida species is locally abundant and widespread on the Ocala National Forest, where it occurs in sand pine/oak scrub and longleaf pine/wiregrass sandhill. All stands with known occurrences were included in the aerial retardant avoidance zones. Research is needed on the effectiveness of fire surrogates for long-term maintenance of this species in scrub types. The greatest long-term threat to this species may be the current insufficient capacity on the Ocala National Forest to restore and maintain early-successional scrub habitat needed by this species. It is known or believed to occur in the following counties: Highlands, Lake, Marion Orange, Osceola, and Polk. It is also known to occur on Lake Wales Ridge National Wildlife Refuge and several other public/ private conservation lands.

No critical habitat has been designated for this species. ***All stands with known occurrences were included in aerial retardant avoidance areas.*** The National Forests of Florida have reduced use of retardant to less than 0.01 percent of their land base annually since the original analysis was done in 2011. Impacts to the species due to application of aerial retardant are expected to be minimal due to the low level of retardant use and to avoidance mapping of known occurrences of the species. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted.

Eutremia penlandii **- Penland alpine fen mustard**

Penland alpine fen mustard is a Colorado endemic known from Park, Lake, and Summit Counties. Limited to a 25-mile stretch of the Continental Divide above 12,000 feet, its estimated range is 192 square kilometers (72 square miles). This species has been documented on the Pike-San Isabel and White River National Forests. Habitat for this species is alpine tundra above 12,100 feet, where it grows rooted in mosses on stream banks and in wetlands that remain wet year-round. It has been found on the White River National Forest at elevations as low as 11,800 feet on a north aspect (Proctor 2011). It occurs primarily on soils developed from a calcareous substrate.

Occurrences on the White River National Forest include one occurrence within the Hoosier Ridge Research Natural Area, a second occurrence is documented on private lands adjacent to White River National Forest lands, and a third occurrence was found in 2010 on the south side of Blue Lakes (White River National Forest). Most occurrences on National Forest lands are in places where fire retardant use is low, such as alpine, or wet streamside areas. Since a new occurrence has been documented as low as 11,800 feet, however, the potential exists for retardant application on some occurrences (Proctor 2011).

No critical habitat has been designated for this species. ***All known populations and modeled habitat are avoidance mapped***. The Pike and San Isabel and White River National Forests apply low amounts of retardant to their land bases annually (estimated to be less than 0.01 percent of each National Forest's land base). Impacts to this species due to aerial retardant application are expected to be minimal due to the low level of retardant use and avoidance mapping of known occurrences. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted.

Fritillaria gentnerei - Gentner mission-bells

Gentner mission bells is known to or is believed to occur in California (Siskiyou County) and Oregon (Jackson and Josephine Counties). It is known to occur on the Rogue River-Siskiyou National Forests (Forest Service Region 6) and is suspected to occur on the Klamath National Forest (Forest Service Region 5). It grows in open, somewhat dry, low elevation, mixed oak-madrone woodlands, ponderosa pine (*Pinus ponderosa*) woodlands and chaparral.

No critical habitat has been designated for this species. ***The forests have mapped known and would map newly discovered occurrences with a 300-foot avoidance buffer***. Retardant use has increased on the Rogue River-Siskiyou National Forest where this species is known to occur and the Klamath National Forest where it is expected to occur since the last analysis. Both forests now apply retardant on average, to 0.01 percent of their land base annually. The Rogue-River-Siskiyou National Forest has 3 known occurrences (out of 72 for the species) and potential habitat for more, often in the wildland urban interface, so retardant drops might occur. However, since fires mostly occur in this forest after this species has completed its annual growth and is beginning summer dormancy, and since the plant perennates from a bulb in a fairly broad range of microsite conditions, it is presumably not sensitive to the retardant salts or changes in the environment that the retardant could cause; therefore, so retardant is **not likely to adversely affect individuals** or populations (Skinner 2011).

Geum radiatum– spreading avens

This species is known or suspected to occur in North Carolina and Tennessee. It is documented to occur on the Cherokee and North Carolina National Forests (all on Roan Mountain). The habitat is exposed, high elevation areas in the southern Appalachians, primarily in the crevices of northwest-facing cliffs, and at the bases of talus slopes, or, rarely, in openings in heath balds. It is found only at elevations over 1310 meters (4,298 feet).

No critical habitat has been designated for this species. The Cherokee National Forest and Forests of North Carolina have applied fire retardant, on average, to less than 0.01 percent of their land base annually. Due to the low probability of fire in the habitat, there is a reduced potential for retardant application, particularly where occurrences are known. With ***avoidance mapping of 1,500 feet surrounding all occurrences***, combined with the low probability of retardant being applied on these forests and especially this plant's habitat, this species **may be affected but not likely to be adversely affected**.

Gymnoderma lineare– rock gnome lichen

This species is known or suspected to occur in North Carolina, Virginia and Tennessee. It is documented to occur on the Chattahoochee, George Washington Jefferson, Cherokee and North Carolina Forests. The habitat is shady rock or shady moss-covered rock, areas of high humidity, either on high-elevation cliffs, where it is frequently bathed in fog, or in deep river gorges at lower elevations. It is primarily limited to vertical rock faces, where seepage water from forest soils above flows only at very wet times, and large stream side boulders, where it receives a moderate amount of light but not high-intensity solar radiation.

No critical habitat has been designated for this species. The George Washington Jefferson National Forest does not use aerial fire retardant. The Chattahoochee, Cherokee and North Carolina National Forests have applied fire retardant, on average, to less than 0.01 percent of their land base annually. Due to the habitat, the potential for retardant application is very low, particularly where occurrences are known. With ***avoidance mapping of 1,500 feet surrounding all occurrences***, combined with the low probability of retardant being applied on these forests, there is reduced potential for retardant being dropped on an unknown population or a misapplication or exception for retardant use, and thus rock gnome lichen **may be affected but not likely to be adversely affected**.

Harperocallis flava– Harper's beauty

Harper's beauty is a fire-dependent Florida endemic species, found in Bay, Franklin, and Liberty Counties. The vast majority of the extant population occurs on the Apalachicola National Forest, which is the only population protected on conservation land. On the Forest it occurs within a relatively small area in open wet prairie savannahs and seepage slopes that require frequent, relatively intense fire. The distribution and abundance of this species on the forest may be declining due to shade/ competition of encroaching shrubs.

No critical habitat has been designated for this species. ***All stands that have known occurrences or that have boundaries within 100 feet of known occurrences are included in aerial retardant avoidance areas. All mapped "savannah" stands across the Apalachicola National Forest were also included in avoidance areas***. The National Forests of Florida have reduced retardant use to less than 0.01 percent landbase annually since the last analysis. Impacts to this species due to aerial retardant application are expected to be minimal due to the low level of retardant use and avoidance mapping of known occurrences. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted.

Helenium virginicum – Virginia sneezeweed

Known or suspected to occur in Missouri and Virginia. This species is known to occur on the George Washington-Jefferson and the Mark Twain National Forests. It occurs in ponds of various size, basin depth and shape, and length of hydroperiod.

No critical habitat has been designated for this species. The George Washington Jefferson National Forest does not use aerial fire retardant; therefore, no mapping is needed and there are no effects to plants occurring on this forest. The Mark Twain National Forest has applied fire retardant, on average, to less than 0.01 percent of their land base annually. ***The 300-feet. buffer along waterways is sufficient to ensure that this species will be protected***. Due to the low probability of retardant being applied in these areas this **species may be affected but not likely to be adversely affected**.

***Helianthus schweintzii* – Schweintz's sunflower**

This species is known or suspected to occur in North and South Carolina. It is documented on the National Forests in North Carolina. Schweinitz's sunflower grows in clearings and edges of upland oak-pine-hickory woods and piedmont longleaf pine forests in moist to dryish sandy loams.

The National Forests in North Carolina estimates retardant application of less than 0.01 percent of their land base annually. The potential for retardant application is very low in the habitat type where this species occurs, particularly where occurrences are known. ***Avoidance area mapping of 1,500 feet is required around known locations***; avoidance areas combined with the low probability of retardant being applied on these forests means there is low probability of retardant being dropped on a currently unknown population, or of an intrusion or exception for retardant use. Therefore, this species **may be affected but not likely to be adversely affected**.

***Helonias bullata* – swamp pink**

Swamp pink is known or suspected to occur in Delaware, Georgia, Maryland, North Carolina, New Jersey, New York, South Carolina and Virginia. It is known to occur on the George Washington-Jefferson, Chattahoochee-Oconee National Forest and National Forests of North Carolina. It is restricted to forested wetlands that are groundwater-influenced and that are perennially water-saturated with a low frequency of inundation. It occurs on sites where the water table is at or very near the surface and is stable, fluctuating only slightly during spring and summer. These habitats include emergent portions of hummocks in and along stream channels in Atlantic white cedar (*Chamaecyparis thyoides*) swamps, headwater seepage wetlands, red maple (*Acer rubrum*) swamps, mixed hardwood/evergreen swamps, and (rarely) black spruce-tamarack (*Picea mariana-Larix laricina*) bogs. It is often found at stream sources.

No critical habitat has been designated for this species. The George Washington Jefferson National Forest does not use aerial fire retardant; therefore, no mapping is needed and there are no effects to plants occurring on this forest. The Chattahoochee-Oconee and North Carolina National Forests have applied fire retardant, on average, to less than 0.01 percent of their land base annually. ***This species is protected by standard aquatic avoidance areas wtih 300-foot buffers; avoidance areas with a 300-foot buffer are also mapped around occurrences that are outside those areas***. Due to the low probability of retardant being applied in these areas, this species **may be affected but not likely to be adversely affected**.

***Hibiscus dasycalyx* – Neches River rose mallow**

This species is a Texas endemic found only in wetlands of the East Texas Pineywoods Ecoregion in Cherokee, Harrison, Houston, and Trinity counties, including on the Davy Crockett National Forest. There are 12 known occurrences of this species. The Davy Crockett National Forest has one natural and three introduced occurrences. This species occurs in openings in shrub swamps or along the margins of riparian woodlands in seasonally wet soils (often found near standing water). Sites are typically flooded during late winter and early spring, and surface soils are usually dry by late summer. One of the biggest threats to the species is non-native species and aggressive, woody native species.

The National Forests of Texas (including the Davy Crockett National Forest) have very low retardant use (used on less than 0.01 percent of the landbase annually), ***species occurrences are mapped with avoidance areas***, and this species occurs in wetlands. Therefore, direct effects from aerial retardant use are not expected. However due to the potentially fertilizing effect of retardant and the possible resulting increase of invasive species, this species **may be affected but is not likely to be adversely affected**.

Critical habitat was designated in 2013 (78 FR 56072) on 166 acres, of which 47.3 acres are on the Davy Crockett National Forest. Primary constituent elements are: Intermittent or perennial wetlands within the Neches, Sabine, and the Angelina River floodplains or the Mud and Tantabogue Creek basins that contain a) hydric alluvial soils and the potential for flowing water when found in depressional sloughs, oxbows, terraces, side channels, or sand bars, and b) native woody or associated herbaceous vegetation, largely with an open canopy providing partial to full sun exposure with low levels of or no non-native species. ***All critical habitat is avoidance mapped***. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Houstonia montana – Mountain bluet

This species occurs or is suspected to occur on the National Forests of North Carolina and on the Cherokee National Forest. It is considered a narrow endemic to metamorphic rock outcrops above 1,350 meters in northwestern North Carolina and adjacent Tennessee. This species occurs primarily in gravel-filled pockets and crevices of cliff ledges and walls. It also colonizes gravelly, frost-churned talus, where it forms larger mats. Approximately 17 small populations are known. A very limited amount of potential habitat exists, and most is subject to intensive recreational uses (ski resort development, trampling by hikers, and climbing/rock scrambling).

No critical habitat has been designated for this species. ***Occurrences of this species will be mapped with avoidance areas***. Because the National Forests of North Carolina and the Cherokee National Forest have very low retardant use (applied to less than 0.01 percent of their land base annually) and species occurrences will be avoidance mapped, this species **may be affected but is not likely to be adversely affected**.

Houstonia (Hedyotis) purpurea var. *montana* – Roan Mountain bluet

This species is known or suspected to occur in North Carolina and Tennessee. It is documented on the National Forests in North Carolina, and on the Cherokee National. Habitat includes high elevation cliffs and rock outcrops in and around grassy balds.

Neither the National Forests in North Carolina nor the Cherokee National Forest nor the Forests of North Carolina apply aerial retardant to more than 0.01 percent of their land bases annually. Retardant is unlikely to be applied in the habitat in which this species is found, and ***all known occurrences are mapped with avoidance areas that include a 1,500-foot buffer***. The low retardant application potential, combined with the low potential use in habitat where this species occurs and the use of avoidance areas minimizes the potential for retardant to be dropped on a currently unknown population, or for intrusions or exceptions that result in retardant drops where it occurs. Therefore, the Rocky Mountain bluet **may be affected but is not likely to be adversely affected** by the use of aerial fire retardant.

No critical habitat has been designated for this species.

Howellia aquatilis -Water howellia

Water howellia is currently known from California, Idaho, Montana, and Washington, and was known to occur historically in Oregon. The species is documented to occur in the Mendocino National Forest in California and the Flathead National Forest in Montana. It is suspected to occur on the following forests: Six Rivers, Lolo, Kootenai, Idaho Panhandle, Colombia River Gorge in Oregon and Washington, Gifford Pinchot, Okanagan Wenatchee and the Mount Hood.

This aquatic annual grows submerged, rooted in bottom sediments of ponds and sloughs and in small vernal wetlands with firmly consolidated bottoms. These include shallow, low-elevation glacial pothole ponds and former river oxbows with margins of deciduous trees and shrubs. These habitats are inundated by spring rains and snowmelt runoff, and typically dry out by the end of the growing season. The plants tend to root in the shallow water at the edges of deeper ponds that are (at lower elevations) surrounded by deciduous trees. Water howellia was proposed for delisting on October 7, 2019, but a final rule change has not been completed as of this analysis.

No critical habitat has been designated for this species. ***All known populations are protected from direct and indirect effects by the 300-foot aquatic avoidance area buffer; other known populations (those that may not be indicated with use of the National Hydrologic Dataset for mapping aquatic avoidance areas) have mapped avoidance areas with 300-foot buffers extending beyond the edge of the occurrence.*** The Mendocino National applies retardant, on average, to 0.01 percent of its land base annually. However, specific locations and habitats where this species occurs are not subject to fire and therefore have a very low likelihood of retardant application or intrusion (USDA Forest Service 2011b). The Flathead National Forest applies retardant, on average, to less than 0.01 percent of its land base annually. Therefore, a **may affect not likely to adversely affect determination** is warranted.

Hudsonia montana – Mountain golden heather

This species is known or believed to occur in Burke and McDowell Counties in North Carolina. It is known to occur on the Pisgah National Forest in North Carolina. The habitat includes shallow soils that form over quartzite or mica gneiss rock ledges, usually in the sparsely vegetated ecotone between bare rock and heath bald. A contributor to the decline of this species is wildfire suppression, which has resulted in changed forest composition and encroachment into open habitat required by this species.

The Forests of North Carolina uses aerial retardant on less than 0.01 percent of its land base. ***All known occurrences of mountain golden heather are avoidance mapped with a 1,500-foot buffer.*** Due to the low probability of retardant being applied in these specific habitat areas, and the use of avoidance areas around known occurrences, there is a low potential for currently unknown populations to experience a retardant drop due to an intrusion or use of the exception. Therefore, a **may affect not likely to adversely affect determination** is warranted for mountain golden heather.

Critical habitat was designated for this species in 1980 (45 FR 69360). Primary constituent elements were not identified in the designation, but activities identified as having potential adverse effects include trampling or disturbance of fragile areas where the species is found. The Pisgah National Forest has ***buffered all critical habitat for this species by 1,500 feet***. Retardant application is unlikely to be used in the area, plan occurrences and critical habitat are buffered, and effects that could be caused by retardant drops are not among those identified as having potential to adversely modify or destroy critical habitat for this species. Therefore, a **may affect, not likely to adversely affect determination** is warranted **for mountain golden heather critical habitat**.

***Ipomopsis polyantha* - Pagosa skyrocket**

Pagosa skyrocket is known from Archuleta County in southern Colorado. It is a narrow endemic, found only in two populations in and near the town of Pagosa Springs, Colorado. It occurs on rocky clay soils of the Mancos Shale in the southern San Juan Mountains, typically on road shoulders where the soil has been disturbed. Highest densities are found under Pinus ponderosa forests with montane grassland understory between 2073 to 2195meters (6,801 to 7,201 feet) elevation. This species is not presently known to occur on National Forest System lands, but is suspected on the San Juan National Forest, portions of which are included in two of the designated critical habitat units (see below). The closest known occurrence is approximately 1 to 2 miles from the National Forest boundary. The San Juan National Forest has moderate potential habitat for this species, but extensive surveys have not been completed.

Since the San Juan National Forest applies retardant on average, to 0.01 percent of its land base annually, there is increased potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. However, there are no known occurrences on the forest. ***If an occurrence is identified on the National Forest, the occurrence would be mapped with an avoidance area***, and coordination with the local Fish and Wildlife Service office would occur. There is low probability for a currently unknown individual or population to be impacted by a retardant drop. Therefore, a **may affect not likely to adversely affect** determination is warranted.

Critical habitat is designated on 1,1711 acres in the San Juan National Forest. Primary constituent elements are:

- Mancos shale soils.
- Elevation and climate. Elevations from 6,400 to 8,100 feet (1,950 to 2,475 meters) and current climatic conditions similar to those that historically occurred around Pagosa Springs, Colorado. Climatic conditions include suitable precipitation; cold, dry springs; and winter snow.
- Plant Community.
  - ♦ Suitable native plant communities (as described in b. below) with small (less than 100 ft2 (10 m2) or larger (several hectares or acres) barren areas with less than 20 percent plant cover in the actual barren areas.
  - ♦ Appropriate native plant communities, preferably with plant communities reflective of historical community composition, or altered habitats which still contain components of native plant communities. These plant communities include
    - ▪ Barren shales
    - ▪ Open montane grassland (primarily Arizona fescue) understory at the edges of open Ponderosa pine, or
    - ▪ Clearings within the Ponderosa pine/Rocky Mountain juniper and Utah juniper/oak communities.
- Habitat for pollinators.
  - ♦ Pollinator ground and twig nesting areas. Nesting and foraging habitats suitable for a wide array of pollinators and their life history and nesting requirements. A mosaic of native plant communities and habitat types generally would provide for this diversity.

- ♦ Connectivity between areas allowing pollinators to move from one site to the next within each plant population.
- ♦ Availability of other floral resources, such as other flowering plant species that provide nectar and pollen for pollinators. Grass species do not provide resources for pollinators.
- ♦ A 3,280-ft (1,000-m) area beyond occupied habitat to conserve the pollinators essential for plant reproduction.

- Appropriate disturbance regime.
  - ♦ Appropriate disturbance levels— Light to moderate, or intermittent or discontinuous disturbance.
  - ♦ Naturally maintained disturbances through soil erosion, or human maintained disturbances, that can include light grazing, occasional ground clearing, and other disturbances that are not severe or continual

(https://www.govinfo.gov/content/pkg/FR-2012-08-13/pdf/2012-18833.pdf#page=1)

All critical habitat occurring on National Forest System lands is protected with avoidance areas. Impacts to primary constituent elements due to use of aerial fire retardant is expected to be minor; **critical habitat may be affected but is not likely to be adversely affected**.

Isotria medeoloides –small whorled pogonia

This species is known or suspected to occur in numerous states and in Canada (Ontario). The species is known to occur in acidic soils, in dry to mesic second-growth, deciduous or deciduous-coniferous forests; typically with light to moderate leaf litter, an open herbaceous layer (occasionally dense ferns), moderate to light shrub layer, and relatively open canopy. Small whorled pogonia frequently occurs on flats or slope bases near canopy breaks.

This species is known to occur on the Chattahoochee -Oconee, Cherokee, George Washington-Jefferson, Francis-Marion-Sumter, Monongahela, and White Mountain National Forests and the National Forests in North Carolina. It is suspected on the Allegheny and Wayne National Forests; and has been extirpated from the Mark Twain National Forest. The species occurrence on the George Washington Jefferson consists of one known location in a place where aerial fire retardant would not be used (Croy 2011). On the Francis Marion and Sumter National Forest, three populations of small whorled pogonia are known to occur within mesic hardwood/hemlock forests, including one in the Ellicott Rock Wilderness. The standard aquatic avoidance area and 300-foot buffer would protect most occurrences (Mackie 2011); additionally, ***300-foot buffers are mapped around known locations on the Francis Marion and Sumter National Forest***.

No critical habitat has been designated for this species. The George Washington-Jefferson, Monongahela, White Mountain, Allegheny, Francis-Marion-Sumter and Wayne National Forests do not use aerial fire retardant. Therefore, there would be no impacts to plants that may occur on these forests. The Chattahoochee-Oconee, Cherokee and North Carolina National Forests apply aerial retardant to less than 0.01 percent of their land bases annually. The Cherokee National Forest, and the National Forests of North Carolina, have mapped avoidance areas around the occurrences on those forests, and have carried out surveyed for this species for the past 15 years (Kauffman 2011). Based on lack of retardant use on several National Forests and low probability of retardant use on others, along with protection of occurrences with avoidance areas, a **may affect not likely to be adversely affect determination** is warranted.

Lesquerella pallida – white bladderpod

This species is known or suspected to occur in San Augustine County in Texas. It is known to occur on the National Forests of Texas. Its habitat includes open areas associated with exposed calcareous Weches Formation outcrops that are seepy and wet most of the year; and soils are thin, poorly drained, and alkaline.

No critical habitat has been designated for this species. The Forest has not mapped known occurrences with avoidance areas. Because the National Forests of Texas have applied fire retardant, on average, to less than 0.01 percent of their land base annually, there is low potential for aerial fire retardant to occur in the habitats and locations this species occupies. Therefore, a **may be affected but not likely to be adversely affected determination** is warranted.

Liatris helleri – Heller's blazing star

This species is known or suspected to occur in Ashe, Avery, Burke, Caldwell, Mitchell, and Watauga counties in North Carolina. It is documented to occur on the National Forests of North Carolina. Habitat for this species includes shallow, acidic soils that form on and around exposed granite ledges, outcrops, and balds at high elevations. It occurs in full sun along with grasses, sedges, and other composites.

No critical habitat has been designated for this species. The National Forests of North Carolina have applied fire retardant, on average, to less than 0.01 percent of their land base annually. The type of habitat where Heller's blazing star occurs has very low potential for retardant application. Also, known locations are mapped with avoidance areas that have 1,500-foot buffers. The low probability of retardant use on these forests means there is a low potential for retardant to be dropped on a currently unknown population or experiencing an intrusion or use of an exception. The low overall retardant use, low probability of retardant application in the species' habitat, and use of avoidance areas mean that aerial retardant use **may affect, but is not likely to adversely affect** this species.

Lupinus oreganus var. *kincaidii* (*Lupinus sulphureus* ssp. *Kincaidii*) – Kincaid's Lupine

Kincaid's lupine is known or suspected to occur in eleven counties in Oregon, including on the Baskett Slough National Wildlife Refuge, and in one county in Washington. This species is documented on the Umpqua National Forest. The occurrence on the Umpqua National Forest is on a low ridge in a wildland urban interface directly adjacent to private land. It is associated with oak at the edge of a dense stand of second-growth Douglas-fir that was thinned to release the oak and provide additional habitat for Kincaid's lupine (Skinner, 2011). The occurrence is also immediately adjacent to an open serpentine bald which has been identified as a potential retardant drop area.

The forest has mapped known and would map newly discovered occurrences with a 300-foot avoidance area buffer. The Umpqua National Forest applies aerial retardant to less than 0.01 percent of its land base annually. Impacts to this species due to aerial retardant application are expected to be minimal due to the low level of retardant use and to avoidance mapping of known occurrences. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted

Critical habitat was designated for this species. The physical and biological features required by this species are:

- Early serial upland prairie, or oak savanna habitat with a mosaic of low-growing grasses and forbs, and spaces to establish seedlings or new vegetative growth; an absence of dense canopy vegetation, and undisturbed subsoils.
- The presence of insect outcrossing pollinators, such as *Bombus mixtus* and *Bombus californicus*, with unrestricted movement between existing lupine patches.

All federal lands were excluded from the critical habitat designation (FR 63862).

Lysimachia asperulaefolia - rough-leaved loosestrife

This species is known or suspected to occur in North and South Carolina. It is documented to occur on the National Forests of North Carolina. Rough-leaved loosestrife occurs most often in ecotones between longleaf pine uplands and pond pine pocosins in moist, sandy or peaty soils with low vegetation that allows for abundant sunlight to the herb layer. It is a fire adapted species. Fire is primarily responsible for maintaining low vegetation in these ecotones, which have been documented to occur between the following habitat types: longleaf pine savanna and pocosin; longleaf pine flatwood and pocosin; longleaf pine savanna and mixed herb; longleaf pine-pond pine and evergreen shrub; longleaf pine/wiregrass savanna and Carolina bay pocosin; streamhead pocosin and pine/scrub oak sandhill; and sandhill seep and pine/scrub oak sandhill.

No critical habitat has been designated for this species. The National Forests of North Carolina estimates aerial fire retardant is applied to less than 0.01 percent of their land base annually. ***Known locations are mapped with avoidance areas with 1,500-foot buffers***. Due to the low probability of retardant being applied on the National Forests of North Carolina, there is low potential for retardant to be dropped on any currently unknown populations, or for intrusions or retardant drops from use of the exception. Therefore, this species **may be affected but is not likely to be adversely affected**.

Macbridea alba – white birds-in-a-nest

This northwest Florida plant is a fire-dependent species and is locally abundant and fairly widespread on the Apalachicola National Forest. The species occurs in fire-maintained grassy vegetation on poorly drained, infertile sandy peat soils of the Florida Gulf coastal lowlands near the mouth of the Apalachicola River. It also occurs in seepage slopes, wet prairie “savannas” and, sparingly, on drier flatwoods sites with longleaf pine and runner oaks. This species is known to occur in the following counties: Bay, Franklin, Gulf and Liberty.

No critical habitat has been designated for this species. ***All stands that include known occurrences or with boundaries that are within 100 feet of known occurrences are included in aerial retardant avoidance areas***. ***All mapped “savannah” stands across the Apalachicola National Forest are also included in avoidance areas***. The National Forests of Florida have reduced retardant use to less than 0.01 percent of their land base annually since the previous analysis was completed in 2011. Impacts to this species due to aerial retardant application are expected to be minimal due to the low level of retardant use and avoidance mapping of known occurrences. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted.

***Pectis imberbis*- Beardless chinchweed**

Beardless chinchweed was listed as endangered on 15 June 2021. It is known from eight populations in five mountain ranges in Cochise and Santa Cruz Counties, Arizona, and five populations in eastern Sonora and western Chihuahua, Mexico. Beardless chinchweed is found in open grassland and oak/grassland habitats. It appears to be adapted to disturbance, and has been found on roadcuts, arroyo cuts and unstable rocky slopes. Threats include loss of habitat due to invasion by nonnative species; altered fire regime exacerbated by nonnative invasion; altered precipitation, drought, and temperature; road and trail maintenance, mining, livestock, wildlife, and post-wildfire runoff. There are many unknowns, however, regarding this species' distribution, habitat selection, and tolerance to fire, grazing, nonnatives, etc.

In some habitats where this species grows, alteration of the fire regime has been exacerbated by the presence of non-native Lehmann's lovegrass (*Eragrostis lehmanniana*). The fuels created by Lehman's lovegrass burn quickly, lovegrass resprouts from roots and tiller nodes not killed by hot fire, and lovegrass-dominated grasslands recover quickly from fire.

The use of fire retardants may promote more vigorous growth of Lehmann's lovegrass, but it is unlikely to increase encroachment into beardless chinchweed habitat because that habitat is largely already occupied by Lehmann's lovegrass and other non-native grasses. Further, Lehmann's lovegrass will likely regenerate just as vigorously when burned as when treated with fire retardants. Additionally, fire retardants are seldom used to control fires in southern Arizona desert grasslands or desert scrub unless needed to protect resources such as urban interface, developments, or facilities. These types of resources are unlikely to occur in the general vicinity of the beardless chinchweed populations on National Forest System lands, so the likelihood of fire retardant applications is low. If fire retardant is used, it may be applied to areas adjacent to rugged terrain and Wilderness areas (Huachuca Mountains) to protect these areas from wildfire.

Fire retardant is unlikely to be used in the Coronado National Forest beardless chinchweed habitat, even though the Forest has the potential to apply fire retardant at an annual rate of 0.01 percent of the land base (or more). Although this species does not have a wide distribution in southeastern Arizona (all known populations are within 50 miles of each other), the eight known populations are distributed across two ranger districts and one population is largely on National Park Service lands, and are in geographical areas separated by different land forms and habitat types, so the likelihood that all populations would be affected by any single event (a wildfire and/or the application of fire retardant) is unlikely. Due to this distribution, the likelihood that Lehmann's lovegrass will regenerate just as vigorously when burned as when treated with fire retardants, and the low potential for fire retardant use, ***avoidance mapping on the Coronado National Forest is not desired***.

The Coronado National Forest has been employing a conservation measure to monitor to the maximum extent feasible the response of the species and habitat to aerial retardant use. Continued implementation of this conservation measure would be determined by the Coronado National Forest and the local Fish and Wildlife Service office. If monitoring would detect the need for a change in management, the Forest could map populations of beardless chinchweed for avoidance. Therefore, the proposed action **may affect but is not likely to adversely affect beardless chinchweed**.

Critical habitat is designated on 7,025 acres of National Forest System lands (FR 31849). Primary constituent elements are:

- Native-dominated plant communities, consisting of:
  - ♦ Plains, great basin, and semi-desert grasslands, oak savanna, or Madrean evergreen woodland,
  - ♦ Communities dominated by bunchgrasses with open spacing (adjacent to and within 10 meters [33 feet] of individual Pectis imberbis plants) and with little competition from other plants, and
  - ♦ Communities with plants for pollinator foraging and nesting within 1 kilometer (0.62 miles) of Pectis imberbis populations
- Elevations from 3,799 feet to 5,699 feet
- Eroding limestone or granite bedrock substrate
- Steep, south-facing, sunny to partially shaded hill slopes
- The presence of pollinators (i.e., flies, bees, and butterflies)

Aerial retardant may affect the components essential to conservation relating to native dominated communities. Since fire would likely stimulate the growth of non-native species similar to levels that aerial retardant would, the Coronado National Forest has determined that ***mapping avoidance areas for beardless chinchweed is not required***.

Impacts to the primary constituent elements are expected to be insignificant and **may affect but are not likely to adversely affect beardless chinchweed critical habitat**.

***Pediocactus peeblesianus* ssp. *fickeiseniorum* - Fickeisen plains cactus**

This species occurs on the Kaibab National Forest and is also documented from widely scattered populations in Coconino and Mojave counties of northern Arizona. Habitat for this species consists of gravelly limestone soils in desert scrub communities at elevations of 4,200 to 5,950 feet (1,280 to 1,814 meters).

Avoidance mapping reduces the potential for increased non-native invasive species of increasing in the area as a result of nutrient increases. **Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer.** Since the Kaibab National Forest has applied fire retardant, on average, to less than 0.01 percent of its land base annually, there is very low potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Additionally, this species occurs in somewhat open habitat, where retardant is not typically used. Therefore, this species **may be affected but not likely to be adversely affected**.

Critical habitat is designated in multiple discrete units on lands that include the Kaibab National Forest. Primary constituent elements are:

- Soils derived from limestone that are found on mesas, plateaus, terraces, the toe of gentle sloping hills with up to 20 percent slope, margins of canyon rims, and desert washes. These soils have the following features:
  - ♦ They occur on the Colorado Plateau in Coconino and Mohave Counties of northern Arizona and are within the appropriate series found in occupied areas

- ♦ They are derived from alluvium, colluvium, or eolian deposits of limestone from the Harrisburg member of the Kaibab Formation and limestone, siltstone, and sandstone of the Toroweap and Moenkopi Formations,
  - ♦ They are nonsaline to slightly saline, gravelly, shallow to moderately deep, and well-drained with little signs of soil movement. Soil textures consist of gravelly loam, fine sandy loam, gravelly sandy loam, very gravelly sandy loam, clay loam, and cobbly loam.
- Native vegetation within the Plains and Great Basin grassland and Great Basin desertscrub vegetation communities from 1,310 to 1,813m (4,200 to 5,950 feet) in elevation that has a natural generally intact surface and subsurface that preserves the bedrock substrate and is supportive of microbiotic soil crusts where they are naturally found
- Native vegetation that provides for habitat of identified pollinators within the effective pollinator distance of 1,000 meters (3,280 feet) around each individual Fickeisen plains cactus.

All critical habitat is mapped with avoidance areas. Impacts to primary constituent elements are expected to be minor, therefore **critical habitat for Fickeisen plains cactus may be affected but is not likely to be adversely affected**.

Penstemon haydenii - blowout penstemon

This plant is currently known from 9 small populations (13 sites) comprised of approximately 3,000 to 5,000 individuals across approximately 32,049 square kilometers (12,374 square miles) in the Nebraska Sandhills, as well as from sites in Wyoming. Only a small proportion of the entire known distribution of the species occurs on National Forest System land where they could be potentially impacted by the proposed action. Blowout penstemon occurs on Samuel R. McKelvie National Forest and the Nebraska National Forest Bessey Unit.

This species is restricted to active sand blowouts, which are irregular crater-shaped depressions are naturally occurring in the Nebraska Sandhills. The plant can be found in early successional blowout habitat where it has little competition from other plants because of scarce water and nutrients. However, as blowout habitats mature and become stabilized, other plants will become established, and the blowout penstemon disappears. Artificial propagation and discovery of additional wild populations have shown that the species appears to be stable in Nebraska. Stabilization of blowouts and other disturbances that result in the physical loss of these habitats can have an adverse effect on the blowout penstemon. The habitats where existing blowout populations occur in Nebraska are not likely to carry fires that would need fire retardants on Forest Lands.

No critical habitat has been designated for this species. Blowout penstemon habitat is unlikely to be subject to firefighting activities. The Nebraska National Forest System lands apply low amounts of retardant to their forest landbase (less than 0.01 percent of the land base annually); and ***all known sites have been avoidance mapped with a ¼ mile buffer around each known population***. Due to the low probability of retardant being applied on these forests, reducing the potential for retardant being dropped on a currently unknown population, or for an intrusion or exception for retardant use, in combination with avoidance mapping of known individuals or populations on National Forest System lands, this species **may be affected but not likely to adversely affected**.

***Phacelia scopulina* var. *submutica* (*Phacelia submutica*) – DeBeque phacelia**

Debeque phacelia was listed as a threatened species in August of 2011. The species is a Colorado endemic known from Garfield and Mesa Counties. The estimated range is 712 square kilometers (275 square miles). This species occurs on barren, cracked soils, of the Wasatch Formation, often on steep exposures. The species is known on the Grand Mesa Uncompahgre-Gunnison and White River National Forests in Forest Service Region 2.

***The Forests have mapped known occurrences with avoidance areas that include a 300-foot buffer, and would similarly map newly discovered occurrences as well as modeled habitat*.** Retardant use on the National Forests where this species is known to occur has increased since the previous analysis was completed in 2011. The Grand Mesa Uncompahgre -Gunnison and White River National Forests apply low amounts of retardant annually (less than 0.01 percent of their land base each). Impacts to this species due to aerial retardant application are expected to be minimal due to the low level of retardant use and avoidance mapping of known occurrences. Therefore, a determination that the **species may be affected but is not likely to be adversely affected** is warranted.

Critical habitat was designated for this species in 2012 in several units that include National Forest System lands. The primary constituent elements of the physical and biological features essential to the conservation of *Phacelia submutica* consist of five components:

- Suitable soils and geology.
  - ♦ Atwell Gulch and Shire members of the Wasatch formation.
  - ♦ Within these larger formations, small areas (from 10 to 1,000 ft2 (1 to 100 m2)) on colorful exposures of chocolate to purplish brown, light to dark charcoal gray, and tan clay soils. These small areas are slightly different in texture and color than the similar surrounding soils. Occupied sites are characterized by alkaline (pH range from 7 to 8.9) soils with higher clay content than similar nearby unoccupied soils.
  - ♦ Clay soils that shrink and swell dramatically upon drying and wetting and are likely important in the maintenance of the seed bank.
- Topography. Moderately steep slopes, benches, and ridge tops adjacent to valley floors. Occupied slopes range from 2 to 42 degrees with an average of 14 degrees.
- Elevation and climate.
  - ♦ Elevations from 4,600 feet (1,400 meters) to 7,450 feet (2,275 meters).
  - ♦ Climatic conditions similar to those around DeBeque, Colorado, including suitable precipitation and temperatures. Annual fluctuations in moisture (and probably temperature) greatly influences the number of *Phacelia submutica* individuals that grow in a given year and are thus able to set seed and replenish the seed bank.
- Plant community.
  - ♦ Small (from 10 to 1,000 ft2 (1 to 100 m2)) barren areas with less than 20 percent plant cover in the actual barren areas.
  - ♦ Presence of appropriate associated species that can include (but are not limited to) the natives *Grindelia fastigiata, Eriogonum gordonii, Monolepis nuttalliana*, and *Oenothera caespitosa*. Some presence, or even domination by, invasive nonnative

species, such as Bromus tectorum, may occur, as *Phacelia submutica* may still be found there.

- ♦ Appropriate plant communities within the greater pinyon-juniper woodlands that include:
  - ▪ Clay badlands within the mixed salt desert scrub; or
  - ▪ Clay badlands within big sagebrush shrublands.

- Maintenance of the seed bank and appropriate disturbance levels.
  - ♦ Within suitable soil and geologies undisturbed areas where seed banks are left undamaged.
  - ♦ Areas with light disturbance when dry and no disturbance when wet.

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 existing within the legal boundaries on September 12, 2012.

Avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant to critical habitat. Impacts to primary constituent elements are expected to be minor and **may be affected but not likely to be adversely affected**.

Pinguicula ionantha - Godfrey's butterwort

Godfrey's butterwort is a fire-dependent Florida endemic species. This northwest Florida species is locally abundant and widespread in appropriate habitat on the Apalachicola National Forest. It occurs in fire-maintained open, acidic soils of seepage bogs on gentle slopes, deep quagmire bogs, ditches, and depressions in grassy pine flatwoods and grassy savannas, often found in shallow standing water. This species is known or believed to occur in the following counties: Bay, Calhoun, Franklin, Gulf, Liberty and Wakulla.

No critical habitat has been designated for this species. ***All stands with known occurrences were included in aerial retardant avoidance areas. All mapped "savannah" stands across the Apalachicola National Forest were also included in these zones***.

The National Forests of Florida have reduced retardant use to less than 0.01 percent of their land bases annually since the previous analysis was completed in 2011. Impacts to this species due to aerial retardant application are expected to be minimal due to the low level of retardant use and avoidance mapping of known occurrences. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted.

Pinus albicaulis Whitebark Pine

Whitebark pine is a wide-ranging species found in California, Idaho, Montana, Nevada, Oregon, Washington, and Wyoming, and it is proposed as threatened. Whitebark pine occurs on cold and windy, high elevation or high latitude sites. It is typically found growing at alpine timberline, or with other high mountain conifers just below the timberline and upper montane zone. In the United States, 88 percent of whitebark pine occurs on federally-owned land, the majority of which (74 percent) is National Forest System land (USDI Fish and Wildlife Service 2019c).

Reasons for the decline of whitebark pine include white pine blister rust, mountain pine beetle, destruction or modification of habitat due to environmental changes related to fire suppression, and direct habitat loss due to climate change.

No critical habitat has been designated for this species. This species occurs on many forests that apply aerial retardant to more than 0.01 percent of their land base. Retardant use in high elevation habitats is likely to be limited. However, allowing high-intensity fire to burn through stands of whitebark pine would be more detrimental to the species than would application of fire retardant. Retardant use can be beneficial to whitebark pine stands, as recommended by Montana and Idaho Fish and Wildlife Service field offices and the Montana Northern Region (Region 1) office (USDI Fish and Wildlife Service and USDA Forest Service 2021). Recommended measures include use of retardant drops to slow or prevent the spread of wildfire into whitebark pine stands and seed orchards/tree improvement areas. For these reasons, ***populations of whitebark pine will not be mapped for avoidance***. Individual trees are extremely unlikely to be felled by retardant drops. Impacts could include loss of branches or, rarely, a broken top or browning of needles. However, these impacts are discountable due to the low probability of retardant use in whitebark pine habitat. Therefore, a **may affect, not likely to adversely affect determination** is warranted.

Pityopsis ruthii – Ruth's golden-aster

This species is known or believed to occur in Polk County, Tennessee along short reaches of the Ocoee and Hiwassee River. This species is known to occur on the Cherokee National Forest. The habitat includes soil-filled cracks in phyllite boulders along riverbanks and in rivers, is shade intolerant but adapted to annual high water flows; requires periodic flooding and scouring to remove competing vegetation.

There is no critical habitat designated for this species. Because the Cherokee National Forest has applied fire retardant, on average, to less than 0.01 percent of its land base annually, there is low potential for unknown occurrences to be hit with retardant or for exceptions to be used. Additionally, the habitat where it occurs has a low probability of fire and the aquatic 300-foot buffer would protect known occurrences. Therefore, a **may affect not likely to be adversely affect determination** is warranted.

Plantathera integrilabia – white fringeless orchid

This species occurs on the National Forests of Alabama, and its modeled range overlaps the Daniel Boone, the Chattahoochee-Oconee, and the National Forests of North Carolina. This species grows in wet, boggy areas at the heads of streams and on sloping areas kept moist by groundwater seeping to the surface. It is currently known from over 60 occurrences in the southeastern U.S. Development, canopy closure, improper timber harvest techniques, and invasive exotic plants such as kudzu (*Pueraria lobata*) remain threats.

No critical habitat has been designated for this species; therefore, none will be affected. Because the Daniel Boone and the National Forests of Alabama have no retardant use, it is determined that there will be no effect to this species on these Forests. The other forests where this species is either documented or suspected are all forests with low retardant use annually (less than 0.01 percent landbase annually). Additionally, species occurrences will be avoidance mapped, and the habitat where this plant grows in a habitat with typically low retardant use (wet bogs). Therefore, this species **may be affected but is not likely to be adversely affected**.

Platanthera praeclara -Western prairie fringed orchid

Western prairie fringed orchid is known or believed to occur in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, and South Dakota. It is known to occur on the Dakota Prairie Grasslands in southeastern North Dakota (Forest Service Region 1) in one of the few remaining metapopulations of this species. Western prairie fringed orchid is also suspected to occur on Samuel R. McKelvie National Forest, Nebraska in Forest Service Region 2.

This orchid is a perennial orchid of the North American tall grass prairie and is found most often on unplowed, calcareous moist tallgrass prairies and sedge meadows. Soil moisture is a critical determinant of growth, flowering, and distribution of western prairie fringed orchid. Although the species is well adapted to survive fires, the location of the known occurrence of this species on National Forest System lands is frequently flooded and therefore has a very low risk of wildfire.

No critical habitat has been designated for this species. The Dakota Prairie grasslands have applied fire retardant, on average, to less than 0.01 percent of its land base annually. There is a low probability of a currently unknown individual or population to be impacted by a retardant drop. Therefore, a **may affect not likely to adversely affect determination** is warranted.

Polygala lewtonii -Lewton's polygala

This species occurs on the National Forests of Alabama, and its modeled range overlaps the Daniel Boone, the Chattahoochee-Oconee, and the National Forests of North Carolina. This species grows in wet, boggy areas at the heads of streams and on sloping areas kept moist by groundwater seeping to the surface. It is currently known from over 60 occurrences in the southeastern United States. Development, canopy closure, improper timber harvest techniques, and invasive exotic plants such as kudzu (*Pueraria lobata*) remain threats.

No critical habitat has been designated for this species; therefore, none will be affected. Because the Daniel Boone and the National Forests of Alabama have no retardant use, it is determined that there will be no effect to this species on these Forests. The other forests where this species is either documented or suspected are all forests with low retardant use annually (less than 0.01 percent landbase annually). Additionally, species occurrences will be avoidance mapped, and the habitat where this plant grows in a habitat with typically low retardant use (wet bogs). Therefore, this species **may be affected but is not likely to be adversely affected**.

Primula maguirei - Maguire primrose

Maguire primrose is restricted to cool moss-covered dolomite cliffs and boulders in the low to mid elevations of Logan Canyon, Utah. Monitoring completed on Maguire primrose populations indicate that the numbers of plants and populations are substantially underestimated from previous survey accounts. Maguire primrose is in full bloom and populations are near their peak in May in the lower canyon, and approximately two weeks later at higher elevations. In June plants in all areas are in seed set or have already released their seed. Plants are in full senescence by mid-July, when fire season normally begins in this area.

The probability of receiving a retardant drop is unlikely because the plant occurs in cracks and crevices in the limestone cliffs adjacent to the Logan River or its tributaries low in the canyon. Most known plant locations occur within 300 feet of a waterway. One known occurrence on the Uinta-Wasatch-Cache National Forest occurs at the mouth of a canyon growing in soil with grass/shrub (fire adapted) associated vegetation. A potential retardant drop at that site or anywhere in the canyon within the known range of the species is unlikely based on steep terrain.

No critical habitat has been designated for this species. The Uinta-Wasatch-Cache National Forest applies retardant on average, to 0.01 percent of its land base annually. ***Avoidance areas were mapped in coordination with the Utah office of the Fish and Wildlife Service. The avoidance area includes the 300-foot buffer along the Logan River, with additional inclusions to encompass habitat where the primrose is known to exist outside of the 300-foot river corridor. All existing occurrences are protected with avoidance mapping***. Based on the mapped retardant exclusion zone, the nature of the habitat (cracks and crevices in nearly vertical cliffs) this species occupies, and the discussion provided above, a **may affect not likely to adversely affect determination for this species** is warranted.

Purshia (Cowania) subintegra - Arizona cliffrose

Arizona cliffrose grows in four disjunct populations spread across 320 kilometers (200 miles) in central Arizona. Two of the populations are wholly or partly on National Forest System lands (Coconino and Tonto National Forests). This distribution reduces the likelihood that fire would occur in more than one population at a time.

The habitat of Arizona cliffrose is unlikely to have fires or firefighting activities. Arizona cliffrose grows in a desert scrub plant community. It is endemic to soils developed from white Tertiary limestone lakebed deposits that support only scattered vegetation. In particular, the community supports few grasses or other plants that create fine fuels that carry fires. Avoidance mapping would not provide any additional protection (USDI Fish and Wildlife Service 2011).

No critical habitat has been designated for this species. ***No avoidance mapping is required for this species***. The Coconino and Tonto National Forests have increased applied fire retardant, on average, to 0.01 percent of its land base annually since the 2011 analysis. However, the habitat of this species has a low probability for intrusion or for invoking of an exception for retardant use, so this species **may be affected but is not likely to be adversely affected**.

Rhodiola integrifolia ssp. *leedyi* - Leedy's roseroot

This species is known from four populations in Minnesota, two populations in New York, and one occurrence on National Forest System lands on the Black Hills National Forest. The New York populations occur on cliffs along the western shore of a lake near Glenora Falls. In Minnesota, this species is found on shallow ledges on north-facing dolomite cliffs about 100 feet high. Plants only grow in crevices in moderate cliffs, a very specialized habitat where groundwater seeps through the rock and is cooled by air coming from underground air passages in karst topography.

No critical habitat has been designated for this species. ***Known or newly discovered occurrences would be mapped with a 300-foot avoidance buffer***. Because the Black Hills National Forest has applied fire retardant, on average, to less than 0.01 percent of its land base annually, there is very low potential for currently unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Additionally, this species occurs in cliff habitat, where retardant is typically not applied. Therefore, a **may be affected but not likely to be adversely affected determination** is warranted.

Rhododendron minus var. *chapmanii* (*Rhododendron chapmanii*) – Chapman's rhododendron

Chapman's rhododendron is a fire-dependent Florida endemic species. The species is not known to occur on the National Forest is Florida, but it is suspected to occur on the Apalachicola National Forest. An extant population lies on private land approximately 1 mile from this unit. This plant occurs in highly organic sands of pine flatwoods or in ecotones of flatwoods/sandhill and down slope wetlands (titi bogs) in the drainage tributaries of the Apalachicola River, Florida. The species is known to occur in Clay, Gadsden, Gulf and Liberty Counties in Florida.

No critical habitat has been designated for this species. The National Forests of Florida are estimated to apply retardant to less than 0.01 percent of their land base. Because this species is only suspected to occur on the forest and the closest known population is on private land that would not have aerial fire retardant applied the only possible effect would come from a drop on a currently unknown population. Therefore, a **may affect not likely to be adversely affect determination** is warranted.

Sclerocactus glaucus - Colorado hookless cactus

Colorado hookless cactus is known from Delta, Garfield, Mesa and Montrose Counties in Colorado. It is documented to occur on the Grand Mesa-Uncompahgre-Gunnison National Forests and is suspected to occur on the White River National Forest.

The Sclerocacti are a small and very complex group of cacti presently classified into fifteen species. There is ongoing discussion of the taxonomic status of species in this genus.

The habitat of this species consists of exposed, gravel-covered, clay hills, saltbush or sagebrush flats, or pinyon-juniper woodlands; 1400-2000 meters (USDI Fish and Wildlife Service 2008). Populations occur primarily on alluvial benches along the Colorado and Gunnison Rivers and their tributaries. *Sclerocactus glaucus* generally occurs on gravelly, or rocky surfaces on river terrace deposits and lower mesa slopes. Exposures vary, but *S. glaucus* is more abundant on south-facing slopes. Soils are usually coarse, gravelly river alluvium above the river flood plains usually consisting of Mancos shale with volcanic cobbles and pebbles on the surface. Elevations range from 1200 to 2000 m. Associated vegetation is typically desert scrub dominated by shadscale (*Atriplex confertifolia*), galleta (*Hilaria jamesii*), black-sage (*Artemisia nova*), and Indian rice grass (*Stipa hymenoides*). Fire is not typically characteristic of *S. glaucus* habitat, but areas with large infestations of cheatgrass (*Bromus tectorum*) may build up sufficient fuel to carry fire into *S. glaucus* populations.

No critical habitat has been designated for this species. The Grand Mesa-Uncompahgre-Gunnison National Forests and White River National Forests bot apply retardant to less than 0.01 percent of their land bases annually. ***All known populations and modelled habitat are mapped as avoidance areas*** to protect occurrences from potential effects of retardant. Due to the low retardant application potential on these Forests, there is very low potential for retardant to be dropped on a currently unknown population or for an intrusion or exception, combined with use of avoidance areas of known individuals or populations, the species **may be affected but is not likely to be adversely affected**.

Scutellaria floridana – Florida skullcap

Florida skull cap is a fire-dependent Florida endemic species. This northwest Florida species is locally abundant and widespread in appropriate habitat on the Apalachicola National Forest. It occurs in fire-maintained in open wet prairies, savannahs, seepage slopes, and wet flatwoods. It is known to occur in Bay, Franklin, Gulf and Liberty Counties in Florida.

No critical habitat has been designated for this species. ***All stands with known occurrences and all mapped savanna stands across the Apalachicola National Forest have been included in aerial retardant avoidance areas.***

The National Forests of Florida have reduced retardant use to less than 0.01 percent of their land base annually since the 2011 analysis was completed. Impacts to this species due to aerial retardant application are expected to be minimal due to the low level of retardant use and avoidance mapping of known occurrences. Therefore, a determination that the species **may be affected but is not likely to be adversely affected** is warranted.

Senecio franciscana (*Packera franciscana*) - San Francisco Peaks groundsel

San Francisco Peaks groundsel is endemic to an alpine tundra area of about 490 hectares (1,200 acres) on the summit of the San Francisco Peaks north of Flagstaff, Arizona (USDI Fish and Wildlife Service 2008), on the Coconino National Forest. The entire population is in habitat that is unlikely to have fires or firefighting activities. In fact, the alpine tundra of San Francisco Peaks functions as a fire break against fires moving from one side of the mountain to the other. Fire retardant is unlikely to be used in the sub-alpine forests that directly contact the tundra because any fire will burn out when the tundra is reached. Retardants may be used at lower elevations on the mountain, but the retardants would be washed down hill away from San Francisco Peaks groundsel habitat.

Invasive non-native plants, including those occurring after a fire, are a serious problem in northern Arizona, including in areas near the tundra where this species occurs. Post-fire monitoring did not indicate invasion of tundra habitat by non-native species. Because of the low probability of fire occurring and the low probability of the use of fire retardants occur within areas where this species occurs, avoidance mapping of this species would provide no additional protection. Therefore, ***no avoidance mapping would be completed for this species***. (

The Coconino National Forest has increased its aerial retardant application to 0.01 percent of its land base annually. However, due to the low probability of retardant being applied to the species' alpine tundra habitat, the low probability for currently unknown populations experiencing retardant application, and the low probability for intrusions or for use of exceptions for retardant use, this species **may be affected but not likely to be adversely affected**.

Critical habitat is designated on 749 acres of the Coconino National Forest. Primary constituent elements are the loose cinder talus slopes of the alpine tundra system of the San Francisco Peaks and the absence of disturbance and damage from hikers (https://ecos.fws.gov/docs/federal_register/fr772.pdf). Critical habitat is not avoidance mapped. Aerial retardant use is not expected to impact the primary constituent elements of cinder talus slopes and absence of disturbance and damage from hikers; thus a **no effect determination** is warranted for critical habitat.

Solidago spithamaea – Blue Ridge goldenrod

This species is known or suspected to occur in Tennessee (Carter County) and South Carolina (Ashe, Avery, Mitchell, Watauga). The habitat includes rocky places such as outcrops, ledges, cliffs, and balds at elevations above 1,400 meters (4,593 feet). Sites occupied by the species are generally exposed to full sun. The species is known to occur on the National Forests of North Carolina and the Cherokee National Forest. The occurrences are found at Roan Mountain where the Cherokee National Forest and the National Forests of North Carolina forests share boundaries. All locations on the Cherokee National Forests are within 150 feet of the North Carolina border. The habitat has a low likelihood of retardant application, and top of Roan Mountain is almost completely buffered with avoidance areas to protect this and other species (refer to discussion of the spruce-fir moss spider, Roan Mountain bluet, and spreading avens), that occur in the area.

There is no critical habitat designated for this species. The Cherokee National Forest and Forests of North Carolina have applied fire retardant, on average, to less than 0.01 percent of their land base annually. Due to the low probability of fire in the habitat, there is a low potential for retardant application, particularly where occurrences are known. ***Known occurrences are mapped with avoidance areas with 1,500-foot buffers***. Because of the use of avoidance areas, the low probability of retardant being applied on these forests reduces the potential for retardant drops on currently unknown populations or for intrusions or use of exceptions, this species **may be affected but not likely to be adversely affected.**

Spiraea virginiana - Virginia spiraea

This species is known or believed to occur in Georgia, Kentucky, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. It occurs on the following National Forests: Cherokee, Daniel Boone, George Washington-Jefferson, Monongahela, and the Forests of North Carolina and is suspected on the Wayne National Forests. It can be found on periodically flood-scoured banks of high-gradient mountain streams, meander scrolls, point bars, natural levees, and braided features of lower stream reaches, and occasionally near disturbed rights-of-way. Plants are often found on geologically active areas with erosion, deposition, and slumping, along rivers with dynamic flooding regimes, sandbars, scoured river shore and flatrock habitat with crevices. These areas also are associated with cobbles, boulders, and massive rock outcrops with sandy or clay soils. The areas can be periodically xeric.

No critical habitat has been designated for this species. The Daniel Boone, George Washington-Jefferson, Monongahela, and Wayne National Forests do not use aerial fire retardant; therefore, no effects would occur to plants that may occur on these forests. The Cherokee National Forest and National Forests of North Carolina have applied fire retardant, on average, to less than 0.01 percent of their land base annually. ***All occurrences on all National Forests would be protected with the 300-foot aquatic avoidance area buffer***. The Cherokee National Forest occurrences are on scoured banks of larger streams and rivers and are unlikely to be affected by wildfires, limiting retardant use in the area. Therefore, a **may affect not likely to adversely affect determination** for this species is warranted.

Spiranthes diluvialis - Ute ladies'-tresses orchid

Spiranthes diluvialis is known to occur in Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming. National Forests this species is known to occur include Uinta-Wasatch-Cache, Targhee, and near the boundary of the Ashley National Forest's eastern border with the Green River (Forest Service Region 4). The species is also suspected to occur on the following National Forest lands: Medicine-Bow-Routt, White River and Pike San-Isabel (Forest Service Region 2), Boise, Caribou-Targhee, Salmon-Challis, Fishlake, Sawtooth, (suspected Forest Service Region 4), Okanogan (Forest Service Region 6).

This orchid occurs along riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seepy areas associated with old landscape features within historical floodplains of major rivers, as well as in wetlands and seeps near freshwater lakes or springs. Ute ladies'-tresses ranges in elevation from 720 to 1,830 feet in Washington to 7,000 feet in northern Utah. Nearly all occupied sites have a high water table (usually within 5 to 18 inches) of the surface augmented by seasonal flooding, snowmelt, runoff and irrigation.

No critical habitat has been designated for this species. The Uinta-Wasatch-Cache, Medicine-Bow-Routt, White River, Boise, Sawtooth and Okanogan National Forests apply retardant on average, to 0.01 percent of their land bases annually. The Caribou-Targhee, Ashley, Salmon-Challis, Fishlake and Pike San-Isabel National Forest have applied fire retardant, on average, to less than 0.01 percent of their land bases annually.

An avoidance area was mapped to include all known colonies on the Uinta-Wasatch-Cache National Forest. The mapped avoidance area includes the entire flood plain, which incorporates the 300-foot buffer for the river that surrounds the known occupied habitat within the Diamond Fork drainage that includes facultative or obligate wetland vegetation species. Application of a wider exclusion zone (1/4-mile) is not appropriate as this would include considerable pinyon-juniper and other upland habitats well outside the preferred wetland habitat for *Spiranthes diluvialis*. Numerous surveys have been done and no additional populations have been found on the Forest. With retardant drops excluded from the avoidance area as described above, the use of retardant on the Uinta-Wasatch-Cache National Forest **may affect but is not likely to adversely affect this species**.

Occurrences on Targhee and Ashley National Forests are also protected with the 300-foot aquatic buffer area, which protects habitat and likely any currently unknown occurrences. Based on the mapped avoidance area, a **may affect not likely to adversely affect determination** for this species is warranted.

Because this species has the potential to occur on many National Forests, and in most instances would be protected with the existing aquatic avoidance areas, it is expected that any new locations would be protected. If new occurrences are identified, the Forest Service would coordinate with local Fish and Wildlife Service to determine adequacy and/or adjustment of buffer distance.

Spiranthes parksii – Navasota ladies-tresses

This species is known or suspected to occur in Brazos, Burleson, Freestones, Grimes, Jasper, Leon, Madison, Robertson and Washington Counties in Texas. It is known to occur on the National Forests of Texas. The habitat includes margins of post oak (*Quercus stellata*) woodlands in sandy loams along intermittent tributaries of rivers; often in areas where edaphic or hydrologic factors (such as high levels of aluminum in the soil or a perched water table) limit competing vegetation in the herbaceous layer.

No critical habitat has been designated for this species. The National Forests of Texas have applied fire retardant, on average, to less than 0.01 percent of their land base annually. There is a low probability for a currently unknown individual or population to be impacted by a retardant drop. Based on this low probability, and the habitat in which this species occurs a **may affect not likely adversely affect determination** is warranted. In the event a new occurrence is identified on the forest, the species would be avoidance mapped and local coordination with Fish and Wildlife Service office would occur.

Trifolium stoloniferum – Running buffalo clover

This species is known or suspected to occur in Arkansas, Illinois, Indiana, Kansas, Kentucky, Missouri, Ohio, and West Virginia. It occurs on the Mark Twain, the Wayne and the Monongahela National Forests in Region 9 and the Daniel Boone National Forest in Region 8. Running buffalo clover's habitat most commonly is mesic woodlands in partial to filtered sunlight, where there is a pattern of moderate periodic disturbance for a prolonged period, such as mowing, trampling, or grazing. It is most often found in regions underlain with limestone or other calcareous bedrock, but not exclusively. It has been reported from a variety of disturbed woodland habitats, including blue-ash savannahs, floodplains, streambanks, shoals (especially where old trails cross or parallel intermittent streams), grazed woodlots, mowed paths (cemeteries and lawns), old logging roads, jeep trails, skidder trails, mowed wildlife openings within mature forests, and steep, weedy ravines.

No critical habitat has been designated for this species. ***Known individuals or populations on National Forest System lands are protected with mapped avoidance areas***. The Daniel Boone, Monongahela and Wayne National Forests do not use aerial fire retardant, and therefore there would be no impacts to plants that may occur on these forests. Because the Mark Twain National Forest has applied fire retardant, on average, to less than 0.01 percent of its land base annually, there is low potential for currently unknown occurrences to be hit with retardant or for use of exceptions. Therefore, a **may affect but not likely to be adversely affected** determination is warranted.

Trillium reliquum – relict trillium

This species is a spring ephemeral wildflower that occurs in eastern Alabama, central Georgia, and southwestern Carolina (NatureServe 2021) Relict trillium blooms from mid-March through April and is known to occur in rich mixed deciduous forested slopes, bluffs, and stream flats (Case and Case 1997). Fire is a valuable tool for managing the landscape; however, fire management can adversely impact trillium populations (USDI Fish and Wildlife Service 2015). Trillium occurs in hardwood coves, mesic slopes and flood plains that are not considered fire prone. It occurs on the Oconee National Forest in Region 8. It is also within the proclamation boundary of the Francis Marion/Sumter National Forests, but not on the forest.

No critical habitat has been designated for this species; therefore, none will be affected by the proposed action. Known individuals or populations on National Forest System lands are avoidance mapped. The Francis Marion/Sumter National Forests do not use aerial fire retardant therefore no impacts to species that may occur on these forests. Since the Oconee National Forest has applied fire retardant, on average, to less than 0.01% of its land base annually, there is decreased potential for unknown occurrences to be hit with retardant or for exceptions to the guidelines to be invoked. Therefore, a may be affected but not likely to be adversely affected determination is warranted.

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Appendix A. Consultation Re-initiation Framework

DRAFT

Aerial Fire Retardant Product Development and Re-Initiation of Consultation Requirements with the National Oceanic and Atmospheric Administration National Marine Fisheries Service, and the United States Department of Interior Fish and Wildlife Service

Purpose

The purpose of this document is to establish a process for evaluating new aerial fire retardant formulations that are qualified for use by the USDA Forest Service. More specifically, this document provides an agreed-on protocol to be used by the Forest Service and National Oceanic and Atmospheric Administration-National Marine Fisheries Service and Fish and Wildlife Service in making determinations about the potential effects of new aerial retardant formulations on species listed under the Endangered Species Act. The decision(s) to be made and subsequent standard operating procedures developed includes:

- When new retardants fit within the framework and they can be added to the Qualified Products List,
- but those outside of the framework will require a reinitiated consultation to broaden the framework.

These decisions apply only to new product development; all other actions as described within the proposed action within the biological assessment and opinion, including the rates of delivery, will remain unchanged.

This document includes:

- Reinitiation language and analysis parameters for the determination of effects within the Biological Opinions
- Forest Service proposed chemical constituent limits for new product development consistent with retardants previously evaluated within Biological Assessments and Opinions.
- Diagram of process
- Forest Service evaluation and qualification process of new fire retardant chemicals

Re-initiation Language

The following section provides the re-initiation language in Biological Assessments and Biological Opinion, and serves as the baseline in development of re-initiation required before new aerial fire retardants are approved for use in firefighting activities on National Forest System lands.

As provided for in the Code of Federal Regulations Title 50 Subpart B Section 402.16, re-initiation 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) The amount or extent of take is exceeded,

(2) New information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered,

(3) The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered, or

(4) A new species is listed, or critical habitat is designated that may be affected by the action.

If the Forest Service proposes any changes to the United States Department of Agriculture Forest Service Specification (Forest Service Specification FS 5100-304d, current version 304d, January 7, 2020) that affect the evaluation thresholds for toxicity on species, consultation will occur. The Forest Service will inform both regulatory agencies of any changes to the specification if additional ingredients are added to the unacceptable ingredients section, or other changes that do not directly affect the formulations of retardant concentrates.

Analysis Parameters (Proposed Chemical Constituent Limits for New Product Development)

The components of the fire chemicals included in the consultation are described in the proposed action of the Biological Assessment. Appendix A Table 1 provides the ammonia, phosphate, magnesium, and chloride concentrations applied at typical application rates of currently qualified retardants and analyzed within the Biological Assessments and Biological Opinions.

Appendix A, Table 1. Nutrients delivered at specific coverage levels of aerially delivered fire retardant

Retardant	4 GPC Coverage Level		8 GPC Coverage Level	
	pounds of ammonia per square foot	pounds of phosphate per square foot	pounds of ammonia per square foot	pounds of phosphate per square foot
Phos-Chek LC-95A-R	0.0095	0.0301	0.0190	0.0602
Phos-Chek LC-95A-Fx	0.0095	0.0273	0.0191	0.0546
Phos-Chek LC-95-W	0.0095	0.0276	0.0191	0.0553
Phos-Chek MVP-Fx	0.0053	0.0199	0.0105	0.0399
Phos-Chek 259-Fx	0.0070	0.0203	0.0140	0.0406
Phos-Chek LCE20-Fx	0.0073	0.0208	0.0147	0.0415
	pounds of magnesium per square foot	pounds of chloride per square foot	pounds of magnesium per square foot	pounds of chloride per square foot
Fortress FR-100	0.0093	0.0270	0.0185	0.0541

Retardant	4 GPC Coverage Level		8 GPC Coverage Level	
Fortress FR-200 LLX	0.0094	0.0275	0.0188	0.0549

Composition of currently approved retardants and limits for new retardants to be included within the bounds of existing Biological Opinion

Aerially delivered fire retardants are either a liquid concentrate or a dry concentrate. Water is added to each, diluting the products, prior to loading onto an airtanker. Various combinations of di-ammonium phosphate, mono-ammonium phosphate, ammonium polyphosphate (11-37-0), or magnesium chloride retardant salts have previously been or currently are contained in qualified retardant products that have been consulted on. Products containing ammonium sulfate, which was added to the unacceptable ingredients list (Forest Service Specification FS 5100-304d) are not considered in this discussion. In addition to salts, retardants may include thickeners, coloring agents, and performance ingredients (corrosion inhibitors, stabilizers, anti-caking agents, flow conditioners, etc.).

Fire retardant composition is described by percent of ingredient in the mixed product. Composition of retardant salts has ranged from nine to 20 percent of mixed products. Mono-ammonium phosphate and di-ammonium phosphate salts are commonly combined in the same product. Di-ammonium polyphosphate and ammonium polyphosphate are used individually. The amount (percent) of thickener in the mixed product ranges from 0.2 to 0.8 percent. Types of thickener and percent of total mixed product in previously approved products include guar (0.4 to 0.8 percent), xanthan (0.2 to 0.7 percent) and clay (0.3 to 0.5 percent). Coloring agents range from 0.1 to 0.3 percent of the total mixed product and include iron oxide, or fugitive (fading) colorant. Performance ingredients have comprised 0.1 to 0.8 percent of the mixed products.

Aerially delivered retardant is provided at specific coverage levels, expressed as gallons per 100 square feet (GPC), depending on the fuel types present and conditions present. The amount of retardant salt delivered is dependent on the coverage level. The range of chemicals, in pounds per square foot, that would be delivered in a retardant drop at 8 gallons per 100 square feet coverage level for the retardants previously or currently approved are displayed in second column in Appendix A Table 2:

Appendix A, Table 2. Range and upper limits in pounds per square foot (lbs/ft2) of allowable chemicals when applied at a coverage level of 8 gallons per 100 square feet (GPC) of mixed product

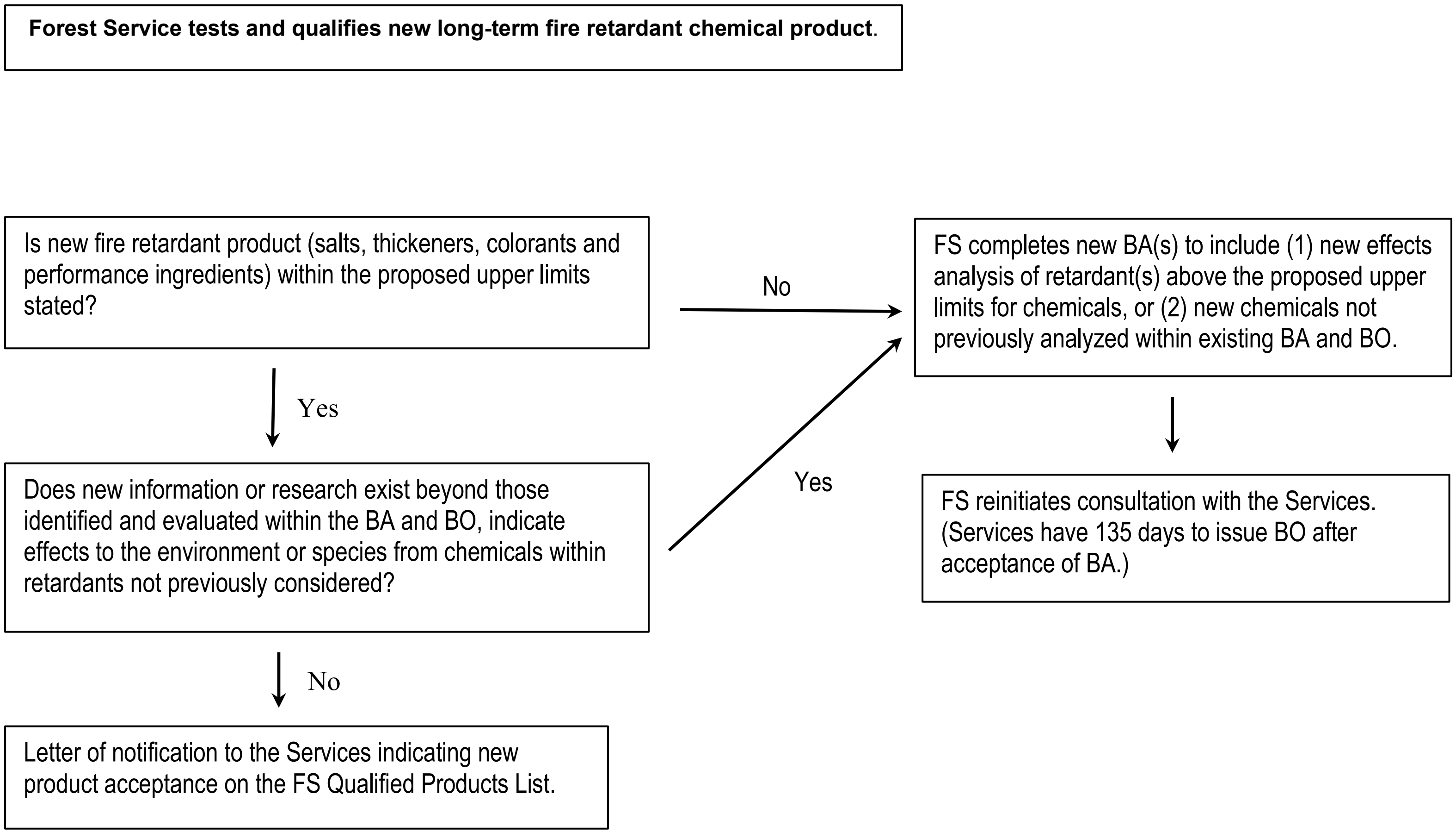
Chemical	Range from previously or currently qualified retardants	Proposed upper limit when delivered at 8 GPC
Ammonia (NH_3)	0.0105 – 0.0191 lbs/ft^2	≤ 0.02 lbs/ft^2
Phosphate (P_2O_5)	0.0399 – 0.0602 lbs/ft^2	≤ 0.07 lbs/ft^2
Magnesium (Mg)	0.0185 lbs/ft^2	≤ 0.02 lbs/ft^2
Chloride (Cl-)	0.0541 lbs/ft^2	≤ 0.06 lbs/ft^2

The Forest Service proposes that the previously approved concentrations of ammonia, phosphate, magnesium, or chloride when delivered at 8 gallons per 100 square feet and displayed in Appendix A Table 2 (third column) be used to establish the upper limit of retardant salts that can be included in newly developed retardants without the need for re-initiation of consultation. Upper limit values provided reflect small increases in constituent levels compared to existing values to allow for minor modifications in formulations as needed by the manufacturer without the need to re-initiate consultation. For any new formulation the toxicity levels must not exceed those of currently approved products. In addition, the maximum extent and duration of effects from new products cannot exceed effects of products already considered in order to be approved without reinitiation.

The Forest Service also proposes establishing the limits of thickeners (guar, xanthan, clay), coloring agents (iron oxide, fugitive) and performance ingredients based on the concentrations found in products that have been previously approved and consulted on. The proposed upper limits are:

- 1 percent thickener (guar, xanthan, and/or clay)
- 0.5 percent colorant (iron oxide and/or fugitive)
- 1.5 percent performance ingredients

Reinitiation process for new long-term fire retardant chemicals



How the Forest Service Qualifies New Aerial Fire Retardant

The following section provides information on how the Forest Service evaluates and qualifies new and modified fire retardants. The information presented here is the same as what was submitted to the services with the consultation(s) and is provided here for clarity.

Since fire retardant is another tool for fire managers to utilize, it is imperative that any product used meets stringent requirements in order to ensure safety is met for people, the environment and equipment.

Retardant formulations in use today are primarily inorganic fertilizers, the active compound being ammonium polyphosphates (Forest Service Specification FS 5100-304d) .Although retardant is approximately 85 percent water, the ammonia salt compounds constitute about 60 to 90 percent of the remainder of the product. The other ingredients include thickeners, such as guar gum; suspending agents, such as clay; dyes; and corrosion inhibitors (Johnson and Sanders 1977; Pattle Delamore Partners 1996). Corrosion inhibitors are added and required to minimize the deterioration of retardant tank structures and aircraft. Acceptable corrosion inhibitors do not include sodium ferrocyanide (previously shown to have toxic effects to aquatic species and aquatic environments) or any of the other chemicals included in the list of prohibited chemicals which have been shown to have adverse effects on people or the environment.

History

A full understanding about how retardant chemical components interacted with various elements of the environment was generally lacking during early use of the materials (pre-1990s). Over the past two decades, wildland firefighting agencies have conducted more monitoring and review of the environmental and safety aspects of retardant use (Auxilio Management Services 2020, Labat Environmental 2007, Labat-Anderson Incorporated August 1994, Finger 1997, Carmichael 1992, Krehbiel 1992, Van Meter and Hardy 1975, and others).

The Columbia Environment Research Center report (Little and Calfee 2000) spurred a review of procedures used by the Forest Service, Bureau of Land Management, National Park Service, and Fish and Wildlife Service during aerial firefighting. As a result of these studies, the Guidelines for Aerial Delivery of Retardant or Foam near Waterways were established as interim guidelines in April 2000. Due to the potential increased toxicity, the Forest Service has not accepted for evaluation, contract or purchased retardants that contain sodium ferrocyanide since 2005 (USDA Forest Service 2000, 2002). The Forest Service discontinued the use of retardants containing sodium ferrocyanide beginning with the 2007 fire season.

Besides the ongoing work with outside agencies and environmental entities, the USDA Forest Service Wildland Fire Chemicals program includes a specification review and revision process applied to all categories of wildland fire chemicals. The current specification was established in 2020 (Forest Service Specification FS 5100-304d).

Evaluation Process

The evaluation process for any product is funded by the company that is seeking to have a product on the Qualified Products List. The Forest Service does not use any wildland fire chemical that is not listed on the Qualified Product List. A product must meet all requirements of the specification (Forest Service Specification FS 5100-304d) to become qualified. The initial request from a company or manufacturer for the Forest Service to evaluate a product results in a review of the formulas' ingredients and quantity used to prepare the product. The submitted paperwork from the company shall include:

- Each ingredient, quantity and supply source in the formulation
- Copies of the Safety Data Sheets for the product and for each ingredient used to prepare the retardant.

This is done to assure the product does not contain ingredients meeting the criteria for Chemicals of Concern, which is checked against the list of unacceptable ingredients as contained in the specification section 3.4.2: (National Toxicology Program Annual Report of Carcinogens; International Agency for Research on Cancer Monographs for Potential Carcinogens; Comprehensive Environmental Response, Compensation, and Liability Act List of Extremely Hazardous Substances and Their Threshold Planning Quantities) in order to determine if there are any ingredients that could pose a threat to either the environment or human populations. If this review identifies an ingredient of potential concern, and the supplier wants to proceed with the evaluation, a risk assessment is conducted by a third party before proceeding with a full evaluation.

The specification includes requirements for effectiveness, safety and environmental protection, materials protection, stability, and physical properties. The Forest Service developed unique test methods or identified standard test methods for each requirement in the evaluation process.

The Forest Service establishes formal national retardant contracts in order to ensure that only products on the Qualified Products List are purchased and applied to National Forest System lands. The Qualified Products List and retardant contracts are also used by other Federal land management agencies through their authorities and policies.

Conclusion

Fire retardant manufacturers are continuing to develop retardant formulations that perform effectively and submit products to the Forest Service for evaluation and testing. Often new formulations (which may be identified by the same or new product names but are always identified by a unique formulation identification number) have only very minor changes in constituents, while some may be completely different. The Forest Service performs rigorous testing of these products prior to placing them products on the Qualified Product List. To summarize:

- The Forest Service does not make or develop the products, private industry does.
- The Forest Service does test to the specification, not just a spot check.
- If a product does not meet all the requirements, it is not added to Qualified Products List.
- Prohibited ingredients and mammalian and aquatic toxicity testing are included in the Long-Term Retardant Specification.
- Listed ingredients trigger additional study.
- Specification requirements are not optional

Appendix A Literature Cited

Auxilio Management Services. 2020. Ecological Risk Assessment of Wildland Fire-Fighting Chemicals: Long-Term Fire Retardants (non-confidential summary). Prepared for Fire and Aviation Management & National Technology and Development Program, USDA Forest Service, Missoula, MT. August 2020.

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Van Meter, W.P. and Charles E. Hardy. 1975. Predicting effects on fish of fire retardants in streams. Res. Pap. INT-166. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 16 p

Additional Information

Forest Service Wildland Fire Chemical Program and Process

https://www.fs.fed.us/rm/fire/wfcs/index.php

Chemical Profiles

Safety Data Sheets (SDS) for components of long-term retardants on the Forest Service Qualified Products can we found at: https://www.fs.fed.us/rm/fire/wfcs/sds.php

Chemical profiles for these same ingredients are considered in the risk assessment process as described in the biological assessment.

Appendix B. Intrusion Maps

Intrusions into National Forest System land avoidance areas, as reported from 2012 through 2019, were mapped based on the provided latitude and longitude. These maps provide a perspective of the extent of intrusions and their proximity to each other. Intrusions are categorized by the type of avoidance area (aquatic threatened, endangered, proposed, candidate, or sensitive species; terrestrial threatened, endangered, proposed, candidate, or sensitive species; waterway; waterway buffer zone; or dry intermittent stream), and whether the intrusion was accidental or an exception. Because of their large size, the maps are not included here, but our provided online at: Interagency Wildland Fire Chemicals Policy and Guidance.

The available maps include:

- Region 1 Intrusions Map
- Region 2 Intrusions Map
- Region 3 Intrusions Map
- Region 4 Intrusions Map
- Region 4 Boise National Forest Enlargement
- Region 5 Intrusion Map North
- Region 5 Intrusion Map Central
- Region 5 Intrusion Map South
- Region 5 Mendocino National Forest Enlargement
- Region 6 Intrusion Map
- Region 8 Intrusion Map
- Region 9 Intrusion Map

Appendix C. Tables of Intrusions by Year, 2012 through 2019

Appendix C, Table 1. List of intrusions in 2012

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R1	Nez Perce	Mallard Fire	airtanker	1		1	1		1			100	
R1	Nez Perce	McGuire Complex	SEAT	1		1	1	1			500		
R2	Arapaho & Roosevelt	High Park	SEAT	1		1	1	1			600		
R2	Pike-San Isabel	Waldo Canyon	helicopter	5		2	5	1	4		2	1500	
R2	Grand Mesa-Uncompahgre-Gunnison	Twin Basin	airtanker	1		1	1	1			2200		
R2	San Juan	HD-4	SEAT		6	1	6		6			4179	
R2	San Juan	Vallecito	SEAT	10		1	10		10			50000	
R3	Prescott	Gladiator	airtanker	1		1	1	1			2000		
R3	Tonto	Comet	helicopter		3	3	3	3			12000		
R3	Tonto	Poco	SEAT	2		2	2		2			3500	
R4	Boise	Avelene	SEAT		1	1	1	1			100		
R4	Boise	Bearskin	SEAT	2		1	2		2			800	
R4	Boise	Trinity Ridge	airtanker	6		5	6	3	3		13	unknown	
R4	Bridger-Teton	Chall Cr	SEAT	3		3	3		3			31	
R4	Bridger-Teton	Forest Park	airtanker	1		1	1			1			1000
R4	Dixie	Reserve	airtanker	1		1	1	1			3000		
R4	Dixie	Shingle	airtanker	10		10	10	1	8	1	500	5000	200
R4	Salmon-Challis	Halstead	airtanker	2		2	2	2			240		
R4	Uinta-Wasatch-Cache	Pumpkin	airtanker	2		2	2	1	1		2000	999	
R4	Uinta-Wasatch-Cache	Quail	airtanker	4		2	4		4			unknown	
R5	Angeles	Williams	airtanker		4	1	4		4			8400	
R5	Lake Tahoe Basin	ELKS	airtanker	1		1	1	1			unknown		

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R5	Lassen	Mill-LNF	airtanker	10		1	10		10			7000	
R5	Mendocino	Board	airtanker		1	1	1		1			5	
R5	Mendocino	Mill	airtanker		3	3	3	1	2		5	2	
R5	Mendocino	North Pass	airtanker	4		4	4		4			11.3	
R5	San Bernardino	Devore	airtanker		11	3	11	11			15900		
R5	San Bernardino	Lawler	airtanker		3	1	3		3			3000	
R5	San Bernardino	LYTLE	airtanker	1		1	1		1			200	
R5	Sequoia	South Fire	airtanker		1	1	1		1			50	
R5	Shasta-Trinity	Creek	airtanker	1		1	1		1			500	
R5	Shasta-Trinity	Garden	airtanker	1		1	1		1			300	
R5	Shasta-Trinity	SHF Stafford	helicopter		2	2	2	2			2558		
R5	Sierra	Bear	airtanker	1		1	1		1			1000	
R5	Six Rivers	Dillon	airtanker		4	2	4	3	1		3000	10	
R5	Six Rivers	Ruth Dam Fire	airtanker		1	1	1		1			1200	
R6	Gifford Pinchot	Cascade Creek	airtanker	1		1	1		1			235.6	
R6	Malheur	Parish Cabin Fire	SEAT	4		3	4	3	1		1420	320	
R6	Okanogan-Wenatchee	Goat	airtanker	2		1	2		2			6000	

Appendix C, Table 2. List of intrusions in 2013.

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	Buffer only	Terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R1	Beaverhead-Deerlodge	Moose Meadows	airtanker	1		1	1	1			69		
R1	Custer	Rock Creek	airtanker	2		2	2	1	1		2760	124.8	
R3	Apache-Sitgreaves	East Fork	SEAT	1		1	1		1			240	

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	Buffer only	Terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R3	Prescott	Doce	airtanker		3	1	3		3			1000	
R4	Boise	Elk Complex	SEAT		1	1	1		1			1	
R4	Boise	Pine Creek	airtanker	1		1	1	1			2400		
R4	Boise	Pony Complex	airtanker	2		2	2		2			800-1000	
R4	Boise	Summit	SEAT	11		5	11	9	2		3850	750	
R4	Bridger-Teton	Packer	airtanker	1		1	1		1			400	
R4	Caribou-Targhee	Lead Draw	SEAT	1		1	1	1			10		
R4	Humboldt-Toiyabe	Smith Ranch	SEAT	2		1	2		2			900	
R4	Payette	Thunder City	SEAT	1		1	1	1			10		
R4	Salmon-Challis	Lodgepole	airtanker	1		1	1	1			75		
R4	Sawtooth	210 Road Fire	airtanker	1		1	1	1			991		
R5	Angeles	Madre	airtanker	1		1	1	1			2000		
R5	Angeles	Powerhouse	unknown	3		3	3		3			18808	
R5	Cleveland	Chariot	airtanker		2	1	2			2			1850
R5	Cleveland	San Juan	airtanker	1		1	1		1			15	
R5	Los Padres	White	airtanker	1		1	1		1			50	
R5	Mendocino	Daves	airtanker	1	2	3	3		3			165	
R5	Mendocino	Sale	airtanker		2	1	2		2			20	
R5	Modoc	Rail Fire	airtanker	2		1	2		2			3000	
R5	Plumas	Game 2	airtanker	3		1	3		3			3989	
R5	San Bernardino	Hathaway	unknown		6	1	6		6			unknown	
R5	San Bernardino	Mountain	airtanker		12	5	12	1	7	4	50	5200	5200
R5	Sequoia	Angora Fire	airtanker, SEAT	8		1	8		8			66612	
R5	Sequoia	Fish Fire	airtanker	4		2	4	4			4860		
R5	Six Rivers	Corral Complex	airtanker	6		6	6	4	2		4800-7200	3600-5400	
R5	Stanislaus	Power	airtanker	5		4	5	2	3		300	700	

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	Buffer only	Terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R5	Tahoe	Buckeye	airtanker	2		1	2		2			unknown	
R6	Mt. Hood	Government Flat Complex	airtanker	2		2	2	1	1		1500	200	

Appendix C, Table 3. List of intrusions in 2014

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	Terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R1	Lolo	Colt Lake	SEAT	1		1	1	1			100		
R2	Medicine Bow Routt	Owen	airtanker	4		1	4	4			8000		
R3	Apache Sitgreaves	San Juan	airtanker	2		1	2	2			11595		
R4	Boise	Bull Creek	SEAT	1		1	1	1			100		
R4	Boise	Control Creek	SEAT	1		1	1	1			714		
R4	Dixie	Basin	SEAT	2		1	2		2			1600	
R4	Dixie	Bull Mountain	SEAT	3		1	3		3			2000	
R4	Dixie	Scar	airtanker	1		1	1		1			6000	
R4	Humboldt Toiyabe	Woodchuck	SEAT	1		1	1		1			7008	
R4	Payette	Rush Fire	SEAT		1	1	1	1			150		
R4	Payette	Weasel Springs	SEAT	1		1	1		1			800	
R4	Sawtooth NRA	Hell Roaring	airtanker	1		1	1		1			2.5	
R5	Klamath	Leef Fire	airtanker	1		1	1	1			1100		
R5	Klamath	Log Fire	helicopter	1		1	1	1			unknown		
R5	Klamath	Man Fire	unknown	1		1	1	1			unknown		
R5	Klamath	White's Fire	helicopter	3		3	3	3			unknown		
R5	Klamath	Happy Camp	helicopter	3		2	3	3			301		
R5	Lake Tahoe Basin	Kingsbury	airtanker		2	1	2	2			16800		

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	Terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R5	Lassen	Black	airtanker	1		1	1		1			1000	
R5	Lassen	Day	airtanker	2		2	2	2			5900		
R5	Modoc	Modoc July Complex	SEAT	3		1	3		3			1820	
R5	Modoc	Mud	airtanker	1		1	1		1			unknown	
R5	San Bernardino	Tahquitz	airtanker	2		1	2	2			2400		
R5	Sequoia	Way	airtanker	3		3	3		3			350	
R5	Shasta-Trinity	Oregon	airtanker	5		1	5	5			unknown		
R5	Shasta-Trinity	SMMU Lightning Sand Incident	airtanker	1		1	1		1			93	
R5	Sierra	Courtney	airtanker	1		1	1		1			100	
R6	Okanogan- Wenatchee	Carlton-Complex	airtanker		1	1	1		1			unknown	
R6	Okanogan- Wenatchee	Mills Canyon	airtanker		6	1	6			6			30000
R6	Wallowa Whitman	Badger Butte II	SEAT	1		1	1	1			200		
R6	Wallowa Whitman	Cougar	SEAT	3		1	3	3			40		

Appendix C, Table 4. List of intrusions in 2015

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R4	Ashley	Memorial	SEAT	1		1	1		1			70	
R4	Boise	Cougar	SEAT	1		1	1	1			800		
R4	Boise	Pine	airtanker	1		1	1	1			2419		
R4	Boise	Walker	airtanker	3		1	3	3			4088		
R4	Boise	Wolf Fire	SEAT	2		1	2	2			500-600		

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R4	Dixie	Oak Grove	airtanker	3		1	3		3			3000	
R4	Payette	Boulder Meadows	SEAT	2		1	2	2			500-600		
R4	Payette	Rapid	airtanker	6		4	6	3	3		91200	9000	
R4	Sawtooth	Royal	SEAT	1		1	1	1			1		
R5	Angeles	Cabin Fire	airtanker		1	1	1	1			47550		
R5	Eldorado	Kyburz	airtanker	3		2	3	3			2000		
R5	Los Padres	Chorro	airtanker	3		3	3		3			3600	
R5	Los Padres	Cuesta	SEAT	3		1	3	3			9		
R5	Mendocino	Boardman	airtanker	1	5	3	6	6			5864		
R5	Mendocino	Deer	airtanker		3	3	3	3			2965		
R5	San Bernardino	Green	airtanker	2		1	2	2			333		
R5	San Bernardino	Lake	airtanker		3	3	3	2		1	300-750		2
R5	Sequoia	Rough	airtanker	7		7	7	4	3		5500	2600	
R5	Shasta-Trinity	Castle	airtanker	3		1	3	3			2880		
R5	Shasta-Trinity	Fork Complex	airtanker	2		2	2	1	1		2800	2800	
R5	Shasta-Trinity	River Complex	unknown	3		1	3	3			8380		
R5	Shasta-Trinity	Saddle	airtanker	2		1	2	2			1980		
R5	Shasta-Trinity	South Complex	SEAT	1		1	1	1			800		
R5	Six Rivers	Mad River	airtanker	4	4	5	8	7	1		unknown	unknown	
R5	Six Rivers	Route Complex	airtanker	1		1	1		1			unknown	
R5	Tahoe	Burnett	airtanker	1		1	1		1			500	
R6	Malheur	Canyon Creek Complex	airtanker	2		2	2	2			20		

Appendix C, Table 5. List of intrusions in 2016

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R1	Custer	North	SEAT	2		1	2	2			1000		
R1	Lolo	Copper King	SEAT	1		1	1	1			750		
R3	Apache-Sitgreaves	Juniper	SEAT	1		1	1	1			50		
R4	Boise	Buck Fire	airtanker	2		2	2	2			1955		
R4	Boise	Pioneer	airtanker	9		9	9	7	2		7978	2465	
R4	Caribou-Targhee	Peterson Hollow	airtanker	1		1	1	1			1575		
R4	Caribou-Targhee	South Mink Wildfire	airtanker	1		1	1	1			100		
R4	Caribou-Targhee	Toponce Creek Fire	airtanker	6		1	6	6			14525		
R4	Dixie	Aspen	airtanker	10		1	10		10			28000	
R4	Dixie	Pine Canyon	airtanker	6		1	6		6			16800	
R4	Dixie	Saddle	airtanker, SEAT, helicopter	5	41	9	46	1		45	700		105483
R4	Sawtooth	Dry Creek Fire	airtanker	2		2	2	2			16		
R4	Uinta-Wasatch- Cache	Sheep Creek	airtanker	2		1	2	2			300-500		
R5	Cleveland	Holy	airtanker	1		1	1		1			2400	
R5	Cleveland	Three Sisters	airtanker	2		1	2	2			2000		
R5	Inyo	Horseshoe	airtanker	1		1	1		1			3150	
R5	Inyo	Marina	airtanker	2		1	2	2			1200		
R5	Lassen	Lemm Fire	SEAT	4		1	4	4			700		
R5	Lassen	Potato	airtanker	2		1	2		2			500	
R5	Los Padres	Pine Fire	airtanker	10		1	10		10			1500	
R5	Los Padres	Rey fire	airtanker, helicopter, unknown	12		9	12	6	6		6000-6300	2100-2300	
R5	Los Padres	Sherpa	airtanker	3		1	3		3			2000	

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R5	Los Padres	Soberanes Fire	airtanker	1		1	1	1			unknown		
R5	Mendocino	Alder	airtanker		3	1	3	3			221.5		
R5	San Bernardino	Blue Cut	airtanker	2	6	3	8		6	2		15700	3000
R5	San Bernardino	Horn	airtanker	1		1	1		1			1000	
R5	San Bernardino	Pilot	airtanker		2	1	2			2			12000
R5	Shasta-Trinity	Gillman	airtanker		4	2	4	3	1		812	812	
R5	Stanislaus	Old Fire	airtanker	3		1	3		3			50	
R6	Wallowa- Whitman	Sheep	airtanker	1		1	1	1			600		
R8	National Forests of North Carolina	Silver Mine Creek	airtanker		1	1	1		1			450	

Appendix C, Table 6. List of intrusions in 2017

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R1	Beaverhead-Deerlodge	Morgan	airtanker	3		1	3		3			4380	
R1	Custer	Sartin Draw	airtanker		6	1	6		6			6800	
R1	Helena-Lewis and Clark	Arrastra Creek	airtanker	1		1	1	1			2000		
R1	Helena-Lewis and Clark	Alice Creek	airtanker	1		1	1	1			1000		
R1	Helena-Lewis and Clark	Park Creek	airtanker	1		1	1		1			881	
R1	Lolo	Lolo Peak	helicopter		2	1	2	2			1800		
R1	Lolo	HWY 200 Complex	airtanker	1		1	1	1			3800		
R1	Lolo	Rice Ridge	airtanker	10		8	10	10			29850		

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R1	Lolo	Sapphire	SEAT	2		1	2	2			1600		
R1	Lolo	Sunrise	helicopter	11		2	11		11			3250	
R2	Grand Mesa, Uncompagre, Gunnison	Carson	SEAT	1		1	1	1			710		
R2	Medicine Bow- Routt	Keystone	airtanker		4	1	4	4			10		
R3	Prescott	Goodwin	airtanker	2		1	2		2			1000	
R3	Tonto	Picadilla	airtanker	1		1	1		1			3500	
R4	Boise	Wapiti	SEAT	1		1	1	1			51		
R4	Boise	Whitehawk	helicopter	2		1	2	1	1		715	unknown	
R4	Humboldt-Toiyabe	Quinn Fire	SEAT	1		1	1		1			700	
R5	Klamath	Klamath Fire	airtanker		1	1	1	1			3500		
R5	Klamath	Little	airtanker	2		2	2	2			2028		
R5	Klamath	Marble	airtanker	2		2	2	2			5710		
R5	Klamath	Salmon-August Complex	airtanker		2	1	2	2			21000		
R5	Klamath	Ukonom Spot 1	airtanker	4		1	4	4			157.5		
R5	Los Padres	Thomas	airtanker	4		3	4	2	2		4000	1000	
R5	Los Padres	Whittier	airtanker	3		2	3		3			300	
R5	Mendocino	Skeleton	airtanker	4		3	4	4			3563		
R5	Mendocino	Slides	airtanker	1		1	1	1			1138		
R5	Plumas	Minerva 5	airtanker	4		4	4	4			unknown		
R5	San Bernardino	Dollar	airtanker	1		1	1		1			500	
R5	San Bernardino	Holcomb T	airtanker		10	4	10		1	9		3000	12500
R5	San Bernardino	Rouse	airtanker		3	1	3		3			1400	
R5	Shasta-Trinity	Buck	airtanker	1		1	1	1			20		
R5	Sierra	Railroad	airtanker	19		19	19	17	2		79523	8592	

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
R5	Six Rivers	Ruth Complex	airtanker	3	10	2	13		13			43000	
R6	Deschutes	Milli	airtanker	1		1	1	1			140		
R6	Fremont- Winema	Devils Lake	airtanker	1		1	1	1			1000		

Appendix C, Table 7. List of intrusions in 2018

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
1	Bitterroot	Reynolds Lake	airtanker	2		1	2	2			1500		
1	Kootenai	OU3MR Highway 37	airtanker	3		3	3	3			600		
1	Nez Perce-Clearwater	Rattlesnake	SEAT	1		1	1		1			100	
2	Medicine Bow- Routt	Badger Creek	airtanker	3	18	4	21	3	18		3000	12000	
2	Pike-San Isabel	Shooting Range	airtanker	1		1	1	1			1000		
2	White River	Two Elk fire	SEAT	1		1	1	1			150		
3	Gila	Ranch	airtanker	2		2	2	2			9119		
4	Boise	German	SEAT	10		1	10		10			2927	
4	Boise	Wren	airtanker	5		1	5		5			1830	
4	Bridger-Teton	Roosevelt	airtanker	34		7	34	9	15	10	71000	60000	30000
4	Dixie	West Valley	airtanker	1		1	1		1			300	
4	Sawtooth	Wapiti	airtanker	1		1	1		1			619	
4	Sawtooth	Wildcat	airtanker		1	1	1	1			4000		
4	Uinita-Wasatch Cache	Pole Creek	airtanker, helicopter	5		5	5		5			unknown	
5	Angeles	Fork Fire	airtanker	2		2	2	2			500		

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
5	Klamath	Petersburg	helicopter	1		1	1		1			unknown	
5	Lassen	Lakes	SEAT		2	1	2		2			1600	
5	Lassen	Parade	SEAT		6	1	6			6			1600
5	Lassen	Roxie	helicopter	2		1	2	2			1400		
5	Lassen	Whaleback	airtanker	1		1	1	1			50		
5	Lassen	Wilson	airtanker		1	1	1	1			1500		
5	Los Padres	Adams	airtanker	2		1	2	2			3500		
5	Mendocino	Eel	airtanker	7		7	7	3	4		2603	1397	
5	Mendocino	Open	airtanker	3		2	3	3			415		
5	Mendocino	Ranch	airtanker	30		22	30	21	9		11920.5	1701.5	
5	San Bernardino	Cranston	airtanker	6	4	6	10		8	2		24000	5000
5	San Bernardino	Kenbrook	airtanker		3	1	3		3			600	
5	Shasta Trinity	Kerlin	airtanker		10	1	10	10			15000		
5	Six Rivers	Signboard	airtanker	1		1	1		1			unknown	
5	Tahoe	North	airtanker	6		3	6	6			unknown		
6	Okanogan-Wenatchee	Cougar Creek	airtanker	2		1	2	2			500		
6	Rogue River- Siskiyou	Klondike West	airtanker	1		1	1			1			20000
6	Rogue River- Siskiyou	Nachez	helicopter	6		1	6	6			2400		
6	Umatilla	Wilson Prairie	airtanker	10		2	10	10			121800		
8	Mark Twain	Rozell	airtanker		1	1	1		1			2799	

Appendix C, Table 8. List of intrusions in 2019

Region	Forest/Unit	Fire Name	Exposure Method	accidental	exception	intrusion reports	drops	direct to water	buffer only	terrestrial TES	Estimated gallons into water	Estimated gallons into buffer	Estimated gallons into Terrestrial
1	NezPerce - Clearwater	Crab	airtanker	1		1	1	1			300		
3	Tonto	Woodbury	airtanker	2		1	2	2			14175		
4	Boise	Nine Fire	airtanker	2		1	2	2			1850		
4	Bridger-Teton	Boulder Lake	unknown	1		1	1	1			unknown		
4	Humboldt-Toiyabe	Corta	airtanker	1		1	1		1			100	
4	Humboldt-Toiyabe	Cherry Fire	SEAT	2		1	2	2			1400		
4	Payette	Nethker Fire	unknown	3		3	3	3			unknown		
4	Salmon-Challis	Vader Fire	airtanker	unknown		1	unk	unk			unknown		
5	Cleveland	Meadow	airtanker		1	1	1			1			650
5	Inyo	Taboose	unknown	2		2	2	1	1		200	100	
5	Klamath	Lime	airtanker	1		1	1	1			unknown		
5	Lassen	Potato Fire	SEAT		4	1	4		4			2000	
5	San Bernardino	Bautista	airtanker	3	10	4	13			13			18800
5	Stanislaus	Pond Fire	airtanker	1		1	1	1			2000		
8	NFs in Florida	Powerline	helicopter		2	1	2			2			1000
Total				600	252	459	852	376	386	108	761282.5	95707.7	248285

Appendix D. List of Species Considered

The following table is the list of species considered during the Endangered Species Act consultation for Nationwide Aerial Application of Fire Retardant on National Forest System Lands. This list is organized by category (e.g. amphibian, plant), and then alphabetically by scientific name. There are no listed species that occur on the National Forest System lands in Region 10 (Alaska). If there are discrepancies between this summary table and the document text, the correct information is the document text. The following list provides descriptions of the coding used in the table.

- Common name or Scientific Name in parentheses indicates an alternate name. DPS = distinct population segment, ESU = evolutionarily significant unit
- Status: E = endangered, T = threatened, PE = proposed endangered, PT = proposed threatened, XN = experimental nonessential population, T(S/A) = threatened due to similar appearance, CH = critical habitat, PCH = proposed critical habitat. A status code CH in parentheses indicates that the critical habitat does not occur on National Forest System lands and was not analyzed for indirect effects.
- Determination: NE = no effect, NLAA = may affect but is not likely to adversely affect, LAA = may affect and is likely to adversely affect, NLJ = not likely to jeopardize the continued existence, na = not applicable (for critical habitat that does not occur on National Forest System lands)
- Forest names in all capital letters are units where designated or proposed critical habitat occurs. A forest name in parentheses indicates that the species does not occur on National Forest System lands. It may still be analyzed for direct or indirect effects.
- Refer to main document for an explanation of retardant application potential categories.
- Table cells without text (i.e., blank) indicate that a species does not occur on any National Forest System lands within a particular Region..

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
amphibian	California tiger salamander - central population	*Ambystoma californiense*	T (CH)	NLAA na					high application potential: **Sequoia**			
amphibian	Frosted Flatwoods salamander	*Ambystoma cingulatum*	T CH	NLAA NLAA							no use: **FRANCIS MARION**; very low application potential: **NATIONAL FORESTS IN FLORIDA**	
amphibian	Sonora tiger salamander	*Ambystoma tigrinum stebbinsi*	E	LAA			low application potential: **Apache-Sitgreaves;** high application potential: **Coronado**					
amphibian	Arroyo toad	*Anaxyrus californicus*	E CH	LAA NLAA					high application potential: **ANGELES, CLEVELAND, LOS PADRES, SAN BERNARDINO**			
amphibian	Yosemite toad	*Anaxyrus canorus*	T CH	LAA NLAA				high application potential: **TOIYABE**	very low application potential: **Lake Tahoe Basin Management Unit;** high application potential: **ELDORADO, INYO, SIERRA, STANISLAUS**			

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
amphibian	Wyoming toad	*Bufo baxteri*	E	NE		moderate application potential: **Medicine Bow-Routt**						
amphibian	Ozark hellbender	*Cryptobranchus alleganiensis bishopi*	E	NLAA							no use: **Ozark**	very low application potential: **Mark Twain**
amphibian	eastern hellbender - Missouri DPS	*Cryptobranchus alleganiensis alleganiensis*	E	NLAA								very low application potential: **Mark Twain**
amphibian	black warrior waterdog	*Necturus alabamensis*	E CH	NE NE							no use: **NATIONAL FORESTS IN ALABAMA**	
amphibian	Neuse River waterdog	*Necturus lewisi*	T	NLAA							very low application potential: **National Forests in North Carolina**	
amphibian	Jemez Mountains salamander	*Plethodon neomexicanus*	E CH	NLAA NLAA			moderate application potential: **SANTA FE**					
amphibian	Cheat Mountain salamander	*Plethodon netting*	T	NE								no use: **Monongahela**
amphibian	Shenandoah salamander	*Plethodon shenandoah*	E	NE							no use: **George Washington and Jefferson**	
amphibian	California red-legged frog	*Rana draytonii*	T CH	LAA NLAA					moderate application potential: **Mendocino**; high application potential: **ANGELES, Cleveland, ELDORADO, LOS PADRES, PLUMAS, San Bernardino, Shasta-Trinity, Sierra, Stanislaus, TAHOE**			
amphibian	Chiricahua leopard frog	*Rana chiracahuensis*	T CH	LAA NLAA			low application potential: **APACHE-SITGREAVES;** moderate application potential: **Cibola, COCONINO, GILA;** high application potential: **CORONADO, TONTO**					
amphibian	mountain yellow-legged	*Rana muscosa*	E CH	LAA NLAA					high application potential: **INYO, SEQUOIA, Sierra**			

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
	frog - northern California DPS											
amphibian	mountain yellow-legged frog - southern California DPS	*Rana muscosa*	E CH	LAA NLAA					high application potential: **ANGELES, SAN BERNARDINO**			
amphibian	Oregon spotted frog	*Rana pretiosa*	T CH	LAA NLAA						no use: **Mt. Baker - Snoqualmie;** very low application potential: **MT. HOOD;** low application potential: **GIFFORD PINCHOT, WILLAMETTE;** moderate application potential: **FREMONT-WINEMA;** high application potential: **DESCHUTES**		
amphibian	Sierra Nevada yellow-legged frog	*Rana sierrae*	E CH	LAA NLAA				high application potential: **TOIYABE**	very low application potential: **LAKE TAHOE BASIN MANAGEMENT UNIT**; moderate application potential: **LASSEN;** high application potential: **ELDORADO, INYO, PLUMAS, SIERRA, STANISLAUS, TAHOE**			
amphibian	dusky gopher frog	*Rano sevosa or Lithobates sevosus*	E CH	NE NE							no use: **NATIONAL FORESTS IN MISSISSIPPI**	
arachnid	spruce-fir moss spider	*Microhexura montivaga*	E CH	NLAA NLAA							no use: **Jefferson;** very low application potential: **CHEROKEE, NATIONAL FOREST IN NORTH CAROLINA**	
bird	Puerto Rican sharp-shinned hawk	*Accipiter striatus venator*	E	NE							no use: **El Junque**	
bird	Puerto Rican parrot	*Amazona vittata*	E	NE							no use: **El Junque**	
bird	Florida scrub-jay	*Aphelocoma coerulescens*	T	NLAA							very low application potential: **National Forests in Florida**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
bird	marbled murrelet	*Brachyramphus marmoratus*	T CH	LAA NLAA					high application potential: **KLAMATH (habitat only), Los Padres, Shasta-Trinity (historic), SIX RIVERS**	no use: **MT. BAKER-SNOQUALMIE, OLYMPIC, SIUSLAW;** low application potential: **GIFFORD-PINCHOT**; high application potential: **SISKIYOU**		
bird	Puerto Rican broad-winged hawk	*Buteo platypterus brunnescens*	E	NE							no use: **El Junque**	
bird	rufa red knot	*Calidris canutus rufa*	T	NE	very low application potential: **Dakota Prairie Grasslands**							no use: **Hiawatha**
bird	ivory-billed woodpecker	*Campephilus principalis*	E	NE							no use: **Ozark**	
bird	Gunnison sage grouse	*Centrocercus minimus*	T CH	NLAA `NLAA		very low application potential: **GRAND MESA UNCOMPAHGRE AND GUNNISON, Rio Grande**; moderate application potential: **Pike-San Isabel, San Juan**						
bird	piping plover	*Charadrius melodus*	T, E CH	NE NE	very low application potential: **Dakota Prairie Grasslands**	low application potential: **Arapahoe -Roosevelt;** moderate application potential: **Medicine Bow-Routt, Pike San Isabel**					no use: **Ouachita;** very low application potential: **National Forests in North Carolina**	no use: **HIAWATHA, HURON-MANISTEE**
bird	western snowy plover	*Charadrius nivosus nivosus*	T CH	NE NE						No use: **SIUSLAW**		

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
bird	western yellow-billed cuckoo	*Coccyzus americanus*	T CH	NLAA NLAA	moderate application potential: **Bitterroot**; high application potential: **Lolo**	very low application potential: (**Grand Mesa Uncompahgre and Gunnison), Nebraska, (Rio Grande);** low application potential: (**Arapaho-Roosevelt), Pawnee;** moderate application potential: (**Medicine Bow-Routt), Thunder Basin, San Juan, (Shoshone)**	very low application potential: **Carson;** low application potential: **Apache-Sitgreaves;** moderate application potential: **COCONINO, GILA, Santa Fe;** high application potential: **CORONADO, PRESCOTT, TONTO**	very low application potential: **Ashley, Targhee;** low application potential: **Fishlake, Manti-La Sal;** moderate application potential: **Salmon-Challis, Sawtooth;** High application potential: **Boise, Bridger-Teton, Humboldt-Toiyabe, Dixie, Payette, Uinta-Wasatch-Cache**	high application potential: **Angeles, Cleveland, Los Padres, Modoc, Sequoia, Shasta-Trinity, Six Rivers**	very low application potential: **Columbia River Gorge;** low application potential: **Colville**		
bird	southwestern willow flycatcher	*Empidonax traillii extimus*	E CH	LAA NLAA		very low application potential: **Rio Grande;** moderate application potential: **San Juan**	very low retardant use: **CARSON;** low retardant use: **APACHE-SITGREAVES;** moderate application potential: **GILA;** high application potential: **TONTO**	low application potential: **Manti-La Sal;** high application potential: **Toiyabe**	high application potential: **ANGELES, CLEVELAND, LOS PADRES, SAN BERNARDINO, SEQUOIA**			
bird	northern Aplomado falcon	*Falco femoralis septentrionalis*	XN	NLJ			moderate application potential: **Cibola, Gila, Lincoln;** high application potential: **Coronado**					
bird	whooping crane	*Grus americana*	E	NE	very low application potential: **Dakota Prairie grasslands**	very low application potential: **Nebraska and Samuel R. McKelvie;** low application potential: **Arapahoe & Roosevelt;** moderate application potential: **Medicine Bow-Routt, Pike and San Isabel**		very low application potential: **Targhee;** high application potential: **Bridger-Teton**				
bird	Mississippi sandhill crane	*Grus (Antigone) canadensis pulla*	E	NE							no use: **National Forests in Mississippi**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
bird	California condor	*Gymnogyps californianus*	E, XN CH	NLAA NE			very low application potential: **Kaibab;** low application potential: **Apache-Sitgreaves;** moderate application potential: **Coconino;** high application potential: **Prescott, Tonto**	high application potential: **Dixie**	high application potential: **Angeles, LOS PADRES, San Bernardino, SEQUOIA, Sierra**			
bird	wood stork	*Mycteria americana*	T	NE							no use: **National Forests in Alabama, Francis Marion and Sumter;** very low application potential: **Chattahoochee-Oconee, National Forests in Florida, National Forests in North Carolina**	
bird	red-cockaded woodpecker	*Picoides borealis*	E	NLAA							no use: **National Forests in Alabama, Francis Marion and Sumter, Kisatchie, National Forests in Mississippi, Ouachita;** very low application potential: **Chattahoochee-Oconee, National Forests in Florida, National Forests in North Carolina**	
bird	Coastal California gnatcatcher	*Polioptila californica californica*	T CH	LAA NLAA					high application potential: **ANGELES, CLEVELAND, San Bernardino**			
bird	Yuma Ridgways rail	*Rallus obsoletus (longirostris) yumanensis*	E	NE			moderate application potential: **Coconino;** high application potential: **Tonto**					
bird	Elfin-woods warbler	*Setophaga angelae*	T	NE							no use: **El Junque**	
bird	roseate tern	*Sterna dougallii*	E	NE							very low application potential: **National Forests in North Carolina**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
bird	northern spotted owl	*Strix occidentalis caurina*	T CH	LAA NLAA					moderate application potential: **LASSEN, MENDOCINO;** high application potential: **KLAMATH, MODOC, SHASTA-TRINITY, SIX RIVERS**	no use: **MT. BAKER-SNOQUALMIE, SIUSLAW, OLYMPIC;** very low application potential: **COLUMBIA RIVER GORGE, MT. HOOD;** low application potential: **GIFFORD PINCHOT, WILLAMETTE;** moderate application potential: **Fremont-Winema, UMPQUA;** high application potential: **DESCHUTES, OKANOGAN-WENATCHEE, ROGUE RIVER-SISKIYOU**		
bird	Mexican spotted owl	*Strix occidentalis lucida*	T CH	LAA NLAA		very low application potential: **Grand Mesa Uncompahgre and Gunnison, Rio Grande;** low application potential: **Arapaho & Roosevelt;** moderate application potential: **PIKE AND SAN ISABEL, San Juan, White River**	very low application potential: **CARSON, KAIBAB;** low application potential: **APACHE-SITGREAVES;** moderate application potential: **CIBOLA, COCONINO, GILA, LINCOLN, SANTA FE;** high application potential: **CORONADO, PRESCOTT, TONTO**	low application potential: **Fishlake, Manti-La Sal;** high application potential: **Dixie**				
bird	least Bell's vireo	*Vireo bellii pusillus*	E CH	NLAA NLAA					high application potential: **Angeles , Cleveland, LOS PADRES, San Bernardino, Sequoia**			
bivalve	Cumberland elktoe	*Alasmidonta atropurpurea*	E CH	NE NE							no use: **DANIEL BOONE**	
bivalve	Appalachian elktoe	*Alasmidonta raveneliana*	E CH	NLAA NLAA							very low application potential: **CHEROKEE, NATIONAL FORESTS IN NORTH CAROLINA**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
bivalve	fat three-ridge mussel	*Amblema neislerii*	E CH	NLAA NLAA							very low application potential: **NATIONAL FORESTS IN FLORIDA**	
bivalve	Ouachita rock pocketbook	*Arkansia wheeleri*	E	NLAA							no use: **Ouachita**; very low application potential: **National Forest and Grasslands in Texas**	
bivalve	spectaclecase	*Cumberlandia monodonta*	E	NLAA							no use: **Ozark, Ouachita, George Washington and Jefferson**	no use: **Shawnee**; very low application potential: **Mark Twain**
bivalve	fanshell	*Cyprogenia stegaria*	E, XN	NE							no use: **Daniel Boone, George Washington and Jefferson**	no use: **Hoosier, Shawnee, Wayne**
bivalve	dromedary pearlymussel	*Dromus dromas*	E, XN	NE							no use: **George Washington and Jefferson**	
bivalve	purple bankclimber	*Elliptoideus sloatianus*	T CH	NLAA NLAA							very low application potential: **NATIONAL FORESTS IN FLORIDA**	
bivalve	Cumberlandian combshell	*Epioblasma brevidens*	E, XN CH	NE NE							no use: **DANIEL BOONE, JEFFERSON**	
bivalve	oyster mussel	*Epioblasma capsaeformis*	E, XN CH	NLAA NE							no use: **DANIEL BOONE, JEFFERSON;** very low application potential: **Cherokee**	
bivalve	Curtis pearlymussel	*Epioblasma florentina curtisi*	E	NLAA								very low application potential: **Mark Twain**
bivalve	tan riffleshell	*Epioblasma florentina walkeri*	E	NLAA							no use: **Daniel Boone;** very low application potential: **Cherokee**	
bivalve	upland combshell	*Epioblasma metastriata*	E CH	NLAA NE							no use: **NATIONAL FORESTS IN ALABAMA;** very low application potential: **Cherokee**	
bivalve	southern acornshell	*Epioblasma othcaloogensis*	E CH	NLAA NE							no use: **NATIONAL FORESTS IN ALABAMA;** very low application potential: **Cherokee**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
bivalve	southern combshell	*Epioblasma penita*	E	NE							no use: **National Forests in Alabama**	
bivalve	green-blossom pearlymussel	*Epioblasma torulosa gubernaculum*	E	NE							no use: **George Washington and Jefferson**	
bivalve	northern riffleshell	*Epioblasma torulosa rangiana*	E	NE							no use: **Daniel Boone**	no use: **Allegheny**
bivalve	snuffbox mussel	*Epioblasma triquetra*	E	NLAA							no use: **Daniel Boone, George Washington and Jefferson, Ozark**	no use: **Allegheny, Wayne;** very low application potential: **Mark Twain**
bivalve	shiny pigtoe	*Fusconaia cor*	E, XN	NE							no use: **George Washington and Jefferson**	
bivalve	finerayed pigtoe	*Fusconaia cuneolus*	E, XN	NLAA							no use: **George Washington and Jefferson;** very low application potential: **Cherokee**	
bivalve	finelined pocketbook	*Hamiota altilis*	T CH	NLAA NLAA							no use: **NATIONAL FORESTS IN ALABAMA;** very low application potential: **CHATTAHOCHEE, Cherokee**	
bivalve	southern sandshell	*Hamiota australis*	T	NE							no use: **National Forests in Alabama**	
bivalve	orangenacre mucket	*Hamiota perovalis*	T (CH)	NE na							no use: **National Forests in Alabama**	
bivalve	shinyrayed pocketbook	*Hamiota (Lampsilis) subangulata*	E (CH)	NLAA na							very low application potential: **National Forests in Florida**	
bivalve	cracking pearlymussel	*Hemistena lata*	E, XN	NE							no use: **George Washington and Jefferson;(XN on Cherokee with very low retardant application potential)**	
bivalve	pink mucket	*Lampsilis abrupta*	E	NLAA							no use: **Daniel Boone, George Washington and Jefferson, Ozark**	no use: **Shawnee, Wayne;** very low application potential: **Mark Twain**
bivalve	Arkansas fatmucket	*Lampsilis powellii*	T	NE							no use: **Ouachita**	
bivalve	Neosho mucket	*Lampsilis rafinesqueana*	E CH	NE NE							no use: **OZARK**	
bivalve	speckled pocketbook	*Lampsilis streckeri*	E	NE							no use: **Ozark**	

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bivalve	Carolina heelsplitter	*Lasmigona decorata*	E CH	NE NE							no use: **SUMTER**	
bivalve	birdwing pearlymussel	*Lemiox rimosus*	E, XN	NE							no use: **George Washington and Jefferson**	
bivalve	scaleshell mussel	*Leptodea leptodon*	E	NLAA							no use: **Ouachita**, **Ozark**	very low application potential: **Mark Twain**
bivalve	Louisiana pearlshell	*Margaritifera hembeli*	T	NE							no use: **Kisatchie**	
bivalve	Alabama pearlshell	*Margaritifera marrianae*	E	NE							no use: **National Forests in Alabama**	
bivalve	Alabama moccasinshell	*Medionidus acutissimus*	T CH	NLAA NLAA							no use: **NATIONAL FORESTS IN ALABAMA;** very low application potential: **CHATTAHOCHEE, Cherokee**	
bivalve	coosa moccasinshell	*Medionidus parvulus*	E CH	NLAA NE							no use: **NATIONAL FORESTS IN ALABAMA;** very low application potential: **Cherokee**	
bivalve	Ochlockonee moccasinshell	*Medionidus simpsonianus*	E (CH)	NLAA na							very low application potential: **National Forests in Florida**	
bivalve	littlewing pearlymussel	*Pegias fabula*	E	NLAA							no use: **Daniel Boone, George Washington and Jefferson;** very low application potential: **National Forests in North Carolina**	
bivalve	orangefoot pimpleback	*Plethobasus cooperianus*	E	NE								no use: **Hoosier, Shawnee**
bivalve	sheepnose mussel	*Plethobasus cyphyus*	E	NLAA							no use: **George Washington and Jefferson**	no use: **Allegheny, Hoosier, Shawnee, Wayne;** very low application potential: **Mark Twain**
bivalve	clubshell	*Pleurobema clava*	E	NE								no use: **Allegheny, Shawnee**
bivalve	James spinymussel	*Pleurobema collina*	E	NE							no use: **George Washington and Jefferson**	
bivalve	southern clubshell	*Pleurobema decisum*	E CH	NLAA NLAA							no use: **NATIONAL FORESTS IN ALABAMA;** very low application	

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											potential: **CHATTAHOOCHEE**	
bivalve	dark pigtoe	*Pleurobema furvum*	E CH	NE NE							no use: **NATIONAL FORESTS IN ALABAMA**	
bivalve	southern pigtoe	*Pleurobema georgianum*	E CH	NLAA NLAA							no use: **NATIONAL FORESTS IN ALABAMA**; very low application potential: **CHATTAHOOCHEE**	
bivalve	Georgia pigtoe	*Pleurobema hanleyianum*	E CH	NLAA NLAA							no use: **NATIONAL FORESTS IN ALABAMA**; very low application potential: **CHATTAHOOCHEE, CHEROKEE**	
bivalve	ovate clubshell	*Pleurobema perovatum*	E CH	NLAA NE							no use: **NATIONAL FORESTS IN ALABAMA;** very low application potential: **Cherokee**	
bivalve	rough pigtoe	*Pleurobema plenum*	E, XN	NE							no use: **George Washington and Jefferson**	no use: **Hoosier, Shawnee**
bivalve	oval pigtoe	*Pleurobema pyriforme*	E (CH)	NLAA na							very low application potential: **National Forests in Florida**	
bivalve	fuzzy pigtoe	*Pleurobema strodeanum*	T	NE							no use: **National Forests in Alabama**	
bivalve	slabside pearlymussel	*Pleuronaia dolabelloides*	E CH	NLAA NLAA							no use: **GEORGE WASHINGTON AND JEFFERSON;** very low application potential: **CHEROKEE**	
bivalve	fat pocketbook	*Potamilus capax*	E	NE							no use: **Ozark**	no use: **Hoosier, Shawnee**
bivalve	inflated (Alabama) heelsplitter	*Potamilus inflatus*	T	NE							no use: **National Forests in Alabama**	
bivalve	triangular (rayed) kidneyshell	*Ptychobranchus greenii (foremanianus)*	E CH	NLAA NLAA							no use: **NATIONAL FORESTS IN ALABAMA;** very low application potential: **CHATTAHOOCHEE, Cherokee**	
bivalve	southern kidneyshell	*Ptychobranchus jonesi*	E	NE							no use: **National Forests in Alabama**	

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bivalve	fluted kidneyshell	*Ptychobranchus subtentum*	E CH	NLAA NLAA							no use: **DANIEL BOONE, GEORGE WASHINGTON AND JEFFERSON;** very low application potential: **CHEROKEE**	
bivalve	rabbitsfoot	*Quadrula cylindrica cylindrica*	T CH	NLAA NLAA							no use: **OUACHITA, Ozark**	no use: **Allegheny, Shawnee;** very low application potential: **MARK TWAIN**
bivalve	rough rabbitsfoot	*Quadrula cylindrica strigillata*	E (CH)	N na							no use: **JEFFERSON**	
bivalve	winged mapleleaf	*Quadrula fragosa*	E, XN	NE							no use: **Ouachita**	
bivalve	Cumberland monkeyface	*Quadrula intermedia*	E, XN	NE							no use: **George Washington and Jefferson**	
bivalve	Appalachian monkeyface	*Quadrula sparsa*	E, XN	NE							no use: **George Washington and Jefferson**	
bivalve	Choctaw bean	*Villosa choctawensis*	E	NE							no use: **National Forests in Alabama**	
bivalve	rayed bean	*Villosa fabalis*	E	NE								no use: **Allegheny, Wayne**
bivalve	purple bean	*Villosa perpurpurea*	E (CH)	NE na							no use: **Jefferson**	
bivalve	Cumberland bean	*Villosa trabalis*	E, XN	NLAA							no use: **Daniel Boone, George Washington and Jefferson;** very low application potential: **Cherokee, North Carolina**	
crustacean	Madison Cave isopod	*Antrolana lira*	T	NE							no use: **George Washington and Jefferson**	
crustacean	Conservancy fairy shrimp	*Branchinecta conservatio*	E (CH)	NLAA na					high application potential: **Los Padres**			
crustacean	vernal pool fairy shrimp	*Branchinecta lynchi*	T CH	NLAA NLAA					high application potential: **LOS PADRES**			
crustacean	San Diego fairy shrimp	*Branchinecta sandiegonensis*	E (CH)	NLAA na					high application potential: **Cleveland**			
crustacean	Benton County Cave crayfish	*Cambarus aculabrum*	E	NE							no use: **Ozark**	
crustacean	Big Sandy crayfish	*Cambarus callainus*	T	NE							no use: **George Washington and Jefferson**	

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crustacean	Hell Creek Cave crayfish	*Cambarus zophonastes*	E	NE							no use: **Ozark**	
crustacean	vernal pool tadpole shrimp	*Lepidurus packardi*	E (CH)	NLAA na					high application potential: **Sequoia**			
crustacean	Shasta crayfish	*Pacifastacus fortis*	E	LAA					moderate application potential: **Lassen;** high application potential: **Modoc**			
crustacean	Riverside fairy shrimp	*Streptocephalus woottoni*	E (CH)	NLAA na					high application potential: **Angeles**			
fish	white sturgeon - Kootenai River population	*Acipenser transmontanus*	E (CH)	NLAA na	moderate application potential: **Idaho-Panhandle, Kootenai**							
fish	Zuni bluehead sucker	*Catostomus discobolus yarrowi*	E CH	LAA LAA			moderate application potential: **CIBOLA**					
fish	Santa Ana sucker	*Catostomus santaanae*	T CH	LAA LAA					high application potential: **ANGELES, SAN BERNARDINO**			
fish	Warner sucker	*Catostomus warnerensis*	T CH	NLAA NLAA						moderate application potential: **Fremont-Winema**		
fish	shortnose sucker	*Chasmistes brevirostris*	E CH	LAA LAA					high application potential: **MODOC**	moderate application potential: **FREMONT-WINEMA**		
fish	June sucker	*Chasmistes liorus*	E CH	NLAA NLAA				high application potential: **Uinta-Wasatch-Cache**				
fish	blackside dace	*Chrosomus cumberlandensis*	T	NE							no use: **Daniel Boone, George Washington and Jefferson**	
fish	pygmy sculpin	*Cottus paulus*	T	NE							no use: **National Forests in Alabama**	
fish	railroad valley springfish	*Crenichthys nevadae*	T (CH)	LAA na				high application potential: **Toiyabe**				
fish	blue shiner	*Cyprinella caerulea*	T	LAA							no use: **National Forests in Alabama;** very low application potential: **Chattahoochee-Oconee, Cherokee**	

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fish	desert pupfish	*Cyprinodon macularius*	E (CH)	LAA na			moderate application potential: **Coconino;** high application potential: **Tonto**					
fish	Lost River sucker	*Deltistes luxatus*	E CH	LAA LAA					high application potential: **MODOC**	moderate application potential: **FREMONT-WINEMA**		
fish	spotfin chub	*Erimonax monachus*	T, XN CH	NLAA NLAA							no use: **George Washington and Jefferson;** very low application potential: **Cherokee, NATIONAL FORESTS IN NORTH CAROLINA**	
fish	slender chub	*Erimystax cahni*	T	NE							no use: **George Washington and Jefferson**	
fish	Etowah darter	*Etheostoma etowahae*	E	NLAA							very low application potential: **Chattahoochee-Oconee**	
fish	yellowcheek darter	*Etheostoma moorei*	E (CH)	NE na							no use: **Ozark**	
fish	candy darter	*Etheostoma osburni*	E CH	NE NE							No use: **George Washington and Jefferson**	no use: **Monongahela**
fish	duskytail darter	*Etheostoma percnurum*	E, XN	NLAA							no use: **Daniel Boone, George Washington and Jefferson**; very low application potential: **Cherokee**	
fish	rush darter	*Etheostoma phytophilum*	E (CH)	NE na							no use: **National Forests in Alabama**	
fish	Kentucky Arrow darter (Cumberland Plateau darter)	*Etheostoma spilotum*	T CH	NE NE							no use: **Daniel Boone**	
fish	Cumberland darter	*Etheostoma susanae*	E CH	NE NE							no use: **Daniel Boone**	
fish	Unarmored (Shay Creek) 3-spine stickleback	*Gasterosteus aculeatus williamsoni*	E	LAA					high application potential: **Angeles, San Bernardino**			
fish	Owens tui chub	*Gila (Siphateles) bicolor snyderi*	E CH	LAA LAA					high application potential: **INYO**			

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fish	humpback chub	*Gila cypha*	T (CH)	LAA na		very low application potential: **Grand Mesa Uncompahgre and Gunnison, Rio Grande;** low application potential: **Arapaho & Roosevelt;** moderate application potential: **Medicine Bow-Routt, San Juan, White River**		very low application potential: **Ashley, Fishlake, Manti-La Sal;** high application potential: **Bridger-Teton, Dixie, Uinta-Wasatch-Cache**				
fish	Sonora chub	*Gila ditaenia*	T CH	LAA LAA			high application potential: **CORONADO**					
fish	bonytail chub	*Gila elegans*	E (CH)	LAA na		very low application potential: **Grand Mesa Uncompahgre and Gunnison;** low application potential: **Arapaho & Roosevelt;** moderate application potential: **Medicine Bow-Routt, San Juan, White River**		very low application potential: **Ashley, Fishlake, Manti-La Sal;** high application potential: **Bridger-Teton, Dixie, Uinta-Wasatch-Cache**				
fish	Gila chub	*Gila intermedia*	E CH	LAA LAA			low application potential: **APACHE-SITGREAVES;** moderate application potential: **COCONINO, GILA;** high application potential: **CORONADO, PRESCOTT, Tonto**					
fish	Chihuahua chub	*Gila nigrescens*	T (CH)	LAA na			moderate application potential: **Gila**					
fish	Yaqui chub	*Gila purpurea*	E (CH)	LAA na			high application potential: **Coronado**					
fish	Rio Grande silvery minnow	*Hybognathus amarus*	E (CH)	NLAA na			moderate application potential: **(Cibola), (Santa Fe)**					
fish	delta smelt	*Hypomesus transpacificus*	T (CH)	NE na					very low application potential**: (Lake Tahoe Basin Management Unit)**; moderate			

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									application potential: **(Lassen), (Mendocino);** high application potential: (**Eldorado), (Plumas), (Sequoia), (Shasta-Trinity), (Sierra), (Stanislaus), (Tahoe)**			
fish	Yaqui catfish	*Ictalurus pricei*	T (CH)	LAA na			moderate application potential: (**Coronado)**					
fish	Little Colorado spinedace	*Lepidomeda vittata*	T CH	LAA LAA			low application potential: **APACHE-SITGREAVES;** moderate application potential: **COCONINO, Gila**					
fish	spikedace	*Meda fulgida*	E CH	LAA LAA			low application potential: **APACHE-SITGREAVES;** moderate application potential: **COCONINO, GILA;** high application potential: **Prescott, Coronado TONTO**					
fish	Palezone shiner	*Notropis albizonatus*	E	NE							no use: **Daniel Boone**	
fish	Cahaba shiner	*Notropis cahabae*	E	NE							no use: **National Forests in Alabama**	
fish	Arkansas River shiner	*Notropis girardi*	T (CH)	NLAA na			moderate application potential: (**Cibola - near Black Kettle National Grassland)**					
fish	smoky madtom	*Noturus baileyi*	E CH	NLAA NLAA							very low application potential: **CHEROKEE**	
fish	yellowfin madtom	*Noturus flavipinnis*	T CH	NLAA NE							no use: **JEFFERSON;** very low application potential: **Cherokee**	
fish	Little Kern golden trout	*Oncorhynchus aguabonita whitei*	T CH	LAA LAA					high application potential: **SEQUOIA**			
fish	Apache trout	*Oncorhynchus apache*	T	LAA			very low application potential: **Kaibab;** low application potential: **Apache-Sitgreaves**					

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fish	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	T	LAA				high application potential: **Humboldt-Toiyabe**	very low application potential: **Lake Tahoe Basin Management Unit;** high application potential: **Inyo, Sierra, Stanislaus, Tahoe**			
fish	Paiute cutthroat trout	*Oncorhynchus clarki seleniris*	T	LAA				high application potential: **Toiyabe**	high application potential: **Inyo, Sierra**			
fish	greenback cutthroat trout	*Oncorhynchus clarki stomias*	T	LAA		low application potential: **Arapaho & Roosevelt;** moderate application potential: **Pike and San Isabel**						
fish	Gila trout	*Oncorhynchus gilae gilae*	E	LAA			low application potential: **Apache-Sitgreaves;** moderate application potential: **Gila;** high application potential: **Prescott, Tonto**					
fish	amber darter	*Percina antesella*	E (CH)	NLAA na							very low application potential: **Chattahoochee-Oconee, Cherokee**	
fish	goldline darter	*Percina aurolineata*	T (PCH)	NLAA na							no use: **National Forests in Alabama;** very low application potential: **Chattahoochee-Oconee**	
fish	pearl darter	*Percina aurora*	T CH	NE NE							no use: **NATIONAL FORESTS IN MISSISSIPPI**	
fish	conasauga logperch	*Percina jenkinsi*	E CH	NLAA NLAA							very low application potential: **CHEROKEE**	
fish	leopard darter	*Percina pantherina*	T	NE							no use: **Ouachita**	
fish	Roanoke logperch	*Percina rex*	E	NE							no use: **George Washington and Jefferson**	
fish	snail darter	*Percina tanasi*	T	NLAA							very low application potential: **Cherokee**	

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fish	Gila topminnow	*Poeciliposis occidentalis occidentalis*	E	LAA			moderate application potential: **Coconino;** high application potential: **Coronado, Prescott, Tonto**					
fish	Colorado pikeminnow	*Ptychocheilus lucius*	E, XN (CH)	LAA na		very low application potential: (**Grand Mesa Uncompahgre and Gunnison);** low application potential: (**Arapaho & Roosevelt);** moderate application potential: (**Medicine Bow-Routt), (San Juan), (White River)**	moderate application potential: **Coconino;** high application potential: **Prescott, Tonto**	very low application potential: (**Ashley);** low application potential: **(Fishlake), (Manti-LaSal);** high application potential: (**Bridger-Teton), (Dixie), (Uinta-Wasatch-Cache)**				
fish	Kendall Warm Springs dace	*Rhinichthys osculus thermalis*	E	NLAA				high application potential: **Bridger-Teton**				
fish	bull trout	*Salvelinus confluentus*	T CH	LAA LAA	Low application potential: **FLATHEAD;** moderate application potential: **BEAVERHEAD-DEERLODGE, BITTERROOT, HELENA-LEWIS AND CLARK, IDAHO-PANHANDLE, KOOTENAI;** high application potential: **LOLO, NEZ PERCE-CLEARWATER**			moderate application potential: **SALMON-CHALLIS, SAWTOOTH;** high application potential: **BOISE, HUMBOLDT, PAYETTE**		no use: **MT. BAKER-SNOQUALMIE, OLYMPIC;** very low application potential: **COLUMBIA RIVER GORGE, MT. HOOD;** low application potential: **COLVILLE, GIFFORD PINCHOT, WILLAMETTE;** moderate application potential: **FREMONT-WINEMA, UMATILLA;** high application potential: **DESCHUTES AND OCHOCO, MALHEUR, OKANOGAN-WENATCHEE, WALLOWA-WHITMAN**		

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fish	pallid sturgeon	*Scaphirhynchus albus*	E	NLAA	very low application potential: **Dakota Prairie Grasslands**	moderate application potential: **(Pike-San Isabel National Forest and Comanche or Cimmaron National Grasslands), Medicine Bow-Routt and Thunder Basin Grasslands, Arapahoe-Roosevelt and Pawnee Grassland**		high application potential: **Bridger-Teton**			no use: **National Forests in Mississippi, Ozark**	
fish	Alabama sturgeon	*Scaphirhynchus suttkusi*	E CH	NE NE							no use: **NATIONAL FORESTS IN ALABAMA**	
fish	loach minnow	*Tiaroga cobitis*	E CH	LAA LAA			low application potential: **APACHE-SITGREAVES;** moderate application potential: **COCONINO, GILA**					
fish	razorback sucker	*Xyrauchen texanus*	E CH	LAA LAA		very low application potential: **GRAND MESA UMPCOMPAHGRE AND GUNNISON;** low application potential: **Arapahoe-Roosevelt;** moderate application potential: **Medicine Bow-Routt, White River**	moderate application potential: **COCONINO;** high application potential: **PRESCOTT, TONTO**	very low application potential: **Ashley;** low application potential: **Fishlake, Manti LaSal;** high application potential: **Bridger-Teton, Dixie, Uinta-Wasatch-Cache**				
fungi	rock gnome lichen	*Gymnoderma lineare*	E	NLAA							no use: **George Washington and Jefferson;** very low application potential: **Chattahoochee-Oconee, Cherokee, National Forests in North Carolina**	
gastropod	Tumbling Creek cavesnail	*Antrobi culveri*	E (CH)	NLAA na								very low application potential: **Mark Twain**
gastropod	Anthony's riversnail	*Athearnia anthonyi*	E, XN	NLAA							very low application potential: **Cherokee**	
gastropod	lacy elimia	*Elimia crenatella*	T	NE							no use: **National Forests in Alabama**	

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gastropod	Morro shoulderband (banded dune) snail	*Helminthoglypta walkeriana*	E (CH)	LAA na					high application potential: **Los Padres**			
gastropod	round rocksnail	*Leptoxis ampla*	T	NE							no use: **National Forests in Alabama**	
gastropod	painted rocksnail	*Leptoxis taeniata*	T	NE							no use: **National Forests in Alabama**	
gastropod	flat pebblesnail	*Lepyrium showalteri*	E	NE							no use: **National Forests in Alabama**	
gastropod	cylindrical lioplax	*Lioplax cyclostomaformis*	E	NE							no use: **National Forests in Alabama**	
gastropod	noonday globe	*Patera (Mesodon) clarki nantahala*	T	NLAA							very low application potential: **National Forests in North Carolina**	
gastropod	Three Forks springsnail	*Pyrgulopsis trivialis*	E CH	LAA LAA			low application potential: **APACHE**					
gastropod	Alamosa springsnail	*Tryonia alamosae*	E	NLAA			moderate application potential: **near Cibola**					
gastropod	Tulotoma snail	*Tulotoma magnifica*	T	NE							no use: **National Forests in Alabama**	
insect	Uncompahgre fritillary	*Boloria acrocnema*	E	NE		very low application potential: **Grand Mesa Uncompahgre and Gunnison, Rio Grande;** moderate application potential: **Pike-San Isabel, San Juan, White River**						
insect	rusty-patched bumblebee	*Bombus affinis*	E	NLAA							no use: **George Washington and Jefferson**	no use: **Monongahela, Midewin;** very low application potential: **Chippewa**
insect	Franklin's bumble bee	*Bombus franklini*	E	LAA					high application potential: **Klamath, Shasta-Trinity, Six Rivers**	moderate application potential: **Umpqua, Winema**; high application potential: **Rogue River-Siskiyou**		
insect	Hungerford's crawling water beetle	*Brychius hungerfordi*	E	NE								no use: **Huron-Manistee**

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insect	valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	T	NLAA					moderate application potential: **Lassen, Mendocino;** high application potential: **Eldorado, Plumas, Sequoia, Shasta-Trinity, Sierra, Tahoe**			
insect	Smith's blue butterfly	*Euphilotes enoptes smithi*	E PCH	LAA LAA					high application potential: **Los Padres**			
insect	Quino checkerspot butterfly	*Euphydryas editha quino*	E CH	LAA LAA					high application potential: **CLEVELAND, SAN BERNARDINO**			
insect	Taylor's checkerspot	*Euphydryas editha taylori*	E CH	NE NE						no use: **OLYMPIC**		
insect	Kern primrose sphinx moth	*Euproserpinus euterpe*	T	LAA					high application potential: **Los Padres**			
insect	Hermes Copper butterfly	*Hermelycaena (Lycaena) hermes*	PT PCH	LAA LAA					high application potential: **CLEVELAND**			
insect	Dakota skipper Butterfly	*Hesperia dacotae*	T CH	NLAA NLAA	very low application potential: **Dakota Prairie Grasslands**							
insect	Pawnee montane skipper	*Hesperia leonardus montana*	T PCH	LAA LAA		moderate application potential: **Pike-San Isabel**						
insect	Mt Charleston blue butterfly	*Icaricia (Plebejus) shasta charlestonensis*	E CH	LAA LAA				high application potential: **TOIYABE**				
insect	meltwater lednian stonefly	*Lednia tumana*	T	LAA	very low application potential: **Flathead**							
insect	Karner blue butterfly	*Lycaeides melissa samuelis*	E	NE								no use: **Huron-Manistee**
insect	Mitchell's satyr	*Neonympha mitchellii*	E	NE							no use: **National Forests in Alabama**	
insect	American burying beetle	*Nicrophorus americanus*	T	NLAA		very low application potential: **Black Hills, Nebraska and Samuel R. McKelvie**					no use: **Ouachita, Ozark**	no use: **Wayne**
insect	powesheik skipperling	*Oarisma powesheik*	E CH	NLAA NLAA	very low retardant use: **Dakota Prairie Grasslands**							
insect	Laguna Mountains skipper	*Pyrgus ruralis lagunae*	E CH	LAA LAA					high application potential: **CLEVELAND**			

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insect	Hine's emerald dragonfly	*Somatochlora hineana*	E CH	NLAA NLAA								no use: **HIAWATHA, Midewin;** very low application potential: **MARK TWAIN**
insect	Oregon silverspot butterfly	*Speyeria zerene hippolyta*	T CH	NE NE						no use: **SIUSLAW**		
insect	western glacier stonefly	*Zapada glacier*	T	LAA	low application potential: **Custer-Gallatin**							
mammal	Mexican wolf	*Canis lupis baileyi*	E, XN	NLAA			very low application potential: **Kaibab;** low application potential: **Apache-Sitgreaves;** moderate application potential: **Cibola, Coconino, Gila, Lincoln;** high application potential: **Coronado, Prescott, Tonto**					
mammal	Ozark big-eared bat	*Corynorhinus townsendii ingens*	E	NLAA							no use: **Ozark;** Very low application potentia**l: Mark Twain**	
mammal	Virginia big-eared bat	*Corynorhinus townsendii virginianus*	E CH	NLAA NE							no use: **Daniel Boone, George Washington and Jefferson;** very low application potential: **Cherokee, National Forests in North Carolina**	no use: **MONONGAHELA**
mammal	Utah prairie dog	*Cyonomys parvidens*	T	LAA				low application potential: **Fishlake;** high application potential: **Dixie**				
mammal	San Bernardino Merriam's kangaroo rat	*Dipodomys merriami parvus*	E CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
mammal	Stephens' kangaroo rat	*Dipodomys stephensi*	E	NLAA					high application potential: **Cleveland, San Bernardino**			
mammal	southern sea otter	*Enhydra lutris nereis*	T	NLAA					high application potential: **Los Padres**			

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mammal	Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	E	NLAA							no use: **George Washington and Jefferson;** very low application potential: **Cherokee, National Forests in North Carolina**	
mammal	ocelot	*Leopardus pardalis*	E	NLAA			high application potential: **Coronado**					
mammal	Mexican long-nosed bat	*Leptonycteris nivalis*	E	NLAA			high application potential: **Coronado**					
mammal	Canada lynx	*Lynx canadensis*	T CH	NLAA NE	very low application potential: **FLATHEAD;** low application potential: **CUSTER-GALLATIN;** moderate application potential: **Beaverhead-Deerlodge, Bitterroot, HELENA-LEWIS AND CLARK, Idaho-Panhandle, KOOTENAI;** high application potential: **LOLO, Nez Perce-Clearwater**	very low application potential: **Bighorn, Grand Mesa Uncompahgre Gunnison, Rio Grande;** low application potential: **Arapahoe-Roosevelt;** moderate application potential: **Medicine Bow-Routt, Pike-San Isabel, San Juan, SHOSHONE, White River**	very low application potential: **Carson;** moderate application potential: **Santa Fe**	very low application potential: **Ashley, Targhee;** moderate application potential: **Sawtooth;** high application potential: **Boise, BRIDGER-TETON, Payette, Uinta-Wasatch-Cache**		low application potential: **Colville;** moderate application potential: **Umatilla;** high application potential: **Malheur, OKANOGAN-WENATCHEE, Wallowa-Whitman**		no use: **Hiawatha, White Mountain;** very low application potential: **Chippewa, SUPERIOR**
mammal	Pacific marten - coastal DPS	*Martes caurina*	T	NLAA					high application potential: **Six Rivers**	no use: **Siuslaw;** high application potential: **Rogue River-Siskiyou**		
mammal	black-footed ferret	*Mustela nigripes*	E	NLAA	very low application potential: **Dakota Prairie Grasslands**	very low application potential: **Nebraska and Samuel R. McKelvie**; moderate application potential: **Medicine Bow-Routt, Pike-San Isabe**l		high application potential: **Bridger-Teton, Wasatch-Cache**				

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mammal	gray bat	*Myotis grisescens*	E	NLAA							no use: **National Forests in Alabama, Daniel Boone, George Washington and Jefferson, Ozark, Land Between the Lakes;** very low application potential: **Chattahoochee-Oconee, Cherokee, National Forests in Florida, National Forests in North Carolina**	no use: **Hoosier, Shawnee;** very low application potential: **Mark Twain**
mammal	northern long-eared bat	*Myotis septentrionalis*	T	NLAA	very low application potential: **Dakota Prairie Grasslands**; low application potential: **Custer Gallatin**	very low application potential: **Black Hills, Nebraska and Samuel R. McKelvie;** moderate application potential: **Medicine Bow-Routt**					no use: **National Forests in Alabama, Daniel Boone, Francis Marion and Sumter, Kisatchie, National Forests in Mississippi, George Washington and Jefferson, Ouachita, Ozark, Land Between the Lakes;** very low application potential: **Chattahoochee-Oconee, National Forests in North Carolina**	no use: **Allegheny, Chequamegon-Nicolet, Green Mountain and Finger Lakes, Hiawatha, Hoosier, Huron-Manistee, Monongahela, Midewin, Ottawa, Shawnee, Wayne, White Mountain;** very low application potential: **Chippewa, Mark Twain, Superior**
mammal	Indiana bat	*Myotis sodalis*	E CH	NLAA NE							no use: **National Forests in Alabama, Daniel Boone, National Forests in Mississippi, GEORGE WASHINGTON and Jefferson, Ouachita, Ozark, Land Between the Lakes;** very low application potential: **Chattahoochee-Oconee, CHEROKEE, NATIONAL FORESTS IN NORTH CAROLINA**	no use: **Allegheny, Green Mountain and Finger Lakes, HOOSIER, Huron-Manistee, MONONGAHELA, Shawnee, WAYNE;** very low application potential: **MARK TWAIN**

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mammal	Peñasco least chipmunk	*Neotamias minimus atristriatus*	PE PCH	NLAA NLAA			moderate application potential: **LINCOLN**					
mammal	peninsular bighorn sheep	*Ovis canadensis nelsoni*	E (CH)	NLAA na					high application potential: **SAN BERNARDINO**			
mammal	Sierra Nevada bighorn sheep	*Ovis canadensis sierra*	E CH	NLAA NE				high application potential: **Toiyabe**	high application potential: **INYO, SEQUOIA, SIERRA, STANISLAUS**			
mammal	jaguar	*Panthera onca*	E CH	NLAA NE			high application potential: **CORONADO**					
mammal	fisher - Southern Sierra Nevada DPS	*Pekania pennanti*	E	NLAA					high application potential: **Sequoia, Sierra, Stanislaus**			
mammal	Florida panther	*Puma concolor coryi*	E	NE							very low application potential: **National Forests in Florida**	
mammal	woodland caribou	*Rangifer tarandus caribou*	E CH	NLAA NE	moderate application potential: **IDAHO-PANHANDLE**					low application potential: **COLVILLE**		
mammal	north Idaho ground squirrel	*Urocitellus brunneus*	T	LAA				high application potential: **Boise, Payette**				
mammal	Mt. Graham red squirrel	*Tamisciurus hudsonicus grahamensis*	E CH	NLAA NE			high application potential: **CORONADO**					
mammal	West Indian manatee	*Trichechus manatus*	T CH	NLAA NLAA							no use: **Francis Marion;** very low application potential: **Apalachicola and OCALA in National Forests in Florida, Croatan in National Forests in North Carolina**	
mammal	grizzly bear	*Ursus arctos horribilis*	T	NLAA	very low application potential: **Flathead;** low application potential: **Custer-Gallatin;** moderate application potential: **Beaverhead-Deerlodge, Bitterroot, Helena-Lewis and Clark, Idaho-Panhandle, Kootenai;** high application potential: **Lolo**	moderate application potential: **Shoshone**		very low application potential: **Targhee;** high application potential: **Bridger-Teton**		no use: **Mt. Baker-Snoqualmie;** low application potential: **Colville, Gifford Pinchot;** high application potential: **Okanogan-Wenatchee**		

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mammal	San Joaquin kit fox	*Vulpes macrotis mutica*	E	NLAA					high application potential: **Sequoia**			
mammal	Sierra Nevada red fox - Sierra Nevada DPS	*Vulpes vulpes necator*	E	NLAA					high application potential: **Inyo, Stanislaus**	high application potential: **Humboldt-Toiyabe**		
mammal	New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	E CH	LAA NLAA		very low application potential: **Rio Grande**; moderate application potential: **San Juan**	low application potential: **APACHE-SITGREAVES;** moderate application potential: **Gila, LINCOLN, SANTA FE**					
mammal	Preble's meadow jumping mouse	*Zapus hudsonius preblei*	T CH	LAA NLAA		low application potential: **ARAPAHOE-ROOSEVELT;** moderate application potential: **Medicine Bow-Routt, PIKE-SAN ISABEL**						
plant	San Diego thornmint	*Acanthomintha ilicifolia*	T CH	LAA NLAA					high application potential: **CLEVELAND**			
plant	northern wild monkshood	*Aconitum novemboracense*	T	NE								no use: **Wayne**
plant	sensitive joint-vetch	*Aeschynomene virginica*	T	NE							very low application potential: **National Forests in North Carolina**	
plant	Munz's onion	*Allium munzii*	E CH	LAA NLAA					high application potential: **CLEVELAND**			
plant	Price’s potato-bean	*Apios priceana*	T	NE							no use: **National Forests in Alabama, Land Between the Lakes**	
plant	McDonald's rock cress	*Arabis macdonaldiana*	E	LAA					high application potential: **Klamath, Six Rivers**	high application potential: **Rogue River-Siskiyou**		
plant	marsh sandwort	*Arenaria paludicola*	E	NE					high application potential: **San Bernardino**			
plant	Bear Valley sandwort	*Arenaria ursina*	T CH	LAA NLAA					high application potential: **SAN BERNARDINO**			

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plant	Sacramento prickly poppy	*Argemone pleiacantha spp. Pinnatisecta*	E	LAA			moderate application potential: **Lincoln**					
plant	Mead's milkweed	*Asclepias meadii*	T	NLAA								no use: **Shawnee;** very low application potential: **Mark Twain**
plant	American hart's-tongue fern	*Asplenium scolopendrium var. americanum*	T	NE								no use: **Hiawatha**
plant	Cushenbury milk-vetch	*Astragalus albens*	E CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	Applegate's milk-vetch	*Astragalus applegatei*	E	NE					high application potential: **Klamath**			
plant	Braunton's milk-vetch	*Astragalus brauntonii*	E CH	LAA NLAA					high application potential: **ANGELES, CLEVELAND, San Bernardino**			
plant	Coachella Valley milk-vetch	*Astragalus lentiginosus var. coachellae*	E CH	NE NE					high application potential: **SAN BERNARDINO**			
plant	heliotrope milkvetch	*Astragalus montii*	T CH	LAA NE				low application potential: **MANTI-LASAL**				
plant	Osterhout milkvetch	*Astragalus osterhoutii*	E	NLAA		low application potential: **Arapahoe-Roosevelt;** moderate application potential: **Medicine Bow-Routt**						
plant	triple-ribbed milk-vetch	*Astragalus tricarinatus*	E	LAA					high application potential: **San Bernardino**			
plant	Encinitas baccharis	*Baccharis vanessae*	T	LAA					high application potential: **Cleveland**			
plant	Nevin's barberry	*Berberis nevinii*	E CH	LAA NLAA					high application potential: **Angeles, CLEVELAND, San Bernardino**			
plant	Virginia round-leaf birch	*Betula uber*	T	NE							no use: **George Washington and Jefferson**	
plant	shale barren rockcress	*Arabis (Boechera) serotina*	E	NLAA							no use: **George Washington and Jefferson**	no use: **Monongahela**

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plant	Florida bonamia	*Bonamia grandiflora*	T	NLAA							very low application potential: **National Forests in Florida**	
plant	thread-leaved brodiaea	*Brodiaea filifolia*	T CH	LAA NLAA					high application potential: **Angeles, CLEVELAND, San Bernardino**			
plant	capá rosa	*Callicarpa ampla*	E	NE							no use: **El Junque**	
plant	Mariposa pussypaws	*Calyptridium (Cistanthe) pulchellum*	T	LAA					high application potential: **Sierra**			
plant	Stebbins' morning glory	*Calystegia stebbinsii*	E	LAA					high application potential: **Tahoe**			
plant	ash-grey paintbrush	*Castilleja cinerea*	T CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	California jewelflower	*Caulanthus californicus*	E	LAA					high application potential: **Los Padres, Sequoia**			
plant	Vail Lake ceanothus	*Ceanothus ophiochilus*	T CH	LAA NLAA					high application potential: **CLEVELAND**			
plant	purple amole (Camatta Canyon amole)	*Chlorogalum purpureum (var. reductum)*	T CH	LAA NLAA					high application potential: **LOS PADRES**			
plant	La Graciosa thistle	*Cirsium loncholepis*	T (CH)	NE na					high application potential: **LOS PADRES**			
plant	Pitcher's thistle	*Cirsium pitcheri*	T	NE								no use: **Hiawatha, Huron-Manistee**
plant	Sacramento Mountains thistle	*Cirsium vinaceum*	T	LAA			moderate application potential: **Lincoln**					
plant	Wright's Marsh Thistle	*Crisium wrightii*	PT PCH	LAA NLAA			moderate application potential: **LINCOLN**					
plant	Springville clarkia	*Clarkia springvillensis*	T	LAA					high application potential: **Sequoia**			
plant	Alabama leather flower	*Clematis socialis*	E	NE							no use: **National Forests in Alabama**	
plant	small sweet-scented pigeonwings	*Clitoria fragrans*	T	NE							very low application potential: **National Forests in Florida**	
plant	Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	E	NLAA			high application potential: **Coronado**					
plant	Lee pincushion cactus	*Coryphantha sneedii var. leei*	T	LAA			moderate application potential: **Lincoln**					

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plant	Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*	E	LAA			moderate application potential: **Lincoln**					
plant	leafy prairie-clover	*Dalea foliosa*	E	NE							no use: **National Forests in Alabama**	no use: **Midewin**
plant	slender-horned spineflower	*Dodecahema leptoceras*	E	LAA					high application potential: **Angeles, Cleveland, San Bernardino**			
plant	smooth purple coneflower	*Echinacea laevigata*	E	NLAA							no use: **Francis Marion and Sumter, George Washington and Jefferson;** very low application potential: **Chattahoochee-Oconee, National Forests in North Carolina**	
plant	Kuenzler hedgehog cactus	*Echinocereus fendleri var. kuenzleri*	E	NLAA			moderate application potential: **Lincoln**					
plant	Arizona hedgehog cactus	*Echinocereus triglochidiatus var. arizonicus*	E	NLAA			high application potential: **Tonto**					
plant	Kern mallow	*Eremalche kernensis (Eremalche parryi* ssp. *kernensis)*	E	NE					high application potential: **Los Padres**			
plant	Santa Ana River woolly-star	*Eriastrum densifolium* ssp. *sanctorum*	E	LAA					high application potential: **San Bernardino**			
plant	Parish's daisy	*Erigeron parishii*	T CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	Zuni fleabane	*Erigeron rhizomatous*	T	NLAA			moderate application potential: **Cibola**					
plant	Southern Mountain buckwheat	*Eriogonum kennedyi* var. *austromontanum*	T CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	scrub buckwheat	*Eriogonum longifolium var. gnaphalifolium*	T	NLAA							very low application potential: **National Forests in Florida**	
plant	Cushenbury buckwheat	*Eriogonum ovalifolium var. vineum*	E CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	uvillo	*Eugenia haematocarpa*	E	NE							no use: **El Junque**	

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plant	Penland alpine fen mustard	*Eutrema penlandii*	T	NLAA		moderate application potential: **Pike-San Isabel, White River**						
plant	Mexican Flannelbush	*Fremontodendron mexicanum*	E CH	NE NE					high application potential: **CLEVELAND**			
plant	Gentner mission-bells	*Fritillaria gentneri*	E	NLAA					high application potential: **Klamath**	high application potential: **Rogue River-Siskiyou**		
plant	geocarpon	*Geocarpon minimum*	T	NE							no use: **Ozark**	
plant	spreading avens (cliff avens)	*Geum radiatum*	E	NLAA							very low application potential: **Cherokee, National Forests in North Carolina**	
plant	Bartrum stonecrop	*Graptopetalum bartramii*	T	LAA			High application potential: **Coronado**					
plant	showy stickseed	*Hackelia venusta*	E	LAA						high application potential: **Okanogan-Wenatchee**		
plant	Harper's beauty	*Harperocallis flava*	E	NLAA							very low application potential: **National Forests in Florida**	
plant	Todsen's pennyroyal	*Hedeoma todsenii*	E	LAA			moderate application potential: **Lincoln**					
plant	Roan Mountain bluet	*Hedyotis (Houstonia) purpurea var. montana*	E	NLAA							very low application potential: **Cherokee**	
plant	Virginia sneezeweed	*Helenium virginicum*	T	NLAA							no use: **George Washington and Jefferson**	very low application potential: **Mark Twain**
plant	Schweinitz's sunflower	*Helianthus schweinitzii*	E	NLAA							very low application potential: **North Carolina**	
plant	swamp-pink	*Helonias bullata*	T	NLAA							no use: **George Washington and Jefferson;** very low application potential: **Chattahoochee-Oconee, National Forests in North Carolina**	
plant	dwarf-flowered heartleaf	*Hexastylis naniflora*	T	NE							very low application potential: **National Forests in North Carolina**	

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plant	Neches River rose mallow	*Hisbiscus dasycalyx*	T CH	NLAA NLAA							very low application potential: **National Forests and Grasslands in Texas**	
plant	mountain bluet	*Houstonia montana*	E	NLAA							very low application potential: **National Forests of North Carolina**	
plant	water howellia	*Howellia aquatilis*	T	NLAA	very low application potential: **Flathead;** moderate application potential: **Idaho-Panhandle;** high application potential: **Lolo, Nez Perce-Clearwater**				moderate application potential: **Mendocino;** high application potential: **Six Rivers**	very low application potential: **Columbia River Gorge, Mt. Hood;** low application potential: **Gifford Pinchot;** high application potential: **Okanogan-Wenatchee**		
plant	mountain golden heather	*Hudsonia montana*	T CH	NLAA NLAA							very low application potential: **NATIONAL FORESTS IN NORTH CAROLINA**	
plant	Texas prairie dawn	*Hymenoxys texana*	E	NE							very low application potential: **National Forests and Grasslands in Texa**s	
plant	Sintenis' holly (Cuero de Sapo)	*Ilex sintenisii*	E	NE							no use: **El Junque**	
plant	Peter's mountain-mallow	*Iliamna corei*	E	NE							no use: **George Washington and Jefferson**	
plant	Pagosa skyrocket	*Ipomopsis polyantha*	E CH	NLAA NLAA		moderate application potential: **San Juan**						
plant	Holy Ghost ipomopsis	*Ipomopsis sancti-spiritus*	E	LAA			moderate application potential: **Santa Fe**					
plant	dwarf lake iris	*Iris lacustris*	T	NE								no use: **Hiawatha**
plant	Louisiana quillwort	*Isoetes louisianensis*	E	NE							no use: **National Forests in Alabama**, **National Forests in Mississippi**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	small whorled pogonia	*Isotria medeoloides*	T	NLAA							no use: **Francis Marion and Sumter, George Washington and Jefferson;** very low application potential: **Chattahoochee-Oconee, Cherokee, National Forests in North Carolina**	no use: **Allegheny, Monongahela, Wayne, White Mountain**
plant	Webber ivesia	*Ivesia webberi*	T CH	LAA NLAA				high application potential: **Toiyabe**	high use potential: **Plumas, Tahoe**			
plant	fleshy-fruit gladecress	*Leavenworthia crassa*	E	NE							no use: **National Forests in Alabama**	
plant	Luquillo Mountain babyboot orchid	*Lepanthes eltoroensis*	E	NE							no use: **El Junque**	
plant	slick-spot peppergrass	*Lepidium papilliferum*	T	NE				high application potential: **Boise**				
plant	Missouri bladderpod	*Lesquerella filiformis (Physaria)*	T	NE							no use: **Ozark**	
plant	San Bernardino Mountains bladderpod	*Lesquerella (Physaria) kingii* ssp. *bernardina*	E CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	lyrate bladderpod	*Lesquerella lyrata*	T	NE							no use: **National Forests in Alabama**	
plant	white bladderpod	*Lesquerella pallida*	E	NLAA							Very low application potential: **National Forests and Grasslands in Texas**	
plant	Heller's blazing star	*Liatris helleri*	T	NLAA							very low application potential: **National Forests in North Carolina**	
plant	Huachuca water umbel	*Lilaeopsis schaffneriana* spp. *Recurva*	E CH	LAA NLAA			high application potential: **CORONADO**					
plant	western lily	*Lilium occidentale*	E	NE						no use: **Siuslaw**		
plant	pondberry	*Lindera melissifolia*	E	NE							no use: **Francis Marion and Sumter, National Forests in Alabama, National Forests in Mississippi**	
plant	Cook's lomatium	*Lomatium cookii*	E	NE						high application potential: **Rogue River-Siskiyou**		

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	Kincaid's lupine	*Lupinus oreganus var. kincaidii*	T CH	NLAA NE						moderate application potential: **Umpqua**		
plant	rough-leaved loosestrife	*Lysimachia asperulifolia*	E	NLAA							very low application potential: **National Forests in North Carolina**	
plant	white birds-in-a-nest	*Macbridea alba*	T	NLAA							very low application potential: **National Forests in Florida**	
plant	Mohr's Barbara's buttons	*Marshallia mohrii*	T	NE							no use: **National Forests in Alabama**	
plant	Cumberland sandwort	*Minuartia (Arenaria) cumberlandensis*	E	NE							no use: **Daniel Boone**	
plant	Macfarlane's four-o'clock	*Mirabilis macfarlanei*	T	LAA	high application potential: **Nez Perce-Clearwater**					high application potential: **Wallowa-Whitman**		
plant	Britton's beargrass	*Nolina brittoniana*	E	LAA							very low application potential: **National Forests in Florida**	
plant	Houghton's goldenrod	*Oligoneuron (Solidago) houghtonii*	T	NE								no use: **Hiawatha**
plant	Bakersfield cactus	*Opuntia (basilaris var.) treleasei*	E	LAA					high application potential: **Sequoia**			
plant	California orcutt grass	*Orcuttia californica*	E	NE					high application potential: **Cleveland, Los Padres**			
plant	slender orcutt grass	*Orcuttia tenuis*	T CH	LAA NLAA					moderate application potential: **LASSEN;** high application potential: **MODOC**			
plant	Canby's dropwort	*Oxypolis canbyi*	E	NE							no use: **Francis Marion and Sumter**	
plant	Cushenbury oxytheca	*Oxytheca (Acanthoscyphus) parishii var goodmaniana*	E CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	Fassett's locoweed	*Oxytropis campestris var. chartacea*	T	NE								no use: **Chequamegon-Nicolet**
Plant	Beardless chinchweed	*Pectis imberbis*	E CH	NLAA NLAA								
plant	San Rafeal cactus	*Pediocactus despainii*	E	NE				low application potential: **Fishlake**				

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	Fickeisen plains cactus	*Pediocactus peeblesianus var. fickeiseniae*	E CH	NLAA NLAA			very low application potential: **KAIBAB**					
plant	Winkler cactus	*pediocactus winkleri*	T	NE				low application potential: **Manti-LaSal**				
plant	blowout penstemon	*Penstemon haydenii*	E	NLAA		very low application potential: **Nebraska;** moderate application potential: **Medicine Bow-Routt**						
plant	Penland beardtongue	*Penstemon penlandii*	E	NE		low application potential: **Arapahoe-Roosevelt;** moderate application potential: **Medicine Bow-Routt**						
plant	clay phacelia	*Phacelia argillacea*	E	LAA				low application potential: **Manti-LaSal;** high application potential: **Uinta**				
plant	North Park phacelia	*Phacelia formosula*	E	NE		moderate application potential: **Medicine Bow-Routt**						
plant	DeBeque phacelia	*Phacelia submutica*	T CH	NLAA NLAA		very low application potential: **Grand Mesa Uncompahgre Gunnison;** moderate application potential: **White River**						
plant	Yreka phlox	*Phlox hirsuta*	E	LAA					high application potential: **Klamath**			
plant	Godfrey's butterwort	*Pinguicula ionantha*	T	NLAA							very low application potential: **National Forests in Florida**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	whitebark pine	*Pinus albicaulis*	PT	NLAA	very low application potential: **Flathead;** low application potential: **Custer Gallatin;** moderate application potential: **Beaverhead-Deerlodge, Bitterroot, Helena-Lewis and Clark, Idaho Panhandle, Kootenai;** high application potential: **Lolo, Nez Perce-Clearwater**			very low application potential: **Targhee;** moderate application potential: **Salmon-Challis, Sawtooth;** high application potential: **Boise, Bridger-Teton, Humboldt-Toiyabe, Payette**	very low application potential: **Lake Tahoe Basin Management Unit;** moderate application potential: **Lassen, Mendocino;** high application potential: **Eldorado, Inyo, Klamath, Modoc, Plumas, Sequoia, Shasta-Trinity, Sierra, Six Rivers, Stanislaus, Tahoe**	no use: **Mt. Baker-Snoqualmie, Olympic;** very low application potential: **Mt. Hood;** low application potential: **Colville, Gifford Pinchot, Willamette;** moderate application potential: **Fremont-Winema, Umatilla, Umpqua;** high application potential: **Deschutes, Malheur, Ochoco, Okanogan-Wenatchee, Rogue River-Siskiyou, Wallowa-Whitman**		
plant	Ruth's golden-aster	*Pityopsis ruthii*	E	NLAA							very low application potential: **Cherokee**	
plant	rough popcorn flower	*Plagiobothrys hirtus*	E	NE						moderate application potential: **Umpqua**		
plant	white fringeless orchid	*Platanthera integrilabia*	T	NLAA							no use: **Daniel Boone, National Forests in Alabama;** very low application potential: **Chattahoochee-Oconee, Cherokee, National Forests in North Carolina**	
plant	eastern prairie white-fringed orchid	*Platanthera leucophaea*	T	NE								no use: **Midewin**
plant	western prairie fringed orchid	*Platanthera praeclara*	T	NLAA	very low application potential: **Dakota Prairie Grasslands**	very low application potential: **Nebraska and Samuel R. McKelvie;** moderate application potential: **Medicine Bow-Routt, Pike-San Isabel**						
plant	chupacallos	*Pleodendron macranthum*	E	NE							no use: **El Junque**	
plant	San Bernardino bluegrass	*Poa atropurpurea*	E CH	LAA NLAA					high application potential: **CLEVELAND, SAN BERNARDINO**			

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	Lewton's polygala	*Polygala lewtonii*	E	NLAA							very low application potential: **National Forests in Florida**	
plant	Maguire's primrose	*Primula cusickiana* var. *maguirei*	T	NLAA				high application potential: **Wasatch-Cache**				
plant	San Joaquin Adobe sunburst	*Pseudobahia peirsonii*	T	NE					high application potential: **Sequoia**			
plant	harperella	*Ptilimnium nodosum*	E	NE							no use: **National Forests in Alabama, Ouachita**	
plant	Arizona cliffrose	*Purshia subintegra*	E	NLAA			moderate application potential: **Coconino;** high application potential: **Tonto**					
plant	Leedy's roseroot	*Rhodiola integrifolia* ssp. *Leedyi*	T	NLAA		very low application potential: **Black Hills**						
plant	Chapman's rhododendron	*Rhododendron minus var. chapmanii*	E	NLAA								
plant	Florida gooseberry	*Ribes echinellum*	T	NE							no use: **Francis Marion and Sumter**	
plant	Gambel's watercress	*Rorippa gambellii*	E	NE					high application potential: **San Bernardino**			
plant	bunched arrowhead	*Sagittaria fasciculata*	E	NE							very low application potential: **National Forests in North Carolina**	
plant	Kral's water-plantain	*Sagittaria secundifolia*	T	NE							no use: **National Forests in Alabama**	
plant	green pitcher plant	*Sarracenia oreophila*	E	NE							no use: **National Forests in Alabama;** very low application potential: **Chattahoochee-Oconee, National Forests in North Carolina**	
plant	mountain sweet pitcher plant	*Sarracenia rubra* ssp. *Jonesii*	E	NE							very low application potential: **National Forests in North Carolina**	
plant	Alabama canebrake pitcher plant	*Sarracenia rubra* ssp. *alabamensis*	E	NE							no use: **National Forests in Alabama**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	American chaffseed	*Schwalbea americana*	E	NE							no use: **Francis Marion and Sumter, National Forests in Alabama**	
plant	northeastern bulrush	*Scirpus ancistrochaetus*	E	NE							no use: **George Washington and Jefferson**	no use: **Allegheny**
plant	Colorado hookless cactus	*Sclerocactus glaucus*	T	NLAA		very low application potential: **Grand Mesa Uncompahgre Gunnison;** moderate application potential: **White River**						
plant	Florida skullcap	*Scutellaria floridana*	T	NLAA							very low application potential: **National Forests in Florida**	
plant	large flowered skullcap	*Scutellaria montana*	T	NE							very low application potential: **Chattahoochee-Oconee**	
plant	San Francisco peaks ragwort	*Senecio franciscanus nlaane*	T CH	NLAA NE			moderate application potential: **COCONINO**					
plant	Layne's butterweed	*Senecio layneae*	T	LAA					high application potential: **Eldorado, Plumas, Tahoe**			
plant	Keck's checker-mallow	*Sidalcea keckii*	E (CH)	NE na					high application potential: **Sequoia, Sierra**			
plant	Nelson's checkermallow	*Sidalcea nelsoniana*	T	NE						no use: **Siuslaw**		
plant	Wenatchee Mountains checker-mallow	*Sidalcea oregana var. calva*	E CH	LAA NLAA						high application potential: **OKANOGAN-WENATCHEE**		
plant	Pedate checker-mallow	*Sidalcea pedata*	E	LAA					high application potential: **San Bernardino**			
plant	Spalding's catchfly	*Silence spaldingii*	T	LAA	very low application potential: **Flathead;** moderate application potential: **Idaho-panhandle, Kootenai;** high application potential: **Lolo, Nez Perce-Clearwater**					moderate application potential: **Umatilla;** high application potential: **Wallowa-Whitman**		

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	white irisette	*Sisyrinchium dichotomum*	E	NE							very low application potential: **National Forests in North Carolina**	
plant	Blue Ridge goldenrod	*Solidago spithamaea*	T	NLAA							very low application potential: **Cherokee, National Forests in North Carolina**	
plant	Virginia spiraea	*Spiraea virginiana*	T	NLAA							no use: **Daniel Boone, George Washington and Jefferson;** very low application potential: **Cherokee, National Forests in North Carolina**	no use: **Monongahela, Wayne**
plant	Canelo Hills ladies- tresses	*Spiranthes delitescens*	E	LAA			high application potential: **Coronado**					
plant	Ute ladies'-tresses orchid	*Spiranthes diluvialis*	T	NLAA		low application potential: **Arapahoe-Roosevelt;** moderate application potential: **Medicine Bow-Routt, Pike-San Isabel, White River**		very low application potential: **Caribou-Targhee;** low application potential: **Fishlake;** moderate application potential: **Salmon-Challis, Sawtooth;** high application potential: **Boise, Uinta-Wasatch-Cache**		low application potential: **Colville;** moderate application potential: **Umatilla;** high application potential: **Okanogan-Wenatchee, Wallowa-Whitman**		
plant	Navasota ladies'-tresses	*Spiranthes parksii*	E	NLAA							very low application potential: **National Forests and Grasslands in Texas**	
plant	Palo de Jazmín	*Styrax portoricensis*	E	NE							no use: **El Junque**	
plant	California taraxacum	*Taraxacum californicum*	E CH	LAA NLAA					high application potential: **SAN BERNARDINO**			
plant	Palo Colorado	*Ternstroemia luquillensis*	E	NE							no use: **El Junque**	
plant	El Yunque Colorado	*Ternstroemia subsessilis*	E	NE							no use: **El Junque**	
plant	lakeside daisy	*Hymenoxys (Tetraneuris) herbacea*	T	NE								no use: **Hiawatha**
plant	slender-petaled mustard	*Thelypodium stenopetalum*	E	LAA					high application potential: **San Bernardino**			
plant	Alabama streak-sorus fern	*Thelypteris pilosa var. alabamensis*	T	NE							no use: **National Forests in Alabama**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
plant	last chance townsendia	*Townsendia aprica*	T	LAA				low application potential: **Fishlake;** high application potential: **Dixie**				
plant	running buffalo clover	*Trifolium stoloniferum*	E	NLAA							no use: **Daniel Boone**	no use: **Monongahela, Wayne;** very low application potential: **Mark Twain**
plant	persistent trillium	*Trillium persistens*	E	NE							very low application potential: **Chattahoochee-Oconee**	
plant	relict trillium	*Trillium reliquum*	E	NLAA							no use: **Sumter;** very low application potential: **Oconee**	
plant	Greene's tuctoria (orcutt grass)	*Tuctoria greenei*	E CH	LAA NLAA					moderate application potential: **LASSEN;** high application potential: **Modoc**			
reptile	American alligator	*Alligator mississippiensis*	TSA	NE							no use: **Francis Marion and Sumter, Ouachita, Ozark;** very low application potential: **National Forests in Florida**	
reptile	loggerhead sea turtle	*Caretta caretta*	E, T (PCH)	NLAA na						high application potential: **Siskiyou**	no use: **Francis Marion; National Forests in Mississippi;** very low application potential: **National Forests in North Carolina**	
reptile	green sea turtle - East Pacific DPS	*Chelonia mydas*	T (CH)	NLAA na					high use potential: **Los Padres**		no use: **Francis Marion;** very low application potential: **National Forests in North Carolina**	
reptile	bog turtle	*Clemmys muhlenbergii*	TSA	NE							very low application potential: **Chattahoochee-Oconee, Cherokee**	
reptile	New Mexican ridge-nosed rattlesnake	*Crotalus willardi obscurus*	T	NLAA			high application potential: **Coronado**					

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
reptile	leatherback sea turtle	*Dermochelys coriacea*	E (CH)	NLAA na					high application potential: **Los Padres, Six Rivers**	high application potential: **Siskiyou**	no use: **Francis Marion; National Forests in Mississippi;** very low application potential: **National Forests in North Carolina**	
reptile	eastern indigo snake	*Drymarchon couperi*	T	NLAA							no use: **National Forests in Alabama, National Forests in Mississippi;** very low application potential: **National Forests in Florida**	
reptile	Puerto Rican boa	*Epicrates inornatus*	E	NE							no use: **El Junque**	
reptile	Hawksbill sea turtle	*Eretmochelys imbricata*	E (CH)	NLAA na							no use: **National Forests in Alabama;** very low application potential: **National Forests in Florida, National Forests in North Carolina**	
reptile	blunt-nosed leopard lizard	*Gambelia sila*	E	NLAA					high application potential: **Los Padres**			
reptile	desert tortoise	*Gopherus agassizii*	T (CH)	NLAA na				high application potential: **Toiyabe**	high application potential: **San Bernardino**			
reptile	gopher tortoise	*Gopherus polyphemus*	T	NE							no use: **National Forests in Mississippi**	
reptile	yellow-blotched map turtle	*Graptemys flavimaculata*	T	NE							no use: **National Forests in Mississippi**	
reptile	Kemp's ridley sea turtle	*Lepidochelys kempii*	E (PCH)	NLAA na							no use: **Francis Marion; National Forests in Mississippi;** very low application potential: **National Forests in North Carolina**	
reptile	olive ridley sea turtle	*Lepidochelys olivacea*	T	NLAA					high application potential: **Los Padres, Six Rivers**	high application potential: **Siskiyou**		
reptile	black pinesnake	*Pituophis melanoleucus lodingi*	T	NE							no use: **National Forests in Mississippi**	

Category	Common Name	Scientific Name	Status	Determination	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9
reptile	Louisiana pinesnake	*Pituophis ruthveni*	T	NE							no use: **Kisatchie**	
reptile	sand skink	*Plestiodon (Neoseps reynoldsi*	T	NE							very low retardant use: **National Forests in Florida**	
reptile	eastern massasauga	*Sistrurus catenatus*	T	NE								no use: H**uron-Manistee, Midewin**
reptile	flattened musk turtle	*Sternotherus depressus*	T	NE							no use: **National Forests in Alabama**	
reptile	northern Mexican gartersnake	*Thamnophis eques megalops*	T CH	NLAA NLAA			low application potential: **Apache-Sitgreaves**; moderate application potential: **COCONINO, Gila;** high application potential: **CORONADO, PRESCOTT, TONTO**					
reptile	narrow-headed gartersnake	*Thamnophis rufipunctatus*	T PCH	NLAA NLAA			low application potential: **Apache-Sitgreaves;** moderate application potential: **COCONINO, Gila;** high application potential: **CORONADO, PRESCOTT, TONTO**					

Appendix E. Process for Supplementing Nationwide Consultation

This document provides information on the process by which the Biological Assessment for nationwide aerial application of fire retardant on National Forest System lands will be supplemented.

Supplements to consultation may occur:

- if there are changes in information that would alter the effects discussed in the nationwide consultation, or if there are changes to the federal action or to the status of species or critical habitats (as required by the provisions of 50 CFR 402.16),
- if authorized take is exceeded for a species,
- to approve a new retardant product, or
- if site-specific conditions warrant a request for changes to the requirements of the nationwide Biological Opinion; this includes such things as changes to the size of avoidance areas, adding provisions from local conservation agreements, or others.

This process results in supplements to the National Programmatic Biological Assessment and Biological Opinion, and would be initiated at the national, regional or forest level, depending on the extent of National Forest System lands impacted. For example, for a newly listed species that occurs only on one national forest that forest would initiate the supplemental process. If critical habitat is designated on several forests within a region, the region would initiate the action. Supplemental consultation for approval of new retardants will only be initiated at the national level. Proposed changes and documentation for all supplemental consultations must be provided to the national retardant project manager.

The unit initiating the change would prepare a Biological Assessment that:

- details the changed condition and determination of effects,
- provides clear, defensible rationale and analysis to support the change from the National Programmatic and/or the national Biological Opinion, and
- uses the assumptions, screening process, and other factors applied in the National Programmatic analysis and process.

The unit would request consultation with the appropriate Field Office, which would provide documentation (letter of concurrence or supplemental biological opinion) to the unit requesting consultation. All documentation would also be provided to the appropriate national-level staff of each agency.

Appendix F. No Effects Determination

Appendix D is a complete list of species considered for this consultation, including the regions and forests where they occur or may occur, and the retardant application potential for those units. This appendix lists those species for which the use of aerially applied retardant would have no effect on the species or its designated critical habitat. The tables are presented by species group and summarize the rationale behind the no effect determination. Additional information is located in the project record.

Amphibians

Scientific Name	Common Name	Status	Rationale
Bufo baxteri	Wyoming toad	E	species does not occur on National Forest System lands
Necturus alabamensis	black warrior dog	E, CH	unit does not use retardant, habitat in avoidance area
Plethodon netting	Cheat Mountain salamander	T	unit does not use retardant
Plethodon shenandoah	Shenandoah salamander	E	unit does not use retardant, species not known to occur on forest lands
Rana sevosa (Lithobates sevosus)	dusky gopher frog	E, CH	unit does not use retardant

Birds

Scientific Name	Common Name	Status	Rationale
Accipiter striatus venator	Puerto Rican sharp-shinned hawk	E	unit does not use retardant
Amazona vittate	Puerto Rican parrot	E	unit does not use retardant
Buteo platypterus brunnescens	Puerto Rican broad-winged hawk	E	unit does not use retardant
Calidris canutus rufa	rufa red knot	T	species occurs on units that do not use retardant or with very low application potential, habitat in avoidance area
Campephilus principalis	ivory-billed woodpecker	E	unit does not use retardant
Charadrius melodus	piping plover	T, E, CH	habitat in avoidance area, retardant application not likely in habitat
Charadrius nivosus nivosus	western snowy plover	T, CH	unit does not use retardant
Grus americana	whooping crane	E	habitat in avoidance area, retardant use not likely in habitat

Scientific Name	Common Name	Status	Rationale
Grus canadensis pulla	Mississippi sandhill crane	E	unit does not use retardant
Mycteria americana	wood stork	T	species occurs on units that do not use retardant or with very low application potential, habitat in avoidance area
Rallus obsoletus yumanensis	Yuma Ridgeways rail	E	habitat in avoidance area, retardant use not likely in habitat
Setophaga angelae	elfin-woods warbler	T	unit does not use retardant
Sterna dougallii	roseate tern	E	habitat in avoidance area, retardant use not likely in habitat

Bivalves

Scientific Name	Common Name	Status	Rationale
Alasmidonta atropurpurea	Cumberland elktoe	E, CH	unit does not use retardant, habitat in avoidance area
Cyprogenia stegaria	fanshell	E, XN	unit does not use retardant, habitat in avoidance area
Dromus dromas	dromedary pearlymussel	E, XN	unit does not use retardant, habitat in avoidance area
Epioblasma brevidens	Cumberlandian combshell	E, XN, CH	units do not use retardant, habitat in avoidance area
Epioblasma penita	southern combshell	E	unit does not use retardant, habitat in avoidance area
Epioblasma torulosa gubernaculum	green-blossom pearlymussel	E	unit does not use retardant, habitat in avoidance area
Epioblasma torulosa rangiana	northern riffleshell	E	unit does not use retardant, habitat in avoidance area
Fusconaia cor	shiny pigtoe	E, XN	unit does not use retardant, habitat in avoidance area
Hamiota australis	southern sandshell	T	unit does not use retardant, habitat in avoidance area
Hamiota perovalis	orangenacre mucket	T, (CH)	unit does not use retardant, habitat in avoidance area
Hemistema lata	cracking pearlymussel	E, XN	unit does not use retardant, habitat in avoidance area
Lampsilis powellii	Arkansas fatmucket	T	unit does not use retardant, habitat in avoidance area
Lampsilis rafinesqueana	Neosho mucket	E, CH	unit does not use retardant, habitat in avoidance area
Lampsilis streckeri	speckled pocketbook	E	unit does not use retardant, habitat in avoidance area

Scientific Name	Common Name	Status	Rationale
Lasmigona decorata	Carolina heelsplitter	E, CH	unit does not use retardant, habitat in avoidance area
Lemiox rimosus	birdwing pearlymussel	E, XN	unit does not use retardant, habitat in avoidance area
Margaritifera hembeli	Louisiana pearlshell	T	unit does not use retardant, habitat in avoidance area
Margaritifera marrianae	Alabama Pearlshell	E	unit does not use retardant, habitat in avoidance area
Plethobasus cooperianus	orangefoot pimpleback	E	unit does not use retardant, habitat in avoidance area
Pleurobema clava	clubshell	E	unit does not use retardant, habitat in avoidance area
Pleurobema collina	James spinymussel	E	unit does not use retardant, habitat in avoidance area
Pleurobema furvum	dark pigtoe	E, CH	unit does not use retardant, habitat in avoidance area
Pleurobema plenum	rough pigtoe	E, XN	unit does not use retardant, habitat in avoidance area
Pleurobema strodeanum	fuzzy pigtoe	T	unit does not use retardant, habitat in avoidance area
Potamilus capax	fat pocketbook	E	unit does not use retardant, habitat in avoidance area
Potamilus inflatus	inflated (Alabama) heelsplitter	T	unit does not use retardant, habitat in avoidance area
Ptychobranchus jonesi	southern kidneyshell	E	unit does not use retardant, habitat in avoidance area
Quadrula cylindrica strigillata	rough rabbitsfoot	E, (CH)	unit does not use retardant, habitat in avoidance area
Quadrula fragosa	winged mapleleaf	E, XN	unit does not use retardant, habitat in avoidance area
Quadrula intermedia	Cumberland monkeyface	E, XN	unit does not use retardant, habitat in avoidance area
Quadrula sparsa	Appalachian monkeyface	E, XN	unit does not use retardant, habitat in avoidance area
Villosa choctawensis	Choctaw bean	E	unit does not use retardant, habitat in avoidance area
Villosa fabalis	rayed bean	E	unit does not use retardant, habitat in avoidance area
Villosa perpurpurea	purple bean	E, (CH)	unit does not use retardant, habitat in avoidance area

Crustaceans

Scientific Name	Common Name	Status	Rationale
Antrolana lira	Madison Cave isopod	T	unit does not use retardant, habitat in avoidance area
Cambarus aculabrum	Benton County Cave crayfish	E	unit does not use retardant, habitat in avoidance area
Cambarus callainus	Big Sandy crayfish	T	unit does not use retardant, habitat in avoidance area
Cambarus zophonastes	Hell Creek Cave crayfish	E	unit does not use retardant, habitat in avoidance area

Fish

Scientific Name	Common Name	Status	Rationale
Chrosomus cumberlandensis	blackside dace	T	unit does not use retardant, habitat in avoidance area
Cottus paulus	pygmy sculpin	T	unit does not use retardant, habitat in avoidance area
Erimystax cahni	slender chub	T	unit does not use retardant, habitat in avoidance area
Etheostoma moorei	yellowcheek darter	E, (CH)	unit does not use retardant, habitat in avoidance area
Etheostoma osburni	candy darter	E, CH	unit does not use retardant, habitat in avoidance area
Etheostoma phytophilum	rush darter	E, (CH)	unit does not use retardant, habitat in avoidance area
Etheostoma spilotum	Kentucky arrow darter	T, CH	unit does not use retardant, habitat in avoidance area
Etheostoma susanae	Cumberland darter	E, CH	unit does not use retardant, habitat in avoidance area
Hypomesus transpacificus	delta smelt	T, (CH)	Species occurs downstream of National Forest Systems lands, with dams and large reservoirs in the intervening rivers
Notropis albizonatus	palezone shiner	E	unit does not use retardant, habitat in avoidance area
Notropis cahabae	Cahaba shiner	E	unit does not use retardant, habitat in avoidance area
Percina aurora	pearl darter	T, CH	unit does not use retardant, habitat in avoidance area
Percina pantherina	leopard darter	T	unit does not use retardant, habitat in avoidance area
Percina rex	Roanoke logperch	E	unit does not use retardant, habitat in avoidance area

Scientific Name	Common Name	Status	Rationale
Scaphirhynchus suttkusi	Alabama sturgeon	E, CH	unit does not use retardant, habitat in avoidance area

Gastropods

Scientific Name	Common Name	Status	Rationale
Elimia crenatella	lacy elimia	T	unit does not use retardant, habitat in avoidance area
Leptoxis ampla	round rocksnail	T	unit does not use retardant, habitat in avoidance area
Leptoxis taeniata	painted rocksnail	T	unit does not use retardant, habitat in avoidance area
Lepyrium showalteri	flat pebblesnail	E	unit does not use retardant, habitat in avoidance area
Lioplax cyclostomaformis	cylindrical lioplax	E	unit does not use retardant, habitat in avoidance area
Tulotoma magnifica	Tulotoma snail	T	unit does not use retardant, habitat in avoidance area

Insects

Scientific Name	Common Name	Status	Rationale
Boloria acrocnema	Uncompahgre fritillary	E	unit has very low retardant application potential and application not likely in alpine habitat
Brychius hungerfordi	Hungerfords's crawling water beetle	E	unit does not use retardant, habitat in avoidance area
Euphydryas editha taylori	Taylor's checkerspot	E, CH	unit does not use retardant
Lycaeides melissa samuelis	Karner blue butterfly	E	unit does not use retardant
Neonympha mitchellii	Mitchell's satyr	E	unit does not use retardant
Speyeria zerene hippolyta	Oregon silverspot	E, CH	unit does not use retardant

Mammals

Scientific Name	Common Name	Status	Rationale
Puma concolor coryi	Florida panther	E	species does not occur on National Forest System lands at this time

			(iPaC), retardant application not likely in swampy habitat

Plants

Scientific Name	Common Name	Status	Rationale
Aconitum noveboracense	Northern wild monkshood	T	no retardant use
Aeschynomene virginica	Sensitive joint-vetch	T	suspected on National Forests in North Carolina, habitat surveyed
Apios priceana	Price's potato-bean	T	no retardant use
Minuartia (Arenaria) cumberlandensis	Cumberland sandwort	E	no retardant use
Arenaria paludicola	Marsh sandwort	E	Suspected on San Bernardino, ongoing surveys
Asplenium scolopendrium var. americanum	Hart's tongue fern	T	no retardant use
Astragalus applegatei	Applegate's milk-vetch	E	suspected on Klamath, habitat not likely occupied
Astragalus lentiginosus var. coachella	Coachella Valley milk-vetch	E	Suspected on San Bernardino, ongoing surveys
Betula uber	Virginia round-leaf Birch	T	no retardant use
Boechera serotina	shale barren rockcress	E	no retardant use
Callicarpa ampla	Capa rosa	E	no retardant use
Cirsium loncholepis	La Graciosa thistle	T, (CH)	suspected on Los Padres, ongoing surveys
Cirsium pitcheri	Pitcher's thistle	T	no retardant use, application not likely in habitat
Clematis socialis	Alabama leather flower	E	no retardant use
Clitoria fragrans	small sweet-scented pigeon wings	T	National Forests in Florida with very low application potential, suspected habitat surveyed
Dalea foliosa	Leafy prairie clover	E	no retardant use
Eremalche kernensis (Eremalche parryi ssp. kernensis)	Kern mallow	E	no retardant use
Eugenia haematocarpa	Uvillo	E	no retardant use

Scientific Name	Common Name	Status	Rationale
Fremontodendron mexicanum	Mexican flannelbush	E, CH	suspected on Cleveland, ongoing surveys
Geocarpon minimum	Geocarpon	T	suspected on Ozark, no retardant use
Hexastylis naniflora	Dwarf-flowered heartleaf	T	suspected habitat on National Forests in North Carolina, habitat surveyed
Hymenoxys (Tetraneuris) herbacea	Lakeside daisy	T	no retardant use
Hymenoxys texana	Texas prairie dawn-flower	E	National Forests and Grasslands in Texas with very low retardant use, not found on National Forest Service lands (near Davy Crockett).
Ilex sintenisii	Sintenis' holly (Cuero de Sapo)	E	no retardant use
Iliamna corei	Peter's mountain-mallow	E	Suspected on George Washington and Jefferson, ongoing surveys
Iris lacustris	Dwarf lake iris	T	no retardant use
Isoetes louisianensis	Louisiana quillwort	E	no retardant use
Leavenworthia crassa	fleshy-fruit gladecress	E	no retardant use
Lepanthes eltoroensis	Luquillo Mountain babyboot orchid	E	no retardant use
Lepidium papilliferum	Slick spot peppergrass	T	Suspected on the Boise, habitat surveyed
Lesquerella (Physaria) filiformis	Missouri bladder-pod	E	no retardant use
Lesquerella lyrata	Lyrate bladderpod	T	no retardant use
Lilium occidentale	Western lily	E	no retardant use
Lindera melissifolia	Pondberry	E	no retardant use
Lomatium cookii	Cook's lomatium	E	Suspected on Rogue River-Siskiyou, if located in future occurrence would be avoidance area mapped
Marshallia mohrii	Mohr's Barbara's buttons	T	no retardant use
Rorippa (Nasturtium) gambelii	Gambel's watercress	E	Potential to occur on San Bernardino, no known occurrences
Orcuttia californica	California Orcutt grass	E	Habitat suspected on National Forest lands

Scientific Name	Common Name	Status	Rationale
Oxypolis canbyi	Canby's dropwort	E	no retardant use
Oxytropis campestris var. chartacea	Fassett's locoweed	T	no retardant use
Pediocactus despainii	San Rafael cactus	E	Habitat suspected on Fishlake, ongoing surveys
Pediocactus winkleri	Winkler cactus	T	Habitat suspected on Manti-LaSal, ongoing surveys
Penstemon penlandii	Penland beardtongue	E	Potential to occur but not known on National Forest lands
Phacelia formosula	North Park phacelia	E	Potential to occur but not known on National Forest lands
Plagiobothrys hirtus	Rough popcorn flower	E	Suspected on Umpqua in Oregon, habitat surveyed
Platanthera leucophaea	Eastern prairie white-fringed orchid	T	no retardant use
Pleodendron macranthum	Chupacallos	E	no retardant use
Ptilimnium nodosum	Harperella	E	no retardant use
Pseudobahia peirsonii	San Joaquin adobe sunburst	E	Suspected on Sequoia, ongoing surveys
Ribes echinellum	Florida gooseberry	T	no retardant use
Sagittaria fasciculata	Bunched arrowhead	E	Suspected on National Forests in North Carolina, habitat surveyed
Sagittaria secundifolia	Kral's water plantain	T	no retardant use
Sarracenia rubra ssp. alabamensis	Alabama canebrake pitcher plant	E	no retardant use
Sarracenia rubra ssp. jonesii	Mountain sweet pitcher plant	E	no retardant use
Sarracenia oreophila	Green pitcher plant	E	no retardant use on National Forests in Alabama, suspected only on Chattahoochee and National Forests in North Carolina
Schwalbea americana	American chaffseed	E	no retardant use
Scirpus ancistrochaetus	Northeastern bulrush	E	no retardant use
Scutellaria montana	Large flowered skullcap	T	no retardant use
Sidalcea keckii	Keck's checkermallow	E, (CH)	Suspected on Sierra and Sequoia, no occurrences on or adjacent to forests

Scientific Name	Common Name	Status	Rationale
Sidalcea nelsoniana	Nelson's checker mallow	T	no retardant use
Sisyrinchium dichotomum	White irisette	E	Suspected on National Forests in North Carolina, habitat surveyed
Oligoneuron (Solidago) houghtonii	Houghton's goldenrod	T	no retardant use
Styrax portoricensis	Palo de Jazmin	E	no retardant use
Ternstroemia luquillensis	Palo colorado	E	no retardant use
Ternstroemia subsessilis	El Yunque colorado	E	no retardant use
Thelypteris pilosa var. alabamensis	Alabama streak-sorus fern	T	no retardant use
Trillium persistens	Persistent trillium	E	suspected on Francis Marion and Sumter and Chatahoochee-Oconee, ongoing surveys

Reptiles

Scientific Name	Common Name	Status	Rationale
Alligator mississippiensis	American alligator	TSA	species occurs on unit that does not use retardant or with very low application potential, habitat in avoidance area
Clemmys muhlenbergii	bog turtle	TSA	unit has very low retardant application potential and application not likely in habitat, habitat in avoidance area
Epicrates inornatus	Puerto Rican boa	E	unit does not use retardant
Gopherus polyphemus	gopher tortoise	T	units do not use retardant
Graptemys flavimaculata	yellow-blotched map turtle	T	unit does not use retardant, habitat in avoidance areas
Pituophis melanoleucus lodingi	black pinesnake	T	unit does not use retardant
Pituophis ruthveni	Louisiana pinesnake	T	unit does not use retardant
Plestiodon (Neoseps) reynoldsi	sand skink	T	unit has very low retardant application potential, application not likely in habitat
Sistrurus catenatus	eastern massassauga rattlesnake	T	units do not use retardant
Sternotherus depressus	flattened musk turtle	T	unit does not use retardant, habitat in avoidance area

Appendix G. Retardant Application Potential and Use

Retardant application potential for each forest and identification of those forests where retardant is used on more than 0.01 percent of the land base annually, based upon 2012 to 2019 retardant use data.

Region	Forest	Retardant Application Potential	Is retardant used on more than 0.01 percent of land base annually?
1	Beaverhead-Deerlodge	moderate	No
1	Bitterroot	moderate	No
1	Custer Gallatin	low	No
1	Dakota Prairie grasslands	very low	No
1	Flathead	very low	No
1	Helena-Lewis and Clark	moderate	Yes
1	Idaho-Panhandle	moderate	No
1	Kootenai	moderate	No
1	Lolo	high	Yes
1	Nez Perce - Clearwater	high	No
2	Arapaho & Roosevelt	low	No
2	Bighorn	very low	No
2	Black Hills	very low	No
2	Grand Mesa Uncompahgre and Gunnison	very low	No
2	Medicine Bow-Routt	moderate	No
2	Nebraska	very low	No
2	Pike and San Isabel	moderate	No
2	Rio Grande	very low	No
2	San Juan	moderate	No
2	Shoshone	moderate	No

Region	Forest	Retardant Application Potential	Is retardant used on more than 0.01 percent of land base annually?
2	White River	moderate	No
3	Apache-Sitgreaves	low	No
3	Carson	very low	No
3	Cibola	moderate	Yes
3	Coconino	moderate	No
3	Coronado	high	Yes
3	Gila	moderate	No
3	Kaibab	very low	No
3	Lincoln	moderate	Yes
3	Prescott	high	Yes
3	Santa Fe	moderate	No
3	Tonto	high	Yes
4	Ashley	very low	No
4	Boise	high	Yes
4	Bridger-Teton	high	No
4	Caribou-Targhee	very low	No
4	Dixie	high	Yes
4	Fishlake	low	No
4	Humboldt-Toiyabe	high	No
4	Manti-La Sal	low	No
4	Payette	high	Yes
4	Salmon-Challis	moderate	No
4	Sawtooth	moderate	No
4	Uinta-Wasatch-Cache	high	Yes
5	Angeles	high	Yes

Region	Forest	Retardant Application Potential	Is retardant used on more than 0.01 percent of land base annually?
5	Cleveland	high	Yes
5	Eldorado	high	Yes
5	Inyo	high	Yes
5	Klamath	high	Yes
5	LTBMU	very low	No
5	Lassen	moderate	Yes
5	Los Padres	high	Yes
5	Mendocino	mod	Yes
5	Modoc	high	Yes
5	Plumas	high	Yes
5	San Bernardino	high	Yes
5	Sequoia	high	Yes
5	Shasta-Trinity	high	Yes
5	Sierra	high	Yes
5	Six Rivers	high	Yes
5	Stanislaus	high	Yes
5	Tahoe	high	Yes
6	Columbia River Gorge	very low	No
6	Colville	low	No
6	Deschutes and Ochoco	high	Yes
6	Fremont-Winema	moderate	No
6	Gifford Pinchot	low	No
6	Malheur	high	Yes
6	Mt. Baker-Snoqualmie	none	No
6	Mt Hood	very low	No

Region	Forest	Retardant Application Potential	Is retardant used on more than 0.01 percent of land base annually?
6	Okanogan-Wenatchee	high	Yes
6	Olympic	none	No
6	Rogue River-Siskiyou	high	Yes
6	Siuslaw	none	No
6	Umatilla	moderate	Yes
6	Umpqua	moderate	No
6	Wallowa-Whitman	high	Yes
6	Willamette	low	No
8	Chattahoochee-Oconee	very low	No
8	Cherokee	very low	No
8	Daniel Boone	none	No
8	El Yunque	none	No
8	Francis Marion & Sumter	none	No
8	George Washington and Jefferson	none	No
8	Kisatchie	none	No
8	Land Between the Lakes NRA	none	No
8	National Forests in Alabama	none	No
8	National Forests in Florida	very low	No
8	National Forests in Mississippi	none	No
8	National Forests and Grasslands in Texas	very low	No
8	National Forests in North Carolina	very low	No
8	Ouachita	none	No
8	Ozark-St. Francis	none	No
9	Allegheny	none	No
9	Chequamegon-Nicolet	none	No
9	Chippewa	very low	No
9	Green Mountain and Finger Lakes	none	No

Region	Forest	Retardant Application Potential	Is retardant used on more than 0.01 percent of land base annually?
9	Hiawatha	none	No
9	Hoosier	none	No
9	Huron-Manistee	none	No
9	Mark Twain	very low	No
9	Midewin	none	No
9	Monongahela	none	No
9	Ottawa	none	No
9	Shawnee	none	No
9	Superior	very low	No
9	Wayne	none	No
9	White Mountain	none	No
10	Chugach	none	No
10	Tongass	none	No