

**BIOLOGICAL OPINION**  
Effects to Listed Species from U.S. Forest Service Aerial Application of Fire Retardants on  
National Forest System Lands

Consultation Conducted  
by  
U.S. Fish and Wildlife Service (Regions 1, 2, 3, 4, 5, 6, and 8)  
December 6, 2011

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## Introduction

This document is the U.S. Fish and Wildlife Service’s (USFWS) biological and conference opinion based on our review of the continued aerial application of fire retardants on National Forest System (NFS) Lands and its effects on 75 proposed, threatened, and endangered species and designated critical habitat in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your request for formal consultation was received by us on June 10, 2011. We reviewed the Biological Assessment that accompanied your request and determined that while we needed additional information at the local level, the communication between USFWS Field Offices and their local NFS counterparts which was already ongoing would satisfy those information needs and consequently, consultation was initiated effective that date.

This consultation reviews the aerial application of fire retardant on National Forest System Lands at the national programmatic level with that specificity and analysis that can be predicted considering the nature of the Proposed Action, with additional analysis on local impacts.

This biological and conference opinion (BO) has been prepared in accordance with section 7(b)(4) of the Endangered Species Act is based on information provided in the final Biological Assessment, numerous meetings and telephone conversations with personnel from the U.S.D.A. Forest Service (USFS) and National Marine Fisheries' Service (NMFS), and other sources of information. A complete administrative record of this consultation is on file at 4401 N. Fairfax Dr, room 420, Arlington, VA 22203 and available for viewing by appointment.

## Consultation History

In April 2000, the USFS, with USFWS and NMFS, developed the *Guidelines for Aerial Application of Fire Retardant and Foams in Aquatic Environments* (2000 Guidelines; App. A). These guidelines established a buffer area of 300 feet adjacent to waterways in which no retardant is to be applied, except in the case of certain specified exceptions. Implementation of the Guidelines is intended to minimize instances of retardant entering aquatic systems.

In 2003, the USFS was sued by Forest Service Employees for Environmental Ethics for failure to comply with the National Environmental Policy Act (NEPA) and the Endangered Species Act.

In 2004, the Forest Service Employees for Environmental Ethics filed a lawsuit against the Forest Service relative to not preparing an environmental assessment on the application of fire retardant and failure to engage in formal consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service under the Endangered Species Act (ESA). On September 30, 2005, Judge Molloy ruled that the USFS must complete an Environmental Assessment (EA) or Environmental Impact Statement (EIS) and begin formal consultation with USFWS. The Forest Service further received a decision on October 24, 2005, by the Federal district court for the District of Montana stating that the Forest Service's failure to conduct an environmental analysis on the use of chemical fire retardant on National Forest System land violated the National Environmental Policy Act, and the agency's failure to engage in formal consultation of this program similarly violated the Endangered Species Act.

On February 9, 2006, the judge ruled that the USFS must comply with NEPA by no later than August 8, 2007, which was later extended to October 15, 2007. The USFWS initially advised the Court that it would complete consultation by January 15, 2008, but later advised that it would require additional time.

On July 28, 2006, the Forest Service published a notice of proposed action to conduct an environmental analysis and prepare an environmental assessment to determine whether the continued nationwide aerial application of fire retardant using the *Guidelines for Aerial Application of Retardants and Foams in Aquatic Environments* (April 20, 2000) to fight fires on National Forest System lands would result in any significant environmental impacts within the meaning of the National Environmental Policy Act of 1969.

On October 30, 2006, USFWS and NOAA (hereafter collectively referred to as the Services) were contacted by the USFS to begin discussion/informal consultation on the continued aerial application of fire retardants.

A conference call was held on November 16, 2006, and included personnel from USFS, USFWS, and NOAA. The discussion included information that after the 2007 fire season, the USFS would no longer buy or use retardant formulations containing sodium ferro-cyanide and the USFS's intent to use the section 7 process to assist in making a NEPA decision on retardant use and the significance of environmental impacts; use section 7 to guide future use of retardant in ways that minimize risks to threatened and endangered species; and comply with a court order to comply with the Endangered Species Act. In this call, the USFS informed the Services that due to a court decision in 2005, consultation on this issue needed to be complete by August 8, 2007.

The USFS informed the Services that a draft environmental assessment (EA) would be provided by December 1, 2006. At this time the USFS also provided a spreadsheet with information on fish kills caused by unintentionally introducing retardants to rivers between 2001 and 2005. On December 8, 2006, the USFS provided a draft Aquatics Report to the Services and stated that a draft of the NEPA document would be provided on December 28, 2006. The draft Aquatics Report concluded that since the fire retardants ~~are~~ typically never intentionally applied to waterways, the 300 foot buffer should suffice in keeping retardant chemicals out of the aquatic environment.”

On January 23, 2007, the USFS provided draft versions of the first and second chapters of the EA to USFWS and NOAA.

On February 6, 2007, the Services and the USFS held a conference call to discuss several outstanding issues including the scope of the proposed action. The Services believed that the scope of the proposed action should include not only the general authorization of use of retardants, but also a programmatic review of the use of retardant chemicals, as could be accomplished at the programmatic level. USFS initially had defined the scope more narrowly, but ultimately agreed that the consultation should proceed on the basis of the proposed action including the authorization of the use of retardants, the actual use of retardants and the permanent adoption of the 2000 Guidelines.

On March, 20, 2007, and March 23, 2007, respectively, the USFS provided the Services with the draft EA and a draft Aquatics Report and requested any additional comments be provided promptly so they could make any changes that would be necessary. The draft EA initially concluded that the proposed action (identified as allowing future nationwide aerial application of fire retardant on NFS lands using the 2000 Guidelines) ~~would~~ have No Effect on aquatic species and their habitats, as the Proposed Action does not require the application of retardant.” The draft Aquatics Report also initially concluded that the 2000 Guidelines would prevent any intentional drop of fire retardant in waterways, therefore the Proposed Action was ~~—~~“No Effect.”

On April 20 the USFWS provided informal comments addressing the draft EA. In our comments, we informed the USFS that a No Effect determination was inappropriate because the agency action must include the authorization and use of retardant, and also because we did not agree that

the 2000 Guidelines would always avoid entry of retardant into waterways. We also requested an analysis of potential effects to upland vegetation.

On June 12, 2007, USFWS provided comments on the revised draft Aquatics Report and included some additional literature, and a map from USGS of nationwide alkalinities to assist the USFS in determining differing toxicities of various fire retardant chemicals at different pH levels.

On June 28, 2007, the USFS formally requested initiation of consultation pursuant to section 7 of the ESA.

On July 10, the USFS sent several documents to the USFWS via email, including the final EA, final Aquatics Report, and final Hydrology Report. These documents did not analyze any of the chemicals proposed for use, but did note that if retardant entered water, adverse effects to aquatic species could be possible. The EA also stated that there were no direct or indirect adverse impacts to upland ecosystems.

On July 13, 2007, a conference call was held between the Services and the USFS. The main concern was that the chemical composition of retardants had not been analyzed and the Services did not know if some retardants may pose more risk than others in various regions of the country. The other question was regarding how the decision to use certain chemicals for certain fires was reached.

On July 30, 2007, USFWS received an updated Aquatics Report with a revised finding that the Proposed Action would be ~~may~~ effect, likely to adversely affect, making note of the fact that if retardants get into higher pH streams, the chance of a fish kill is greater. The updated Aquatic Report did not provide further details on this issue since it was not USFS' intention to introduce any retardants to any streams.

On August 29, 2007, the USFS sent the Services a combined Aquatics Report and Biological Assessment. The report provided a ~~pr~~programmatic analysis of effects to aquatic species, habitat, and upland vegetation.” Despite concerns that the effects of the proposed action required a more comprehensive evaluation, the Services agreed to initiate consultation without responses to the all requested information in an effort to meet the USFS's deadline for completing its NEPA process of October 15, 2007.

On September 25, the Services met with the USFS to discuss the project and possible RPAs pursuant to NOAA' determination of jeopardy to 26 fish species. The USFS provided additional information to the Services, including some information on decision making and post-fire evaluation processes that was apparently standard within the USFS, but had not been provided to the Services. The USFWS requested a written description of these processes.

On September 28, 2007, USFS detailed three biologists to the USFWS Washington Office to assist in providing supplemental information as part of the Biological Assessment and other reports. With their assistance, the USFWS continued to receive additional information from the

USFS, including information regarding historical retardant use per Forest and estimates of amount of retardant carried per tanker.

In October 2007, the Forest Service issued an environmental assessment and decision notice and finding of no significant impact (DN/FONSI) entitled “Aerial Application of Fire Retardant”. In February 2008, the Forest Service amended the DN/FONSI by incorporating the reasonable and prudent alternatives proposed by the United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries during the Section 7 consultation process prescribed by the Endangered Species Act.

On October 10, 2007, the USFWS sent a letter to the USFS stating that the consultation was initiated effective August 28, 2007, and that we expected to deliver the finished biological opinion by January 15, 2008. We also stated that due to the scope and complexity of this consultation, we might need an extension.

On December 31, 2007, the USFWS sent a letter to the USFS and advised the Court that USFWS needed an extension until March 15, 2008 in order to complete the biological opinion. However, after the court set a hearing in the matter, USFS requested USFWS to expedite completion.

On February 12, 2008, the USFWS delivered a Biological Opinion to USFS. This final biological opinion completed the consultation.

On July 27, 2010, the United States District Court for the District of Montana issued a decision in *Forest Service Employees for Environmental Ethics v. United States Forest Service*, 08-43 (D. Mont.) that invalidated the Forest Service's decision to adopt the 2000 Guidelines based on violations of NEPA. The Court also held that the USFWS and NOAA Fisheries' Section 7 consultation with the Forest Service violated the ESA. The Court directed the Forest Service, USFWS, and NOAA Fisheries to cure these NEPA and ESA deficiencies and for the Forest Service to issue a new decision no later than December 31, 2011.

September 21, 2010: A meeting was held in Arlington, Virginia between the USFS, USFWS and NOAA to discuss coordination on consultation, the development of the EIS and potential timelines to completion.

September 29, 2010: A meeting was held in Washington D.C. between the USFS, USFWS and NOAA to exchange information on mapping procedures and expectations and to discuss the process of analysis and consultation.

November 3, 2010: A meeting between USFS, USFWS and NOAA was held in Washington D.C. to provide mapping examples, mapping/avoidance guidelines/discussion on buffering, take quantification discussion, step-down process, and discussion of exceptions in which fire retardant might be aurally dropped within the mapped avoidance zones. It was agreed that these cases would be limited to situations where there was a threat to human life or safety.



November 8, 2010: A meeting between USFS, USFWS and NOAA was held in Washington D.C. to provide mapping examples, WFDSS demo, and a discussion of the proposed screening process and pre-season coordination triggers.

November 9, 2010: A conference call was held between USFS, USFWS and NOAA to continue discussions of the step-down analysis process, filtering process and cumulative effects.

November 23, 2010: A conference call was held between USFS, USFWS and NOAA to discuss coordination on consultation process; also, discussion on accidental drops and how to analyze them as potential effects of the proposed action.

November 29, 2010: A conference call between USFS, USFWS and NOAA was held to continue discussions of the proposed screening process, risk factors (potential for fires/use), determinations (No Effect (NE)/Not Likely to Adversely Affect (NLAA)/Likely to Adversely Affect (LAA)), and clarification on inter-related and inter-dependant actions.

December 14, 2010: A conference call was held between USFS and USFWS to discuss inter-related and interdependent actions, effects calls at the national scale (problems/reliability with data), proposed determinations for species based on logical screening processes, timelines and national standard development.

January 10, 2011: A conference call was held between USFS, USFWS and NOAA to update the proposed screening process; to discuss proposed timelines and drop-dead dates for consultation; results of the January 3, 2011, conference call with respective agency attorneys; proposed NE/NLAA/LAA determinations for habitats/species; step-down analysis process; 30-day comment period on draft BA; and inclusion of sensitive species mapping on USFS lands only.

January 27, 2011: A conference call was held between USFS, USFWS and NOAA to discuss components of the consultation process, including accidental drops and how to treat them (still have likelihood of mishaps even with avoidance area, so use worst-case scenario); re-initiation triggers; reporting standardization (how to use data tables); 99.99% confidence level was agreed to by all.

February 7, 2011: A conference call was held between USFS, USFWS and NOAA to discuss timelines, BA format (1 intro with 3 sections for (a) aquatic species; (b) wildlife; and (c) plants for USFWS), NE – keep list, MOU on screens/mapping, coarse filter scale (national, over-arching analysis), fine filter scale (local, field analysis), discussion on one USFWS BO with input from USFWS field offices, NOAA will have one BO, USFS to deliver draft BA to them on February 17.

March 7, 2011: A conference call was held between USFS, USFWS and NOAA to review draft BAs; discuss delineation of the action area; USFS boundary buffers; formal MOU between agencies, inclusion of proposed and candidate species.

March 14, 2011: The USFWS provided informal comments on the wildlife portion of the first draft BA and identified several issues to be addressed.

March 14, 2011: The Washington Office of the USFWS invited the USFWS Regional and Field Offices to review and comment on the first draft BA.

March 16, 2011: The USFWS informally transmitted comments from the Midwestern Region on the first draft BA.

April 7, 2011: A meeting was held in Washington D.C. between USFS and USFWS to discuss the status of the consultation and determine next steps. Later that day, the USFS provided a list of all National Forests to be included in the consultation.

April 11, 2011: The USFWS provided comments from the USFWS Pacific Southwest Region on the first draft BA.

April 13, 2011: The USFS provided a spreadsheet containing species lists organized by Forest to the USFWS.

April 21, 2011: The USFS provided a revised spreadsheet containing species lists organized by Forest.

May 2, 2011: A conference call was held between USFS and USFWS to discuss the status of the revised draft BA and coordinate on next steps.

May 3, 2011: The USFS provided an advance review draft of the Plant section of the second draft BA to USFWS.

May 4, 2011: The USFS provided an advance review draft of the Introduction section of the second draft BA to the USFWS. Both the Plant and Introduction sections were uploaded onto the USFWS' Sharepoint site for review and comment by the USFWS Regions and Field Offices.

May 19, 2011: The USFS provided clarifications for questions from the USFWS Regional and Field Offices.

May 31, 2011: A conference call was held between the USFS and USFWS to discuss the current status of preparations for initiation of formal consultation under section 7 of the ESA.

June 10, 2011: The USFWS received a request for initiation of formal consultation from the USFS.

June 20, 2011: FWS/USFS/NMFS coordination call to discuss timeline of consultation, deliverables, and prioritizing the consultation at the field level.

June 26, 2011: A conference call was held between USFS and USFWS to discuss the timeframe covered by consultation and clarify actions included within the project description.



July 6, 2011: USFS/FWS coordination call to clarify BA revision timeline and management options.

July 8, 2011: USFWS responds to USFS with documentation of the date consultation was initiated

July 8, 2011: A meeting was held between USFWS and NOAA to discuss analytical frameworks.

July 18, 2011: FWS/USFS/NMFS coordination call to discuss which species require avoidance mapping vs. which benefit from no mapping

August 11, 2011: FWS/USFS/NMFS coordination meeting to confirm consultation timeframe, mapping agreements, and analytical approaches.

August 19, 2011: Revised BA delivered to USFWS

September 11 - 14, 2011: USFS and USFWS meet to perform simultaneous biological opinion concatenating/review process in Arlington, VA

September 14, 2011: FWS/USFS/NMFS coordination call to discuss status of maps and the definition of waterway. Textual descriptions will be used if maps are not available in a particular region, and waterway identification will use riparian vegetation as a cue.

September 26, 2011: FWS/USFS/NMFS coordination call to discuss misapplications and to clarify that new chemicals/chemical formulations/additives will require new review.

October 11 – 14, 2011: USFS/USFWS joint workshop to allow simultaneous drafting and review of Biological Opinion (BO)

October 17, 2011: FWS/USFS/NMFS coordination call to discuss misapplications and to clarify that new chemicals/chemical formulations/additives will require new review

October 20 – 25, 2011: Miscellaneous USFS/USFWS calls to resolve issues in draft BO

October 21, 2011: Draft BO made available to local USFWS/USFS field offices

## **Species not likely to be adversely affected**

The USFWS concurs that the proposed action is “not likely to adversely affect” (NLAA) the following species (Table 1), given the justification offered by the USFS in the Biological Assessment. Regions referenced are USFWS regions (see map in Appendix A). In addition to NLAA concurrences, we also present final No Effect and Not Likely to Adversely Affect determinations by forest, as concluded after local level consultation between the USFWS and the USFS (see Appendix B). This satisfies section 7 consultation requirements for these species

within the forests specified, and these species will not be considered further in this consultation within the forests specified.

**Table 1. Record of NLAA Concurrences**

No.	SPECIES or CH	Scientific Name	ESA status <sup>‡</sup>	USFWS Region(s) Affiliated	Applicable forests
1	Gentner Mission-bells/fritillary	<i>Fritillaria gentneri</i>	E	1	Rangewide
2	Northern Idaho Ground Squirrel	<i>Spermophilus brunneus brunneus</i>	T	1	Rangewide
3	Wenatchee checker-mallow CH only	<i>Sidalcea oregana var. calva</i>	E, CH	1	Rangewide
4	Woodland Caribou	<i>Rangifer tarandus caribou</i>	E	1	Rangewide
5	Arizona cliffrose	<i>Purshia subintegra</i>	E	2	Rangewide
6	Arizona hedgehog cactus	<i>Echinocereus triglochidiatus var. arizonicus</i>	E	2	Rangewide
7	Arkansas River shiner	<i>Notropis girardi</i>	T	2	Rangewide
8	California condor <sup>+</sup>	<i>Gymnogyps californicus</i>	E	2	USFWS region 2 national forests
9	gray wolf, Southwestern pop. Mex.	<i>Canis lupus</i>	XN	2	Rangewide
10	Jaguar	<i>Panthera onca</i>	E	2	Rangewide
11	Kuenzler hedgehog cactus	<i>Echinocereus fendleri var. kuenzleri</i>	E	2	Rangewide
12	Lesser long-nosed bat	<i>Leptonycteris curasoae yerbabuena</i>	E	2	Rangewide
13	Mexican long-nosed bat	<i>Leptonycteris nivalis</i>	E	2	Rangewide

<sup>‡</sup>Species status: T, threatened; E, endangered; CH, critical habitat; PE, proposed endangered; XN, experimental population

<sup>+</sup> These species are also referenced in Appendix B because either the determination (NE or NLAA) or the justification for that determination was different than expressed in the USFS BA.

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14	Mount Graham red squirrel and CH	<i>(Tamiasciurus hudsonicus grahamensis)</i>	E, CH	2	Rangewide
15	Northern aplomado falcon	<i>Falco femoralis)</i>	E	2	Rangewide
16	ocelot	<i>Leopardus pardalis</i>	E	2	Rangewide
17	Pima pineapple cactus	<i>Coryphantha scheeri var. robustispina</i>	E	2	Rangewide
18	Rio Grande silvery minnow	<i>Hybognathus amarus</i>	E	2	Rangewide
19	San Francisco peaks groundsel and CH	<i>(Sencio franciscanus)</i>	T, CH	2	Rangewide
20	Southwestern willow flycatcher and CH	<i>Empidonax traillii extimus)</i>	E, CH	2	Rangewide
21	Zuni fleabane	<i>Erigeron rhizomatus</i>	T	2	Rangewide
22	American hart's fern	<i>Asplenium scolopendrium var. americanum</i>	T	3	Rangewide
23	Dwarf lake iris	<i>Iris lacustris</i>	T	3	Rangewide
24	Houghton's goldenrod	<i>Solidago houghtonii</i>	T	3	Rangewide
25	Pallid Sturgeon	<i>Scaphirhynchus albus</i>	E	3	Shawnee
26	Pitcher's thistle	<i>Cirsium pitcheri</i>	T	3	Rangewide
27	Alabama Moccasinshell <sup>+</sup>	<i>Medionidus acutissimus</i>	T	4	National Forests in Alabama, Chattahoochee-Oconee National Forests
28	American Chaffseed	<i>Schwalbea americana</i>	E	4	Rangewide
29	Blue Ridge Goldenrod	<i>Solidago spithamaea</i>	T	4	Rangewide
30	Canby's Dropwort	<i>Oxypolis canbyi</i>	E	4	Rangewide
31	Cape Fear Shiner <sup>+</sup>	<i>Notropis mekistocholas</i>	E	4	National Forests In

<sup>+</sup> These species are also referenced in Appendix B because either the determination (NE or NLAA) or the justification for that determination was different than expressed in the USFS BA.

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					North Carolina
32	Chapman's rhododendron	<i>Rhododendron minus var. champmanii</i>	E	4	Rangewide
33	Cumberland darter <sup>+</sup>	<i>Etheostoma susanae</i>	E	4	Daniel Boone National Forest, George Washington and Jefferson National Forest
34	Cumberland Rosemary	<i>Conradina verticillata</i>	T	4	Rangewide
35	Cumberland Sandwort	<i>Arenaria cumberlandensis</i>	E	4	Rangewide
36	Etowah Darter <sup>+</sup>	<i>Etheostoma etowahae</i>	E	4	Chattahoochee-Oconee National Forests
37	Florida Scrub Jay	<i>Aphelocoma coerulescens</i>	T	4	Rangewide
38	Frosted Flatwoods Salamander	<i>Ambystoma cingulatum</i>	T	4	Rangewide
39	Georgia Pigtoe <sup>+</sup>	<i>Pleurobema hanleyianum</i>	E	4	Chattahoochee-Oconee National Forests
40	Goldline Darter <sup>+</sup>	<i>Percina aurolineata</i>	T	4	Chattahoochee-Oconee National Forests
41	Gopher Tortoise	<i>Gopherus polyphemus</i>	T	4	Rangewide
42	Gulf Sturgeon	<i>Acipenser oxyrinchus desotoi</i>	T	4	Rangewide
43	Harperella	<i>Ptilimnium nodosum</i>	E	4	Rangewide
44	Heller's Blazing Star	<i>Liatris helleri</i>	T	4	Rangewide
45	Louisiana Black Bear	<i>Ursus americanus luteolus</i>	T	4	Rangewide

<sup>+</sup> These species are also referenced in Appendix B because either the determination (NE or NLAA) or the justification for that determination was different than expressed in the USFS BA.

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46	Louisiana Quillwort	<i>Isoetes louisianensis</i>	E	4	Rangewide
47	Magazine Mountain Shagreen <sup>+</sup>	<i>Mesodon magazinensis</i>	T	4	Ozark-St. Francis NF
48	Miccosukee Gooseberry	<i>Ribes echinellum</i>	T	4	Rangewide
49	Mississippi Gopher Frog	<i>Rana capito sevosa</i>	E	4	Rangewide
50	Missouri Bladder-pod	<i>Lesquerella filiformis (Physaria)</i>	E	4	Rangewide
51	Mountain Golden Heather CH only	<i>Hudsonia montana</i>	T, CH	4	Rangewide
52	Noonday Globe <sup>+</sup>	<i>Peters clarkia Nantahala</i>	T	4	NFs in North Carolina
53	Orangenacre Mucket	<i>Lampsilis perovalis</i>	T	4	Rangewide
54	Ovate clubshell <sup>+</sup>	<i>Pleurobema perovatum</i>	E	4	Chattahoochee-Oconee National Forests, National Forests in Alabama
55	Ozark hell bender salamander <sup>+</sup>	<i>Cryptobranchus alleganiensis bishopi</i>	E	4	NFs in Arkansas
56	Pondberry	<i>Lindera melissifolia</i>	E	4	Rangewide
57	Red-cockaded Woodpecker	<i>Picoides borealis</i>	E	4	Rangewide
58	Roan Mountain Bluet	<i>Houstonia purpurea var. montana (Hedyotis)</i>	E	4	Rangewide
59	Rough-leaf Loosestrife	<i>Lysimachia asperulifolia</i>	E	4	Rangewide
60	Ruth's Golden-aster	<i>Pityopsis ruthii</i>	E	4	Rangewide

<sup>+</sup> These species are also referenced in Appendix B because either the determination (NE or NLAA) or the justification for that determination was different than expressed in the USFS BA.

61	Schweinitz's Sunflower	<i>Helianthus schweinitzii</i>	E	4	Rangewide
62	Snuffbox <sup>+</sup>	<i>Epioblasma triquetra</i>	PE	4	Daniel Boone National Forest, George Washington & Jefferson National Forest
63	Southern Clubshell <sup>+</sup>	<i>Pleurobema decisum</i>	E	4	Chattahoochee-Oconee National Forests, National Forests in Alabama, National Forests in Mississippi
64	Spreading Avens	<i>Geum radiatum</i>	E	4	Rangewide
65	Triangular Kidneyshell <sup>+</sup>	<i>Ptychobranthus greenii</i>	E	4	Chattahoochee-Oconee National Forests
66	Upland Combshell	<i>Epioblasma metastriata</i>	E	4	Rangewide
67	White-Haired Goldenrod	<i>Solidago albopilosa</i>	T	4	Rangewide
68	Virginia spiraea	<i>Spiraea virginiana</i>	T	4	Rangewide
69	Northeastern bulrush	<i>(Scirpus ancistrochaetus)</i>	E	5	Rangewide
70	Shale barren rock cress	<i>(Arabis serotina)</i>	E	5	Rangewide
71	Virginia northern flying squirrel	<i>(Glaucomys sabrinus fuscus)</i>	E	5	Rangewide
72	Black-footed Ferret	<i>Mustela nigripes</i>	E	6	Rangewide
73	Blowout penstemon	<i>Penstemon haydenii</i>	E	6	USFWS Region 6 forests
74	Clay Phacelia	<i>(Phacelia argillacea)</i>	E	6	Rangewide

<sup>+</sup> These species are also referenced in Appendix B because either the determination (NE or NLAA) or the justification for that determination was different than expressed in the USFS BA.

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75	Colorado hookless cactus	<i>Sclerocactus glaucus</i>	T	6	Rangewide
76	Debeque phacelia	( <i>Phacelia scopulina</i> var. <i>submutica</i> )	T	6	Rangewide
77	Gray wolf	<i>Canis lupus</i>	T	6	USFWS Region 6 forests
78	Grizzly Bear (Lower 48)	<i>Ursus arctos horribilis</i>	T	6	Rangewide
79	Last Chance Townsendia	( <i>Townsendia Townsendia aprica</i> )	T	6	Rangewide
80	Maguire primrose	( <i>Primula maguirei</i> )	T	6	Rangewide
81	Osterhout milkvetch	<i>Astragalus osterhoutii</i>	E	6	Rangewide
82	Pagosa skyrocket	<i>Ipomopsis polyantha</i>	E	6	Rangewide
83	Penland alpine fen mustard	<i>Eutrema penlandii</i>	T	6	Rangewide
84	Preble's Meadow Jumping Mouse	<i>Zapus hudsonius preblei</i>	T	6	Rangewide
85	Utah Prairie Dog	<i>Cynomys parvidens</i>	T	6	Rangewide
86	Ute ladies'-tresses orchid	<i>Spiranthes diluvialis</i>	T	6	Rangewide
87	Ash-gray paintbrush CH only	<i>Castilleja cinerea</i>	T, CH	8	Rangewide
88	Bakersfield cactus	<i>Opuntia basilaris</i> var. <i>trelease</i>	E	8	Rangewide
89	Bear Valley sandwort CH only	<i>Arenaria ursine</i>	T, CH	8	Rangewide
90	blunt-nosed leopard lizard	<i>Gambelia sila</i>	E	8	Rangewide
91	Braunton's milk vetch CH only	<i>Astragalus brauntonii</i>	E, CH	8	Rangewide
92	California red-legged frog CH only	<i>Rana aurora draytonii</i>	T, CH	8	Rangewide
93	California taraxacum CH only	<i>Taraxacum californicum</i>	E, CH	8	Rangewide
94	Coastal California gnatcatcher CH only	( <i>Polioptila californica</i> )	T, CH	8	Rangewide

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95	Cushenbury buckwheat	<i>Eriogonum ovalifolium</i> var. <i>vineum</i>	E	8	Rangewide
96	Cushenbury milk-vetch	<i>Astragalus albens</i>	E	8	Rangewide
97	Cushenbury oxytheca	<i>Acanthoscyphus parishii</i> var. <i>goodmaniana</i> ( <i>Oxytheca parishii</i> )	E	8	Rangewide
98	Giant kangaroo rat	<i>Dipodomys ingens</i>	E	8	
99	Green's tuctoria CH only	<i>Tuctoria greenei</i>	E, CH	8	Rangewide
100	Kern primrose sphinx moth CH only	<i>Euproserpinus euterpe</i>	T, CH	8	Rangewide
101	Laguna Mountain skipper CH only	<i>Pyrgus ruralis lagunae</i>	E, CH	8	Rangewide
102	Munz's onion CH only	<i>Allium munzii</i>	E, CH	8	Rangewide
103	Nevin's barberry CH only	<i>Berberis nevinii</i> ( <i>Mahonia nevinii</i> )	E, CH	8	Rangewide
104	Parish's daisy CH only	<i>Erigeron parishii</i>	T, CH	8	Rangewide
105	Quino checkerspot butterfly CH only	<i>Euphydryas editha quino</i>	E, CH	8	Rangewide
106	San Bernadino bluegrass CH only	<i>Poa atropurpurea</i>	E, CH	8	Rangewide
107	San Bernadino Mountains bladderpod CH only	<i>Physaria kingii</i> ssp. <i>bernardina</i> ( <i>Lesquerella kingii</i> ssp. <i>bernardina</i> )	E, CH	8	Rangewide
108	San Bernardino kangaroo rat	<i>Dipodomys merriami parvus</i>	E	8	Rangewide
109	San Diego thorn-mint CH only	<i>Acanthomintha ilicifolia</i>	T, CH	8	Rangewide
110	San Joaquin kit fox	<i>Vulpes macrotis mutica</i>	E	8	Rangewide
111	Slender orcutt grass CH only	<i>Orcuttia tenuis</i>	T, CH	8	Rangewide
112	Southern Mountain buckwheat	<i>Eriogonum kennedyi</i> var. <i>austromontanum</i>	T, CH	8	Rangewide



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	CHonly				
113	Stephen's kangaroo rat	<i>Dipodomys stephensi</i>	E	8	Rangewide
114	Thread-leaved brodiaea CH only	<i>Brodiaea filifolia</i>	T, CH	8	Rangewide
115	Valley elderberry longhorn beetle	<i>Desmocerus californicus dimorphus</i>	T	8	Rangewide
116	American burying beetle	<i>Nicrophorus americanus</i>	E	3, 4	USFWS region 3 and 4 national forests
117	OzarK big-eared bat	<i>Corynorhinus townsendii ingens</i>	E	3, 4	Rangewide
118	Running buffalo clover	<i>Trifolium stoloniferum</i>	E	3, 4	Rangewide
119	Gray bat	<i>(Myotis grisescens)</i>	E	3, 4, and 5	Rangewide
120	Virginia sneezeweed	<i>(Helenium virginicum)</i>	T	3, 5	Rangewide
121	Canada lynx	<i>Lynx canadensis</i>	T	3, 6	Rangewide
122	Carolina northern flying squirrel	<i>(Glaucomys sabrinus coloratus)</i>	E	4, 5	Rangewide
123	Indiana bat <sup>+</sup>	<i>(Myotis sodalis)</i>	E	4, 5	USFWS region 4 and 5 national forests
124	Rock gnome lichen	<i>Gymnoderma lineare</i>	E	4, 5	Rangewide

<sup>+</sup> These species are also referenced in Appendix B because either the determination (NE or NLAA) or the justification for that determination was different than expressed in the USFS BA.

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124	Small whorled pogonia	<i>(Isotria medeoloides)</i>	T	4, 5	Rangewide
125	Smooth coneflower	<i>(Echinacea laevigata)</i>	E	4, 5	Rangewide
126	Spruce-fir moss spider	<i>(Microhexura montivaga)</i>	E	4, 5	Rangewide
127	Swamp pink	<i>(Helonias bullata)</i>	T	4, 5	Rangewide
128	Virginia big-eared bat	<i>(Corynorhinus townsendii virginianus)</i>	E	4, 5	Rangewide
129	Virginia Spiraea	<i>(Spiraea virginiana)</i>	T	4, 5	Rangewide
130	Ouachita Rock Pocketbook	Arkansia wheeleri	E	4	Rangewide
131	Rayed Bean	Villosa fabalis	PE	4	Rangewide
132	Razorback Sucker	Xyrauchen texanus	E	2	Rangewide

## **BIOLOGICAL OPINION**

### ***Description of the Proposed Action***

In June 2011, the USFS requested programmatic consultation on the aerial application of nine long-term fire retardants specifically on National Forest System (NFS) lands. Long-term fire retardants are those that continue to retard burning even after the water content has evaporated. Effects described refer to aerial delivery of retardant only. This consultation did not address ground-based application of retardants, other fire suppression activities, or the effects of wildland fire. Foams, other chemical fire suppressants, other types of application of retardant, or the use of retardant by other agencies on lands beyond the NFS lands were not included in this request, and consequently are not analyzed in this biological opinion.

The timeframe for this project is January 1, 2012, to January 1, 2022, and includes annual reviews of operations (including misapplications) and a 5-year programmatic compliance review. If a new chemical is used before that time, re-initiation of consultation per 50 CFR §402.16 may be necessary. The Endangered Species Act and its implementing regulations limit the effects of the action to only those future effects that are reasonably certain to occur. The scope of the consultation is coextensive with the scope of the continued application of these chemicals, as Forest Service's policy on the aerial application of chemical fire retardants is itself limited to ten years (T. Henderson, USFS, pers.comm. 2011); as a result, use of these chemicals beyond ten years is not reasonably certain. A longer-term consultation would be unproductive in assessing the long-term impact of fire retardants on these species because limitations in the current data do not allow a useful analysis beyond ten years, and because the effects of this action are likely to change by then. Current monitoring data have only been acquired opportunistically between 2008 and 2010 and these data do not reveal trends, patterns, or predictive scenarios that would allow us to extrapolate effects of the action decades into the future. This consultation also depends heavily on avoidance area mapping, which may evolve drastically in some areas due to environmental and land use changes. Therefore, the scope of this consultation is from January 1, 2012, to January 1, 2022, because (a) it coincides with the US Forest Service action as proposed, (b) is likely that the Forest Service will be using new formulations of fire retardants by 2022, (c) the avoidance mapping upon which many of the determinations depend is dynamic, and an analytical scope exceeding 10 years would yield an unreliable analysis due to the unpredictable effects of climate change, land conversion, etc., and (d) there will be significantly more data in ten years (as a result of these monitoring efforts and other requirements in the Reasonable and Prudent Measures) that will clarify uncertainties identified within this opinion. After January 1, 2022, another consultation on the new chemicals used and/or new data realized from this action should occur. The determinations and terms expressed herein may or may not still apply, given the potential for improved misapplication data quality and the implications thereof, changes in species locations and mapping, and the effects of any new chemicals used to fight fire.

The project description below captures the majority of conservation measures and agreements made during informal consultation at both the local and national level; however, any

additional conservation measures that were negotiated between the USFS and USFWS and that affect the project description can be found in Appendices H-K.

As provided for in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

- (1) 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 USDA Nationwide Aerial Application of Fire Retardant on National Forest System Land 2011 Biological Assessment that affect the evaluation thresholds for toxicity on species, or propose the allowance of new ingredients that are not currently contained in the specification, reinitiation of consultation may be necessary. 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.

## **Aerial Application of Fire Retardant Direction**

To protect federally listed threatened, endangered, and proposed species, national forests and national grasslands that apply fire retardant using aircraft propose the implementation of the following direction:

- Aircraft Operational Guidance,
- Avoidance Area Mapping Requirements,
- Annual Coordination, and
- Reporting and Monitoring Requirements.

### **Aircraft Operational Guidance**

Whenever practical, as determined by the fire incident, the Forest Service will use water, other suppressants, or the least toxic approved fire retardant(s) in areas occupied by threatened, endangered, and proposed species or their designated critical habitat. Some species and habitats require that only water can be used to protect habitat and populations; these habitats and populations have been mapped as ~~—~~avoidance areas.”

Incident Commanders and pilots are required to avoid aerial application of retardant on mapped avoidance areas for terrestrial threatened, endangered, or proposed (TEP) species or within 300 feet of waterways. This distance is based on the air tanker pilot’s reaction time and the speed of the airtanker, plus a safety factor. This allows time and distance that once the pilot saw the terrestrial avoidance area or waterway and reacted (by removing his thumb from

the trigger), there would still be a safety buffer before the air tanker and its load reached the terrestrial avoidance area or waterway. After crossing the terrestrial avoidance area or waterway, the same guidelines applied before dropping the next part of the load.

This direction does not require the helicopter or airtanker pilots-in-command to fly in such a manner as to endanger their aircraft, other aircraft, or structures, or compromise ground personnel safety or the public. The only exception to this direction is when human life or safety is threatened and the incident commander has determined in advance that use of aerially applied retardant is necessary to alleviate the threat. While we expect such uses to be very rare, this biological opinion has evaluated the effects and included incidental take statements for those species that are likely to be adversely affected by such uses.

The operational guidance for pilots to ensure retardant drops are not made within the 300-foot buffer of waterways or mapped avoidance areas for terrestrial threatened, endangered, and proposed (TEP) species or waterways includes the following:

Medium/Heavy Airtankers, Single Engine Airtankers, and Helicopters:

- Prior to fire retardant application, all pilots shall be briefed on the locations of all TEP species avoidance areas on the unit.
- Prior to aerial application of fire retardant, the pilot will make a “dry run” over the intended application area to identify avoidance areas and waterways in the vicinity of the wildland fire.
- When approaching mapped avoidance areas for TEP species or waterways or riparian vegetation *visible to the pilot*, the pilot will terminate the application of retardant approximately 300 feet before reaching the mapped avoidance area or waterway.
- When flying over a mapped avoidance area or waterway, pilots will wait 1 (one) second after crossing the far border of a mapped avoidance area or waterway before applying retardant.
- Pilots will make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant within the 300-foot buffer zone, or mapped avoidance area in order to avoid drift into protected areas.
- Pilots are provided avoidance area maps at all briefings, and attend required training to maintain necessary certifications to fly for the Forest Service fire program, which includes applying the operational guidelines.

## Avoidance Area Mapping Requirements

Identified avoidance areas are:

- **Aquatic Avoidance Area:**
  - All waterbodies with a 300-foot buffer; this includes perennial streams, intermittent streams, lakes, ponds, identified springs, reservoirs, and vernal pools. Buffer areas may be adjusted for local conditions and coordinated with the U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries offices.
- **Terrestrial Avoidance Area:**
  - May be used to avoid impacts on one or more federally listed threatened, endangered, or proposed plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and/or populations.

To demonstrate the extent the amount of the landbase on national forests that may receive avoidance area mapping, two examples of Avoidance Area Mapping are presented in Appendix L. The San Bernardino National Forest in southern California (Forest Service Southwest Region [Region 5]) and the Boise National Forest in Idaho (Forest Service Intermountain Region [Region 4]) are provided as representative of areas with high potential for wildland fires and high potential for the use of aerial application of fire retardant. The San Bernardino landscape contains a complex diversity of habitats and the most listed threatened and endangered species of any national forest in the nation, and the Boise landscape supports fewer listed aquatic and terrestrial species. The acreage was obtained from the 2010 Lands tabular report.

For the San Bernardino National Forest:

- Total National Forest System (NFS) lands equal approximately 677,628 acres.
- Aquatic Avoidance Areas equal approximately 211, 234 acres for about 31.1 percent of the total NFS lands.
- Terrestrial Avoidance Areas equal approximately 27,753 acres for about 4.1 percent.
- Combined Aquatic and Terrestrial Avoidance Mapped Areas equal 238,987 acres for 29.57 percent of the NFS land.

For the Boise National Forest:

- Total NFS lands equal approximately 2,654,004 acres.
- Aquatic Avoidance Areas equal approximately 950,687 acres for about 35.8 percent.
- No acres in Terrestrial Avoidance Areas.

The following protocols are for a standardized national map template of avoidance areas for TEP species.

- Use USFWS and NOAA Fisheries designated critical habitat layers when available.
- Use National Hydrograph Dataset (NHD) for mapping waterbodies to create aquatic avoidance areas.

- Use USFWS, NOAA Fisheries, and Forest Service species population and designated critical habitat information for occupied sites.
- All forests/ grasslands that have listed species will complete avoidance area maps in cooperation with local offices of USFWS and NOAA Fisheries.
- Update maps annually in cooperation with USFWS and NOAA Fisheries; to reflect changes during the year on additional species or changes made for designated critical habitat.
- A national map template for all revisions and databases will be maintained by U.S. Forest Service Geospatial Service and Technology Center, Salt Lake City, Utah.

### Annual Coordination

The Forest Service will coordinate with local U.S. Fish and Wildlife Service and NOAA Fisheries offices annually or as needed to ensure that:

- Any updates that are needed for retardant avoidance areas on National Forest System lands are mapped using the most up-to-date information.
- Reviewing the *Aerial Application of Fire Retardant Direction* will be conducted with Forest Service biologists/botanists, fire management personnel, and line officers. Fire management personnel should include Type 4 and higher incident commanders (ICs), assistant fire management officers (AFMO), fire management officers (FMO), aviation managers, captains, battalion and division chiefs; or personnel responsible for ordering the aerial delivery of fire retardant during a wildland fire incident.

This annual review will include:

- Review aircraft operational direction,
- Review avoidance area maps,
- Review of reporting process for misapplications, and
- Review of monitoring process.

Aviation managers or appropriate personnel will brief pilots on avoidance area mapping and aircraft operational direction as needed.

- Pilots will be briefed prior to fire operations occurring.
- Sets of avoidance area maps for each national forest will be available through the forest's aviation officer, at tanker bases, at helibases, at dispatch fire manager offices and with all appropriate cooperators.

The Forest Service will coordinate with all personnel involved in fire suppression activities.

- Monitoring and reporting requirements will be discussed at annual incident management teams meetings, meetings with cooperators, and fire refresher courses.

## Reporting and Monitoring

The Forest Service currently reports all misapplication of retardant in waterways and identified terrestrial avoidance areas associated with the Reasonable and Prudent Alternatives (RPAs) (FWS 2008) and follows protocols associated within. The Forest Service acknowledges that misapplications have occurred and likely will in the future due to weather, visibility, pilot error, topography, or other conditions. Data derived from 2008 to 2010 indicate that less than 0.01 percent of the total retardant loads dropped for a given year resulted in a misapplication. The reporting and monitoring data collection sheet (Appendix M) updates the existing reporting form used by the FS and provides an environmental checklist of required and recommended reporting and monitoring elements. Training on requirements for reporting and monitoring will be done at the annual briefings using the *Implementation Handbook for the Reporting and Monitoring for Misapplications of Aerially Applied Fire Retardant* which provides direction and guidance at the local level (expected to be completed early 2012). This guide will provide a framework for local USFS and USFWS offices to use for *species specific* monitoring plans when a mis-application occurs. These local species specific monitoring plans will be developed by the local USFS office in cooperation with USFWS.

The Forest Service will continue to report all misapplications, and existing forms will be updated for use in the reporting process. In addition the Forest Service will conduct the following reporting and monitoring items:

1. **Reporting of Misapplication of Aerial Application of Fire Retardant:**
  - a. Report occurrences at time of event during suppression activities.
    - i. If soil or vegetation and surrounding habitat within the waterway buffers are impacted, implement erosion control measures to reduce retardant delivery during rain events from entering habitat. Follow revegetation and erosion control guidance as outlined within BAER guidance.
  - b. Determine if the exception for human life safety was used.
  - c. Conduct assessment of impacts to species or habitats; to be done by qualified biological resources personnel; if adverse impacts are found, then:
  - d. Determine if misapplication has occurred in area where the incidental take for a species may be at or exceed take, then:
    - i. notification to all FS units and FWS lead within the range of that species (or Designate Population Segment) will need to be notified by the unit where the misapplication occurred.
    - ii. re-initiation of consultation may need to occur if take is exceeded
    - iii. may restrict further use of aerial application of retardant at that time until biological assessment completed.
  - e. Notify and meet with local USFWS and NOAA Fisheries offices and determine the appropriate remediation, restoration and recovery actions



- f. Report annually through national coordinator in Fire and Aviation Management and to USFWS/NOAA Fisheries.
  2. **To determine if misapplication has occurred, the Forest Service will continue to monitor *all large fires* where aerial retardant is used and avoidance areas exist:**
    - a. Determine if exception for human life safety was used.
      - i. If soil or vegetation and surrounding habitat within the waterway buffers are impacted, implement erosion control measures to reduce retardant delivery during rain events from entering habitat. Follow revegetation and erosion control guidance as outlined within BAER guidance.
    - b. If misapplication is found, conduct assessment of impacts to species or habitats; to be done by qualified biological resources personnel; if adverse impacts are found:
      - i. Determine amount of impact
      - ii. Determine if incidental take is occurring or if take for species is approaching threshold or exceeding amount in the biological opinion
      - iii. then:
    - c. Notify and meet with local USFWS and NOAA Fisheries offices and determine the appropriate remediation, restoration and recovery actions
      - i. Refer to item F sub I above if need to coordinate with multiple units.
    - d. Report annually through national coordinator in Fire and Aviation Management and USFWS/NOAA Fisheries.
    - e. Report annually through national TES species staff for compliance with Biological Opinions.
  3. **To determine if misapplication has occurred, the Forest Service will monitor 5 percent of *all initial attack fires* less than 300 acres where aerial retardant is used and avoidance areas exist:**
    - a. Minimum monitoring of one fire per forest where aerial application of fire retardant was used, to determine if a misapplication of aerial fire retardant has occurred in designated avoidance areas or waterways that was not discovered or reported.
    - b. Determine if exception for human life safety was used.
    - c. If misapplication is found, conduct assessment of impacts to species or habitats; to be done by qualified biological resources personnel:
      - i. Determine amount of impact
      - ii. Determine if incidental take is occurring or if take for species is approaching threshold or exceeding amount in the biological opinion
      - iii. then:

- d. Notify and meet with local USFWS and NOAA Fisheries offices and determine the appropriate remediation, restoration and recovery actions.
- e. Report annually through national coordinator in Fire and Aviation Management and USFWS/NOAA.
- f. Report annually through national TES species staff for compliance with Biological Opinions.

**4. Follow-up Monitoring Process will:**

- a. Determine the amount of follow-up monitoring necessary as dictated by the extent of the impacts to species or habitat identified during assessment of the misapplication.
- b. Be conducted in coordination with local unit(s) of the Forest Service/USFWS/NOAA Fisheries/USGS offices and appropriate state agencies.
- c. Determine the type of recovery or restoration of species or habitats:
  - i. may include salvage of species during BAER activities
  - ii. may supplement established captive breeding programs until species can be re-introduced back into impacted area.
- d. Additional assessment of cumulative effects for some species may need to be coordinated with certain agencies.
- e. Determine the appropriate contingency measures for protection of TEP species from aerially applied fire retardant.
  - i. If soil or vegetation and surrounding habitat within the waterway buffers are impacted, implement erosion control measures to reduce retardant delivery during rain events from entering habitat. Follow revegetation and erosion control guidance as outlined within BAER guidance.
- f. Reported annually through forest and national TES species staff for coordination with other agencies.

In addition, the Forest Service will:

- In coordination with USGS and NOAA Fisheries, continue existing research on the temporal lethal and sub-lethal effects of currently approved fire retardants on ocean-type chinook, as well as characterizing the temporal sublethal effects on stream-type chinook testing (in process).
- Provide NOAA Fisheries Headquarters' Office of Protected Resources and U.S. Fish and Wildlife Service Headquarters with a biannual summary (every 2 years) that evaluates the cumulative impacts (as the Council on Environmental Quality has defined that term pursuant to the National Environmental Policy Act of 1969) of their continued use of fire retardants including:

- (a) the number of observed retardant drops entering a waterway, in any sub-watershed and watershed;
- (b) whether the observed drops occurred in a watershed inhabited by listed resources;
- (c) an assessment as to whether listed resources were affected by the misapplication of fire retardants within the waterway; and
- (d) the Forest Service's assessment of cumulative impacts of the fire retardant drops within the sub-watershed and watershed and the consequences of those effects on listed resources. The evidence the Forest Service shall use for this evaluation would include, but is not limited to:
  - (i) the results of consultation with NOAA Fisheries and U.S. Fish and Wildlife Service regional offices and the outcome of the site assessment,
  - (ii) the results of new fish toxicity, and
  - (iii) any actions the Forest Service took or intends to take to minimize the exposure of listed fish species to fire retardants, and reduce the severity of their exposure.

The Forest Service will develop an *Implementation Handbook for the Reporting and Monitoring for Misapplications of Aerially Applied Fire Retardant* providing direction and guidance at the local level.

## **Process for Completing Changes to the National Programmatic Consultation**

If there are necessary changes at the national forest/grassland level based on local conditions, the units will address those changes with a local reinitiation process at a scale commensurate with the range of the species. This action will result in addendums/supplements to National Programmatic BA, and all changes will be tracked at the regional level and reported upward to national level.

This process will be used when:

- There is a change in a determination statement for a species at the local level.
  - Local unit must provide defensible rationale and analysis to support change from national programmatic Biological Assessment and Biological Opinion.
    - Should follow assumptions and factors used in national programmatic process.
- There is an addition of new listed species or critical habitat or changes to critical habitat.

- Updated or corrected information for a local national forest /grassland is relevant; for instance, change in mapping of avoidance areas due to local conditions.
  - NHD layer must be used as base data.
  - IE. intermittent/dry washes, diversions, or irrigation ditches.
- Mitigations or specific conservation assessments/agreements between USFWS and Forest Service at local levels are needed.
- Land and resource management plan (LRMP) requirements are needed.
- Monitoring of incidental take level exceeds the anticipated amount.

## Background

In October 2007, the Forest Service issued an environmental assessment (EA) and decision notice and finding of no significant impact (DN/FONSI) entitled "Aerial Application of Fire Retardant". In February 2008, the Forest Service amended the DN/FONSI by incorporating the reasonable and prudent alternatives proposed by the United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries during the Section 7 consultation process prescribed by the Endangered Species Act (ESA).

On July 27, 2010, the United States District Court for the District of Montana issued a decision that invalidated the Forest Service's decision to adopt the ~~Guidelines for Aerial Delivery of Retardant or Foam Near Waterways~~" (2000 Guidelines). The 2000 Guidelines are to minimize the impact of aerially-delivered fire retardant on aquatic life and habitat. The Court directed the Forest Service, USFWS, and NOAA Fisheries to cure NEPA and ESA violations and for the Forest Service to issue a new decision no later than December 31, 2011.

For purposes of clarification, we present in table 2 below the differences between the 2007 project description and the project description included within this BO.

**Table 2. Comparison of Project Description Actions for USFS and USFWS Consultation on Aerial Delivery of Fire Retardant.**

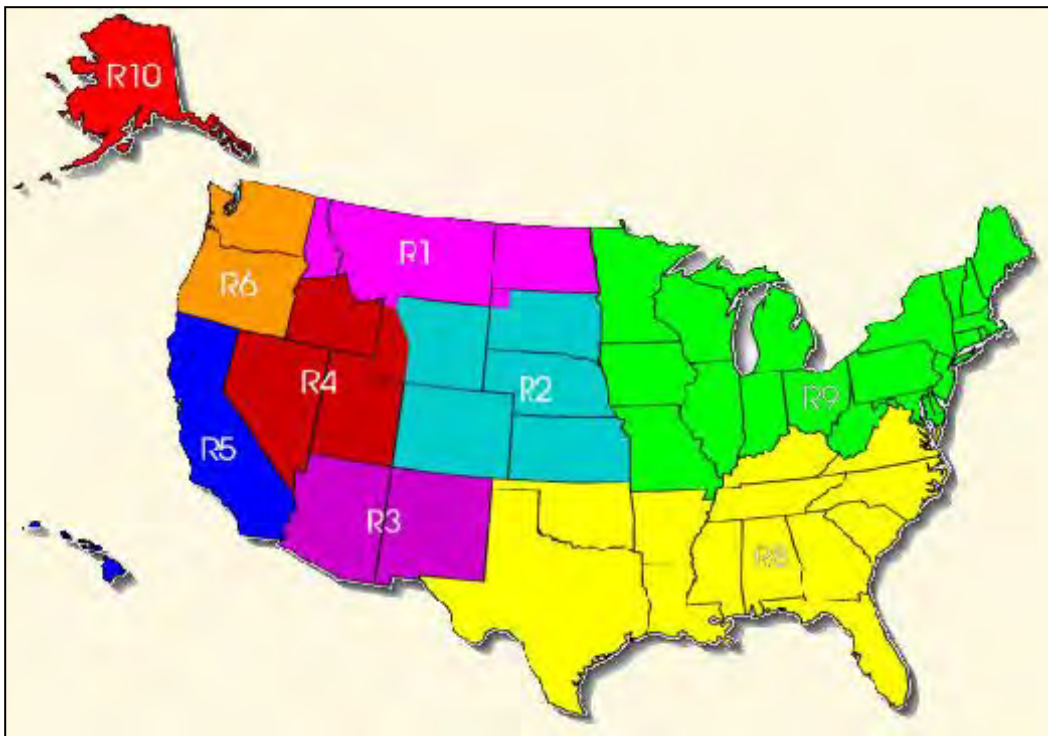
Actions	2007 Consultation	2011 Consultation
Aerial Delivery of Retardant	Yes, retardant and foams	Yes
Exceptions for Retardant Use	Three Exceptions:  For life and property, other valuable resources (campgrounds, plantations, historical structures etc.)	One Exception:  For protection of human life or public safety
Aircraft Operational Guidance	2000 Guidelines for Aerial Delivery of Retardant or Foam	New Aerial Application of Fire Retardant Direction: Avoidance of waterways, established buffers associated with waterways; riparian vegetation visible to pilots , terrestrial avoidance areas, and other resources (e.g., cultural)

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Avoidance Area Mapping	No standardized mapping, pilot guidance for 300 foot buffer for waterways	Yes, National Protocols for Aquatic and Terrestrial Mapping (See Avoidance Area Mapping Requirements)
Annual Coordination with regulatory agencies and other cooperators	None associated with threatened and endangered species	New Aerial Application of Fire Retardant Direction (See Annual Coordination)  Briefings, as needed  Coordination meetings, as needed
Monitoring	Emergency consultation procedures implemented	<ol style="list-style-type: none"> <li>1. Monitoring of misapplication that occur in avoidance areas on any fires, May include implementation of trigger points that restrict retardant use if adverse impacts are identified</li> <li>2. Monitoring of 5% of all fires &lt;300 acres where Aerial retardant was applied</li> </ol> <p>See Reporting and Monitoring</p>
Reporting	All Misapplications into waterways and any affected T&E species habitat or population	<ol style="list-style-type: none"> <li>1. All Misapplications into waterways and any affected TEPCS species</li> <li>2. 5% of small fires and on large fires</li> </ol> <p>See Reporting and Monitoring</p>
Use of Emergency Consultation Regulations (50 CFR 402.05)	Yes	<p>No – Re initiation process developed for exceeding incidental take, new chemicals, new information, species, etc.</p> <p>Review of BA would occur at 5 and 10 years for adequacy of analysis or incorporation of additional information relevant to determination process</p>

## Action Area

The action area for the proposed federal action includes all National Forest System lands encompassing 193 million acres, in 9 regions, in 42 states and 1 territory. This includes 155 national forests, 22 national grasslands, 6 national monuments, 20 national recreational areas, 9 national scenic areas and 1 national preserve. These areas consist of numerous types of environments including terrestrial or aquatic ecosystems containing threatened, endangered or proposed species and any associated critical habitats. The action area also includes areas outside of National Forest System land to account for indirect effects to species and critical habitat from factors, such as drift of retardant onto adjacent lands and transport of retardant in waterways downstream from the application. Areas where species occurrences or critical habitats occur adjacent to or in close proximity to NFS lands and aerially applied fire retardant has the potential to affect species or habitats will be addressed on a case by case basis.



**Figure BA - 1. Map of the Forest Service Regions**

## Species Included in This Consultation

Table 3 below lists all of the species that are likely to be adversely affected by the proposed action. The scientific name column provides a hyperlink to each species' profile in the Service's Threatened and Endangered Species System (TESS) online database that can also be accessed by searching for the scientific name or the common name in the TESS database, available online at <http://ecos.fws.gov>. Information on each species' natural history and status can be obtained from the following documents in this database: listing package, recovery plan (if applicable), five-year reviews (if applicable), and listing/delisting petitions (if applicable).

**Table 3. List of all species included in this consultation.**

No.	SPECIES	Scientific Name	Status	Region Affiliated	Avoidance mapped
1	Apache (Arizona) Trout	<a href="#">Oncorhynchus apache</a>	T	2	Yes
2	Arroyo Southwestern Toad	<a href="#">Bufo californicus</a>	E, CH*	8	Yes
3	Ashgray Paintbrush	<a href="#">Castilleja cinerea</a>	T, CH*	8	Yes
4	Bear Valley Sandwort	<a href="#">Arenaria ursina</a>	T, CH*	8	Yes
5	Bull Trout	<a href="#">Salvelinus confluentus</a>	T, CH*	1, 6	Yes
6	California Jewelflower	<a href="#">Caulanthus californicus</a>	E	8	Yes
7	California Red-legged Frog	<a href="#">Rana aurora draytonii</a>	T, CH*	8	No CH/ Yes popn
8	California taraxacum	<a href="#">Taraxacum californicum</a>	E, CH*	8	Yes
9	Camatta Canyon amole	<a href="#">Chlorogalum purpureum</a>	T*	8	Yes
10	Canelo Hills Ladies Tresses	<a href="#">Spiranthes delitescens</a>	E	2	Yes
11	Chihuahua Chub	<a href="#">Gila nigrescens</a>	T, CH*	2	Yes
12	Chiricahua leopard frog	<a href="#">Rana chiricahuensis</a>	T, CH	2	Yes
13	Cushenbury Buckwheat	<a href="#">Eriogonum ovalifolium var. vineum</a>	E, CH*	8	Yes

\* The USFWS determined that Critical Habitat (CH) for these species is not likely to be adversely affected (NLAA) by the proposed action. Justifications can be found either in the USFS BA (if CH is listed in Table 1) or in Appendices C – G (if CH is listed in Appendix B).

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No.	SPECIES	Scientific Name	Status	Region Affiliated	Avoidance mapped
14	Cushenbury Milk-vetch	<a href="#"><i>Astragalus albens</i></a>	E, CH*	8	Yes
15	Cushenbury Oxytheca	<a href="#"><i>Oxytheca parishii</i> var. <i>goodmaniana</i></a>	E, CH*	8	Yes
16	Desert Pupfish	<a href="#"><i>Cyprinodon macularius</i></a>	E	2	Yes
17	Encinitas Baccharis	<a href="#"><i>Baccharis vanessae</i></a>	T	8	Yes
18	Gila Chub	<a href="#"><i>Gila intermedia</i></a>	E	2	Yes
19	Gila Topminnow	<a href="#"><i>Poeciliopsis occidentalis</i></a>	E	2	Yes
20	Gila Trout	<a href="#"><i>Oncorhynchus gilae</i></a>	E	2	Yes
21	Greenback Cutthroat Trout	<a href="#"><i>Oncorhynchus clarki stomias</i></a>	T	6	Yes
22	Greene's Tuctoria	<a href="#"><i>Tuctoria greenei</i></a>	E, CH*	8	Yes
23	Holy Ghost Ipomopsis	<a href="#"><i>Ipomopsis sancti-spiritus</i></a>	E	2	No
24	Huachuca water-umbel	<a href="#"><i>Lilaeopsis schaffneriana</i> var. <i>recurva</i></a>	E	2	Yes
25	Laguna Mountains Skipper	<a href="#"><i>Pyrgus ruralis lagunae</i></a>	E, CH*	8	Yes
26	Lahontan Cutthroat Trout	<a href="#"><i>Oncorhynchus clarki henshawi</i></a>	T	8	Yes
27	Layne's Butterweed	<a href="#"><i>Senecio layneae</i></a>	T	8	Yes
28	Little Colorado Spinedace	<a href="#"><i>Lepidomeda vittata</i></a>	T	2	Yes
29	Little Kern Golden Trout	<a href="#"><i>Oncorhynchus aguabonita whitei</i></a>	T, CH*	8	Yes
30	Loach Minnow	<a href="#"><i>Tiaroga cobitis</i></a>	T	2	Yes
31	Lost River Sucker	<a href="#"><i>Deltistes luxatus</i></a>	E	8	Yes
32	Macfarlane's Four-O'Clock	<a href="#"><i>Mirabilis</i></a>	T	1	Yes

\* The USFWS determined that Critical Habitat (CH) for these species is not likely to be adversely affected (NLAA) by the proposed action. Justifications can be found either in the USFS BA (if CH is listed in Table 1) or in Appendices C – G (if CH is listed in Appendix B).



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No.	SPECIES	Scientific Name	Status	Region Affiliated	Avoidance mapped
		<a href="#"><i>macfarlanei</i></a>			
33	Marbled murrelet	<a href="#"><i>Brachyramphus marmoratus</i></a>	T, CH	1	No
34	Mariposa Pussypaws	<a href="#"><i>Calyptridium pulchellum</i></a>	T	8	Yes
35	Mexican Spotted Owl	<a href="#"><i>Strix occidentalis lucida</i></a>	T	2, 6	No
36	Modoc sucker	<a href="#"><i>Catostomus microps</i></a>	E	8	Yes
37	Munz' Onion	<a href="#"><i>Allium munzii</i></a>	E, CH*	8	Yes
38	Nevin's Barberry	<a href="#"><i>Berberis nevinii</i></a>	E, CH*	8	Yes
39	New Mexico Ridgenose Rattlesnake	<a href="#"><i>Crotalus willardi obscurus</i></a>	T	2	No
40	Northern Spotted Owl	<a href="#"><i>Strix occidentalis caurina</i></a>	T, CH	1	No
41	Owens Tui Chub	<a href="#"><i>Gila bicolor snyderi</i></a>	E, CH	8	Yes
42	Paiute Cutthroat Trout	<a href="#"><i>Oncorhynchus clarki seleniris</i></a>	T	8	Yes
43	Parish's Fleabane Daisy	<a href="#"><i>Erigeron parishii</i></a>	T, CH*	8	Yes
44	Pawnee Montane Skipper	<a href="#"><i>Hesperia leonardus montana</i></a>	T	6	No
45	Pedate Checkermallow	<a href="#"><i>Sidalcea pedata</i></a>	E	8	Yes
46	Quino Checkerspot Butterfly	<a href="#"><i>Euphydryas editha quino</i></a>	E, CH*	8	Yes
47	Railroad Valley Springfish	<a href="#"><i>Crenichthys nevadae</i></a>	T, CH*	8	Yes
48	San Bernardino Bluegrass	<a href="#"><i>Poa atropurpurea</i></a>	E, CH*	8	Yes
49	San Bernardino Mountains Bladderpod	<a href="#"><i>Lesquerella kingii ssp. bernardina</i></a>	E, CH*	8	Yes
50	San Diego Thorn-mint	<a href="#"><i>Acanthomintha ilicifolia</i></a>	T, CH*	8	Yes

\* The USFWS determined that Critical Habitat (CH) for these species is not likely to be adversely affected (NLAA) by the proposed action. Justifications can be found either in the USFS BA (if CH is listed in Table 1) or in Appendices C – G (if CH is listed in Appendix B).

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No.	SPECIES	Scientific Name	Status	Region Affiliated	Avoidance mapped
51	Santa Ana Sucker	<a href="#"><u>Catostomus santaanae</u></a>	T	8	Yes
52	Shasta Crayfish	<a href="#"><u>Pacifastacus fortis</u></a>	E	8	Yes
53	Shortnose Sucker	<a href="#"><u>Chasmistes brevirostris</u></a>	E	8	Yes
54	Showy Stickweed	<a href="#"><u>Hackelia venusta</u></a>	E	1	Yes
55	Slender Orcutt Grass	<a href="#"><u>Orcuttia tenuis</u></a>	T, CH*	8	Yes
56	Slender-horned Spineflower	<a href="#"><u>Dodecahema leptoceras</u></a>	E	8	Yes
57	Slender-petaled mustard	<a href="#"><u>Thelypodium stenopetalum</u></a>	E	8	Yes
58	Smith's Blue Butterfly	<a href="#"><u>Euphilotes enoptes smithi</u></a>	E, CH*	8	Yes
59	Sonora Chub	<a href="#"><u>Gila ditaenia</u></a>	T	2	Yes
60	Sonoran Tiger Salamander	<a href="#"><u>Ambystoma tigrinum stebbinsi</u></a>	E	2	Yes
61	Southern Mountain Buckwheat	<a href="#"><u>Eriogonum kennedyi var. austromontanum</u></a>	T, CH*	8	Yes
62	Spalding's Catchfly	<a href="#"><u>Silene spaldingii</u></a>	T	1	Yes
63	Spikedace	<a href="#"><u>Meda fulgida</u></a>	T	2	Yes
64	Springville Clarkia	<a href="#"><u>Clarkia springvillensis</u></a>	T	8	Yes
65	Stebbin's morning glory	<a href="#"><u>Calystegia stebinsii</u></a>	E	8	Yes
66	Thread-leaved Brodiaea	<a href="#"><u>Brodiaea filifolia</u></a>	T, CH*	8	Yes
67	Three Forks springsnail	<a href="#"><u>Pyrgulopsis trivialis</u></a>	P, CH	2	Yes
68	Tidewater Goby	<a href="#"><u>Eucyclogobius newberryi</u></a>	E, CH	8	Yes
69	Unarmored Threespine Stickleback	<a href="#"><u>Gasterosteus aculeatus williamsoni</u></a>	E	8	Yes

\* The USFWS determined that Critical Habitat (CH) for these species is not likely to be adversely affected (NLAA) by the proposed action. Justifications can be found either in the USFS BA (if CH is listed in Table 1) or in Appendices C – G (if CH is listed in Appendix B).

No.	SPECIES	Scientific Name	Status	Region Affiliated	Avoidance mapped
70	Vail Lake Ceanothus	<a href="#"><i>Ceanothus ophiochilus</i></a>	T	8	Yes
71	Warner Sucker	<a href="#"><i>Catostomus warnerensis</i></a>	T, CH	1	Yes
72	Yaqui Catfish	<a href="#"><i>Ictalurus pricei</i></a>	T	2	Yes
73	Yaqui Chub	<a href="#"><i>Gila purpurea</i></a>	E	2	Yes

## Consultation Methodology

This consultation is programmatic in scope and addresses impacts to 73 species found on or immediately adjacent to USFS lands (see Table 3). The consultation addresses the Forest Service’s use of the aerial application of fire retardants which contain ammonium salts on National Forest lands throughout the United States where fire retardants are used.

The Washington Office of the USFWS worked closely with the national office of the USFS to develop a national programmatic Biological Assessment (BA). This BA established the programmatic framework within which the USFS intends to implement the aerial application of fire retardant.

As a part of this framework, the USFS stated its intention to map and establish “avoidance zones” on National Forest lands around sensitive areas such as those containing listed species likely to be adversely affected or designated critical habitat likely to be adversely modified by fire retardant chemicals in order to avoid or reduce the likelihood of exposing these species to these chemicals. Within these avoidance zones they propose to not drop fire retardant chemicals except in cases where the Incident Commander deems it necessary to protect human life. Water may be used to fight fires within avoidance zones.

Mapping took place at the local Forest unit. The local Forest units contacted the Service’s Field Offices for technical assistance during this effort. Then, upon initiation of formal consultation, the Forest unit consulted with the corresponding Field and/or Regional Office of the Service on that local Forest’s plans to use fire retardant, including that Forest’s avoidance zones (if maps were not available, textual descriptions were used) and any other proposed minimization measures to reduce the potential impacts to threatened and endangered species, as described in the BA.

We structured our analysis so that the effects of the aerial application of fire retardant, including potential misapplications, would be analyzed first at the local level by local consultation between the Forest unit and the corresponding USFWS Field Office, as mentioned above.

However, because some species have ranges that overlap Field Offices, or even Regions, an additional analysis was conducted by the USFWS Office which has the recovery lead for that

species. For those wide-ranging species, a biologist with Section 7 experience from the lead recovery office was designated to coordinate with each Field and/or Regional Office that analyzed the effects of the proposed action at the local level. In this manner, the effects of the action were analyzed on a local Forest-specific basis; then the range-wide effects were analyzed by incorporating all of the local analyses in order to make a Jeopardy/Adverse Modification determination for each species.

Once we initiated formal consultation, the Regions and Field Offices addressed the following components and delivered them to the USFWS Washington Office:

- (1) An effects analysis of the local Forest's proposed use of fire retardant, with any additional conservation measures that may be needed at the local level. The local Forest's proposed action tiered off of the USFS's national BA and included that Forest's exclusion zone maps and any other locally relevant issues and information;
- (2) A Jeopardy/Adverse Modification recommendation for each species, with RPAs, if necessary. This recommendation reflected the range-wide analysis of effects, as referenced above;
- (3) Incidental Take Statements (ITS) for each species, which were divided between all of the relevant Forests.

## ***Effects of the Action***

The proposed action includes the USFS application and use of nine approved long-term retardants that do not contain sodium ferrocyanide (YPS) on USFS land. The trade names of the nine retardants are: Phos-Chek D75-R<sup>†</sup>, D75-F<sup>1</sup>, G75-F<sup>1</sup>, G75-W<sup>1</sup>, 259-F, LC-95A-R, LC-95-W, LC-95AF, and P100-F. Since Phos-Chek does not contain YPS, the constituents of the different formulations that could cause toxicity are different ammonia formulations (diammonium sulfate, etc.), nitrates/nitrites, guar gum (<10 percent of the total composition), performance additives (proprietary information, but could include surfactants), clay, and iron oxide or other coloring agents. Most scientific studies of Phos-Chek have focused on the function of ammonia as the potentially toxic agent. The Phos-Chek retardants in this consultation do not list nitrates or nitrites in their ingredient list, but MacDonald et al. (1995) found nitrate-nitrogen concentrations from 0.41-0.88 mg/L (ppm; the range is from soft to hard water) and nitrite-nitrogen concentrations from 0.2-0.22 mg/L. Performance additives constitute up to 10 percent of the total composition when it is used. Clay is used as a thickening agent in these long-term retardants and constitutes less than 5 percent of the total composition when it is used. Coloring agents typically comprise less than 5 percent of the

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<sup>†</sup> These retardants are being phased out and are no longer being manufactured; current stocks will be applied during fire season 2011, and no new product will be acquired in the future starting with fire season 2012 (Henderson 2011). Calculations for N and P concentrations were completed by Johnson (2010). They are included in this table to provide comparisons for past scientific research studies reported in this analysis (Johnson 2010).

total composition when it is used. No toxicity information is available for guar gum, performance additives, clay, or coloring agents. These ingredients may have toxic potential.

These retardants are released into the environment by helicopters or airplanes. Listed terrestrial and aquatic species and habitats are buffered by an aerial retardant avoidance zone to minimize the risk of exposure to fire retardant. Buffers are sized appropriately to minimize the risk of exposure given a peripheral intrusion (minimum buffer distance = 300 feet), and take into account topography, average wind speeds, species sensitivity, and likely modes of retardant intrusion, which as described in the proposed action are accidental delivery, drift, and surface run-off.

Accidental delivery is an application of retardant into an area that does not follow the exceptions outlined in the “Guidelines for Aerial Delivery of Retardant or Foam near Waterways.” Of the three examples listed above, accidental delivery into a waterway or a terrestrial exclusion area would result in the largest amount of retardant exposure for sensitive species and habitats, and therefore has the highest potential for adverse effects to sensitive organisms. Several laboratory studies concluded that the exposure of fish and other aquatic organisms to ammonia can result in mortality (Little and Calfee 2000, 2004, and 2005, Buhl and Hamilton 2000). Gaikowski et al. (1996) studied Phos-Chek D75-F and concluded that if we consider the concentration of the retardants used in field mixtures, which is much higher than the lab studies, an accidental spill in a waterway would lead to substantial mortality. We recognize that there are two types of accidental delivery: type 1 is associated with pilot error in honoring the avoidance zone (e.g., cessation of application is slightly late or resuming applications begins slightly early), and type 2 is a pilot or mechanical error that can occur in any airspace. Risk of exposure of a sensitive habitat/species to retardant as a result of a type 1 accidental delivery is correlated to buffer size, and therefore can be managed by increasing the distance between those areas and the buffer edge. Risk of exposure for type 2 errors is not correlated with the size of buffers (i.e., buffers cannot decrease this risk); however, risk of exposure of sensitive habitats/species to retardant as a result of type 2 accidental delivery is positively correlated to frequency of use. As use decreases, so does risk of type 2 exposure occurring. The amount of retardant dropped as a result of a type 1 accidental delivery is substantially lower than that associated with a type 2 accidental delivery (i.e., only a small portion of retardant would be delivered with type 1, vs. a possibly full load with type 2). Other factors should be considered when analyzing the possible adverse effects of an accidental delivery, as discussed below.

Drift occurs after the retardant has been released from the aircraft and wind directs particles of the retardant into a waterway or terrestrial exclusion area. Environmental conditions such as wind direction and speed are evaluated as part of the “Guidelines for Aerial Delivery of Retardant or Foam near Waterways” when retardant drops occur beyond the 300+ foot buffer. Risk of exposure of a sensitive habitat/species to retardant as a result of drift outside of the buffer is correlated to buffer size, and therefore can be managed by increasing the distance between those areas and the buffer edge. However, drift from an accidental retardant drop within the 300+ foot buffer (but outside of a waterway or sensitive habitat) should also be considered. The effect of drift is not as significant to aquatic organisms as accidental delivery but adverse effects such as mortality could occur. Several environmental factors such as wind speed and direction, amount of retardant dropped from the aircraft, topography, the type of

waterway (pond vs. stream), and dilution should be considered when analyzing the level of toxicity in a waterway.

Surface run-off occurs after the retardant is applied to the ground outside of the 300+ foot waterway buffer or terrestrial exclusion area and is carried into the avoidance zone by stormwater runoff. Retardant applied outside of the 300+ foot waterway buffer or terrestrial exclusion area may have adverse effects to sensitive organisms; however, the level of toxicity depends on the surface or soil type (rock, sand, soils with high or low organic matter, etc), persistence in the environment, timing of a rainfall event, and the amount of retardant on the ground. Little and Calfee (2005) found that the substrate upon which the chemicals are applied are important when assessing the resultant environmental persistence. In a study where fire chemicals were weathered on non-porous surfaces at recommended application levels, fire retardants remained toxic for more than 21 days. Additional tests showed the persistence of toxicity was dependent on soil type and quality and that toxicity was often eliminated on soils with high organic content (Little and Calfee 2002). Although the highest toxicity was in formulations that included cyanide, fire retardants caused up to 20% mortality in fathead minnows, depending on soil surface, after 21 days of weathering (Little and Calfee 2002). Because of the large area covered by the proposed action, it is likely that various soil types, and therefore various toxicities, will result from the proposed action. Risk of exposure of a sensitive habitat/species to retardant as a result of surface run-off is correlated to buffer size, and therefore can be managed by increasing the distance between those areas and the buffer edge.

## **Aquatic**

### **Effects to Fish**

The following discussion includes the possible effects to fish after the retardant has entered a waterway. The delivery of retardant (from accidental delivery, drift, or surface run-off) into a waterway occupied by threatened and endangered fish species can cause mortality by exposing fish to ammonia (Little and Calfee 2000, 2004, and 2005, Buhl and Hamilton 2000). Fish may avoid chemicals as they enter a waterbody, as has been documented in recent studies. Little et al. (2006) studied the avoidance/attractance behavior of rainbow trout to Phos-Chek D75-R and found that avoidance of the retardant was significant at low concentrations and that the magnitude of rainbow trout avoidance response also showed an increase with an increase of the D75-R concentration. The study concluded that when rainbow trout were presented with a choice between the treated (D75-R) and untreated water the trout were able to detect and avoid the contaminated water (Little et al. 2006). The interpretation of these avoidance tests should consider field variables such as water temperature, water quality, pH, hardness, and dissolved carbon content, which can influence the response by altering the sensory stimuli of the chemical substance (Little et al. 2006). Although avoidance of the retardant is possible in flowing streams, avoidance may not be possible in bodies of water where there is no running water.

Avoidance of retardant chemicals is possible when drift occurs but is less likely with accidental delivery into a waterway. Both scenarios must consider the amount of retardant dropped from the aircraft, the height at which the retardant was dropped, the wind direction



and speed, and size of the waterbody in order to make an appropriate effects determinations as these factors play a significant role in determining the level of toxicity and the potential dilution factor in a waterbody. In most cases, fish may be able to detect and avoid ammonia in a waterway as a result from drift but given the environmental variables specific to each waterway the potential for mortality still exists. On the other hand, accidental delivery of retardants into a waterway could account for greater than 800 gallons of retardant per second (in medium to heavy fuel types) being released from the aircraft. In this circumstance, avoidance behavior of fish may be more effective downstream but the initial drop site will result in mortality. The level of mortality downstream is uncertain and will depend on the field variables mentioned above and the type of waterbody that is affected.

The delivery of retardant outside the 300+ foot buffer of a waterway (except for drift mentioned above) will not cause adverse effects to fish; should additional buffer size be required due to environmental or circumstantial factors, it is noted in the project description. However, effects from ammonia are likely to result from surface run-off during a rainfall event. As stated above, Little and Calfee (2002) found that on a non-porous surface fire retardants remained toxic for more than 21 days. Again the environmental factors such as surface or soil type (rock, sand, soils with high or low organic matter, etc), persistence in the environment, timing of a rainfall event, and the amount of retardant on the ground play a significant role in determining adverse effects to fish. While Little et al. (2006) determined that rainbow trout may avoid D75-R contaminated water; it is not clear how other fish species will react to such contamination. Given the significant morphological differences of Arizona native fish species to rainbow trout, the number of field variables that may influence response behavior, as well as the effects of fire within the watershed (input of ash that clogs gill membranes, increased turbidity, and stream temperature, and obstruction of water flow by addition of debris) that could cause disruptions in aquatic habitats (Little et al. 2006), we cannot be certain that the avoidance behaviors to the Phos-Chek retardants demonstrated by rainbow trout will effectively reduce or preclude mortality in Arizona native fish species, particularly those in pools or tanks. Also if there is run-off, it may reconnect intermittent streams and provide significant dilution. In rough water, aeration may also help to reduce ammonia levels during the flooding event.

### **Effects to Algae and Benthic Macroinvertebrates**

Algae and benthic macroinvertebrates are important because of the role each plays (primarily as food sources to other organisms) in the aquatic ecosystem. Model organisms are commonly used in toxicity studies. Organisms used as models easily reproduce in the laboratory, are easy to manipulate and count, and are representative of their ecological niche. *Daphnia magna*, an aquatic macroinvertebrate, *Hyalella azteca*, a benthic macroinvertebrate, and *Selenastrum capricornutum*, an alga, were used in some toxicity studies on long-term retardants. Daphnids are invertebrates that live in the water column and feed on primary producers such as algae and bacteria. *Hyalella azteca* is an amphipod that primarily lives in the surface of freshwater sediments. An algal model is useful because it represents the base of the aquatic food web.

One study was conducted using the indigenous aquatic invertebrates which would only be found in Arizona in perennial waters. Mayflies (*Epeorus (Iron) albertae*) were consistently

more sensitive to Phos-Chek D75-F than stoneflies (*Hesperoperla pacifica*) (Poulton et al. 1997). The  $LC_{50}^{\ddagger}$  for mayflies exposed to Phos-Chek D75-F for 3 hours was 1,033 mg/L (Poulton et al. 1997). This concentration is similar to the field concentration that would result from drift or run-off but is almost 10 times lower than the concentration expected if an accidental drop occurred. Mayflies were less sensitive to Phos-Chek D75-F when compared to trout or fathead minnows (Poulton et al. 1997). It is possible that in Arizona's streams, Phos-Chek D75-F would be more directly toxic to fishes than to the fish food items, such as mayflies.

Most toxicity studies have been conducted with Phos-chek D75-F. This formulation is only one of the eight formulations being considered in this consultation; wide variation may exist between the toxicity of the D75-F formulation and the other formulations.

Water hardness can alter the toxicity of the Phos-Chek formulations. The toxicity of Phos-Chek D75-F was increased in soft water compared to hard water (MacDonald et al. 1995, Poulton et al. 1997). Water hardness ( $CaCO_3$ ) on Forest Service lands in Arizona range from 96-150 mg/L near the Coronado National Forest (USGS gauge on the Santa Cruz near Nogales) to 580-1,200 mg/L near the Kaibab National Forest (USGS gauge at Kanab Creek near Fredonia) (USGS 2008).

The most toxic portion of the long-term retardants like Phos-Chek is ammonia (MacDonald et al. 1995). Un-ionized ammonia is more toxic to aquatic organisms than total ammonia (MacDonald et al. 1995, Poulton et al. 1997). Nitrates and nitrites could contribute to the toxicity of long-term retardants, but did not appear to influence the toxicity of Phos-Chek D75-F to daphnids. MacDonald et al. (1995) found that nitrate-nitrogen concentrations in the Phos-Chek toxicity tests were 75-160 times less than those reported to be toxic to freshwater invertebrates. Nitrite-nitrogen concentrations in a Phos-Chek D75-F toxicity study on crayfish were also 30 times less than the crayfish 96-hour  $LC_{50}$  (Gutzmer and Tomasso 1985).

EPA (1986) reported that macroinvertebrates are more tolerant to ammonia than fish. Also, toxicity to ammonia is species-specific for invertebrates. In their toxicity studies with Phos-Chek D75-F, MacDonald et al. (1995) found that their un-ionized ammonia concentrations were lower than toxic concentrations reported in other studies. They believed that other constituents (such as some of the proprietary chemicals) contributed to the toxicity they observed.

Ammonia toxicity to plants is influenced by pH. At neutral pH, Phos-Chek D75-F formed little un-ionized ammonia. Therefore, MacDonald et al. (1995) concluded that some factor other than ammonia influenced its toxicity. Although little un-ionized ammonia was formed during the Phos-Chek D75-F toxicity tests to *Daphnia*, concentrations of un-ionized ammonia were still greater than the EPA recommended concentration of 0.02 mg/L below which all aquatic life may be protected (MacDonald et al. 1995). For only Phos-Chek D75-F, nitrate and nitrite concentrations are not toxic to aquatic invertebrates.

Phos-Chek D75-F exposures to mayflies, stoneflies, trout, *Daphnia*, and fathead minnows indicated that mayflies and stoneflies were much less sensitive to Phos-Chek when compared

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<sup>‡</sup>  $LC_{50}$  – is the concentration lethal to 50% of the test organisms.



to the trout (Poulton et al. 1997). This study was conducted using stream water in Nevada in both a mobile laboratory and an artificial channel to more accurately assess real-world conditions. Two in-stream exposures were also conducted. Macroinvertebrate species may respond to disturbance by allowing themselves to enter the water column and “drifting” away from the disturbance. In this study, in-stream “drift” response after exposure to Phos-Chek D75-F was measured on five invertebrate taxa. Taxa richness and total number of organisms in the drift was low during the 30 minutes prior to the exposures and increased during the 30 minute period of the dose (Poulton et al. 1997). Drift of Ephemeroptera, Plecoptera, and Trichoptera during the first Phos-Chek D75-F exposure period returned to zero at the lower dose but did not return to zero in the second exposure at the higher dose (Poulton et al. 1997). Given these results and the unknown toxicity of the other 7 Phos-Chek formulations, adverse effects are likely to result from 660 mg/L Phos-Chek D75-F in stream systems (Poulton et al. 1997). This dose was comparable to the concentration expected from a surface run-off event.

The rate of Phos-Chek degradation in-stream was accelerated in areas with elevated organic matter (Poulton et al. 1997). Half-life for long-term fire retardants in-stream was 14 to 22 days. In the in-stream test, nitrates were elevated after Phos-Chek D75-F exposure when compared with controls, but not above toxic concentrations and ammonia concentrations were not elevated (Poulton et al. 1997). Overall, Poulton et al. (1997) determined that Phos-Chek D75-F is not highly mobile.

### **Trophic Interaction**

The ammonia component in long-term fire retardants may cause an increase in primary producers which would benefit primary consumers. However, other components of long-term fire retardants could produce toxic effects to primary consumers. Or, for example, since algae appeared to be more sensitive to long-term fire retardants, daphnids could suffer from a poor quality food source at lower concentrations than were directly toxic to the daphnids (MacDonald et al. 1995). Although the exact species used in these toxicity studies may or may not be present in Arizona, adverse effects of long-term retardant chemicals such as Phos-Chek D75-F on primary producers and on aquatic invertebrates in the ecosystem could lead to altered biodiversity and shifts in trophic dynamics (MacDonald et al. 1995).

### **Other Considerations**

There are many variables present in field applications of long-term fire retardants (temperature, wind speed and direction, relative humidity, etc.) that may influence the delivery of the retardant to its target. However, it must be noted that the concentrations of Phos-Chek D75-F used in toxicity studies were substantially lower (500 times in *Daphnia* studies and 3,000 times in algae studies) than the field concentrations.

Discussion. As described above, aquatic systems and species have been subjected to a number of studies and have identified acute toxic effects to a number of fish species and to aquatic invertebrates as a result of exposure to ammonium compounds. Ultimately, toxicity to aquatic organisms in the field is dependent upon the inherent sensitivity of the species and the concentration of ammonia in the water. Though concentrations in waterbodies will vary with

the circumstances of the individual application and the environmental factors of the site, aquatic die-offs documented from previous use of retardants considered in this assessment demonstrate that concentrations of these compounds can reach levels high enough to cause acute toxicity. We can generally predict that ammonia concentrations following an application will be greater in small waterbodies and waterbodies with low or no flow, where dilution and dissipation will be reduced. This is demonstrated in the risk assessment prepared by Labat Environmental (2007), which predicted increased risk to sensitive amphibian and fish species in small streams as compared to large streams. Threatened and endangered species that inhabit these vulnerable habitats thus will experience increased risk of acute toxicity.

Little attention has been paid to the indirect effects of these chemicals. For example, Wells et al. (2004) comments that while the avoidance behavior demonstrated by fish may be advantageous in the short term, it may also result in displacement of fish into less advantageous areas and may also disrupt essential migratory behaviors and could affect the stability of viable populations of these species. In some cases, there is little or no area for the fish to swim away. For example, the Kendall Warm Springs dace (*Rhinichthys osculus thermalis*) is limited to one small stream approximately 328 yards (300 meters) in length that originates at a series of thermal springs near the base of a bluff in Sublette County, Wyoming and exists nowhere else. In the case of a misapplication of retardant into these areas, it is unlikely that the dace would be able to avoid the exposure.

Species with limited mobility have no such avoidance capability. Augsperger et al., (2003) concluded that freshwater mussels are particularly sensitive to exposure to ammonia. The Aquatics Report and Biological Evaluation cites studies (Hermanutz et al., 1987) showing that macroinvertebrate species respond to physical disturbance by entering drift, thereby being carried downstream of the disturbance, but such behavior does not occur in adult mussels. Adult mussels are filter feeders that attach themselves to aquatic substrates and siphon food and oxygen from the water column and interstitial spaces (“pores”) between sediment particles, and cannot exhibit the avoidance behaviors such as swimming or drifting away, as mentioned above. In fact, Augsperger et al., (2003) state that ammonia levels are a limiting factor in the survival of these species and also note that the ammonia concentrations within the sediment pores is typically higher than the overlying water. Entry of ammonia into waterways containing these species could have a severe effect.

Little and Calfee (2002b) stated that “rainwater runoff from watersheds treated with recommended mixed retardant concentrations may pose environmental hazard for weeks after application.” A rain event during this time could expose aquatic organisms to potentially lethal levels of ammonia. They also found that the level of toxicity was highly dependant upon the presence of organic content. Substrates with high organic content virtually eliminated toxicity, whereas retardant dropped on those with little or no organic content such as sand or gravel maintained their toxicity for an extended period. This same study also found that the responses of subject fish exposed to ammonia concentrations in aqueous D75-R solutions were within the lethal range after 7 days of weathering but declined to sublethal concentrations thereafter. These results suggest that the decomposition of D75-R occurs after 7 days of weathering.” This suggests that at least under some conditions, the ammonia concentration from fire retardant in water can remain toxic to fish even after seven days.

We agree that the 2011 Guidelines are a useful tool in minimizing impacts to aquatic species due to the application of fire retardant, although their use does not guarantee that no impacts will occur. For example, the 2000 Guidelines direct pilots to avoid visible water. However, small streams, streams underneath tree canopies or seasonal bodies of water such as vernal pools could be have retardant dropped into them simply because the pilot was unable to see them, especially under smoky conditions. As NMFS pointed out in their 2007 biological opinion, such an accidental application would be unexpected and therefore, unlikely to be reported or monitored. The 2011 guidelines have been updated to instruct pilots to avoid any areas that exhibit riparian vegetation, even if no water is visible.

## **Terrestrial**

Among taxonomic groups, little seems to be known about the direct and indirect effects of the use of aerial fire retardant on most terrestrial species. Only a few studies have investigated the direct impacts on terrestrial systems (Poulton, B. et al., 1997; Bell, 2003; Hopmans and Bickford 2003; Dodge, M., 1970) and almost none have evaluated any indirect effects. A few studies have shown indirect effects (e.g., nitrate poisoning or behavioral disruption) to some aquatic organisms (see discussion and citations above) and domestic livestock (Dodge, M., 1970). Parallels to the findings of any of these studies are difficult given the differing biological and ecological processes and requirements of widely divergent species. Based upon what information does exist, it would be reasonable to assume that the use of fire retardant would not have large scale direct effects to most terrestrial species and therefore would not contribute to jeopardy of these species. However, as discussed below, our analysis focused on specific taxonomic groups that appeared to be at some risk from the use of retardants.

## **Effects to Mammals**

Herbivores, and particularly ruminants, may be indirectly exposed to nitrate poisoning, due to feeding on plants with elevated levels of nitrate within plant tissues (Dodge, M., 1970). However, the literature suggests that a variety of factors must converge simultaneously for this to happen.

## **Effects to Plants**

Labat Environmental (2007) noted that previous studies in both North America and Australia had found a change in species richness after exposure to long-term fire retardant. Particularly, Labat noted that: —in the North Dakota prairie ecosystem, species richness was reduced in plots exposed to both retardant and foam regardless of whether the plot was burned or unburned. All plots were dominated by *Poa pratensis*, which clearly gained a competitive advantage from retardant application and crowded out other species. Investigations in the Great Basin shrub steppe ecosystem also showed that plots treated with fire chemicals experienced initial declines in species richness; however, differences among plots were undetectable after a year. Depression of species richness was most pronounced in the riparian corridor.” Additionally, two studies (Larson and Duncan, 1982; Bradstock et al., 1987) have shown short-term leaf death and mortality in leguminous shrubs and forbs after retardant application.

Indirectly, retardant can affect plant communities and rare plants by facilitating the invasion of non-native species (Bell 2003, Larson and Newton 1996). Retardant application can also

affect plant communities and rare plants indirectly by attracting more herbivore and browsers to an application site (Larson and Duncan 1982), presumably because of the increased quality of the forage or an increase of biomass. Increases in biomass (Bell 2003, Larson and Newton 1996, Larson and Duncan 1982), and decreased plant diversity (Larson and Newton 1996, Bradstock et al 1987) have also been noted in the literature but these effects may only last for one year (Bell 2003, Larson and Newton 1996). Labat Environmental (2007) also stated that –similar to the effects of fertilizers, fire retardants may encourage growth of some plant species and giving them a competitive advantage over others, thus resulting in changes in community composition and species diversity (Tilman 1987, Wilson and Shay 1990). Bell et al. (2005) recorded enhanced weed invasion in an Australian heathland ecosystem, particularly in areas receiving high concentrations of Phos-Chek D75R.”

This is of concern because invasion of non-native weeds is the most likely effect of the use of fire retardant on threatened or endangered plants. While those plant species that are widely distributed are not likely to be jeopardized by the application of retardant on a single fire, of greatest concern are those plants which are considered –narrow endemics,” that is, species that occupy a small geographic area and nowhere else.

## ***Determinations***

The following evaluations have been collated from USFWS Regional and Field offices. They are presented by region (Regions 1-6, and 8) and each include a species-specific effects analysis (both local and range-wide), a jeopardy analysis, and reasonable and prudent measures. Alaska (Region 7) had no listed or proposed species or critical habitat that was likely to be adversely affected. Please note that actual species ranges could extend across regions, but the list of determinations as presented is by the region that had lead for that species (please reference the consultation methodology section).

### **Region 1 Pacific Northwest: Idaho, Oregon, and Washington**

*Lead for eight (8) Species*

#### **Bull Trout (*Salvelinus confluentus*) and Critical Habitat**

*Species Lead:* Pam Druliner, Idaho Fish and Wildlife Office; ph. (208) 378-5348

For a description of the bull trout biology, life history, habitat requirements, and links to the federal register listing notice, go to:

<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E065>

For information regarding critical habitat, including links to the federal register notice, core area descriptions and recovery planning go to: <http://www.fws.gov/pacific/bulltrout/>

### Environmental Baseline

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of state and private actions which are contemporaneous with this consultation.

### Status of Species and Factors Affecting the Species Environment within the Action Area

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon, the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound, east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, and east of the Continental Divide in northwestern Montana (Cavender 1978; Bond 1992; Brewin and Brewin 1997; Leary and Allendorf 1997). The Service completed a 5-year Review in 2008 and concluded that the bull trout should remain listed as threatened (Fish and Wildlife Service 2008a).

Because the action area for this proposed action is so large, covering the range of the species in the coterminous listing, and local populations of bull trout are numerous and difficult to quantify at this scale, the Service relies on the description of core areas and population status from the Bull Trout Status Review conducted in 2008 (Fish and Wildlife Service 2008a) to describe the environmental baseline of bull trout in the action area. The Service does not know of any significant changes to the information provided in the 2008 review at this time that would change this baseline.

Additional information regarding bull trout core areas, including descriptions, local populations, risk assessments, and threats, can be found at <http://www.fws.gov/pacific/bulltrout/Recovery.html> and <http://www.fws.gov/pacific/bulltrout/5yrreview.html>.

The model used to rank the relative risk to bull trout integrates four factors: population abundance, distribution, population trend, and threats. Details of the methodology, data, and results of the assessment are found in Fish and Wildlife Service 2005b and Fish and Wildlife Service 2005a. In addition, the assessment includes an evaluation of the life history composition and level of connectivity within each core area and the level of connectivity among core areas and Canada. Of the 121 core areas comprising the coterminous listing, 43 are at high risk of extirpation, 44 are at risk, 28 are at potential risk, 4 are at low risk and 2 are of unknown status (Fish and Wildlife Service 2008a).

Not all core areas will be affected by the proposed action. The action area for this proposed action includes 27 national forests on which the aerial use of fire retardant may adversely affect bull trout or bull trout critical habitat, including forests in Montana, Nevada, Idaho,

California, Washington and Oregon. These national forests contain all or portions of 97 of the 121 bull trout core areas. All life history forms of bull trout are known to occur in the action area.

**Table 4. Bull Trout Core Area Per Forest**

<b>Core Area</b>	<b>Acres</b>	<b>Forest</b>	<b>Acres of Forest in Core Area</b>	<b>% Core Area in Forest</b>
Upper Klamath Lake	420,665	Fremont-Winema	226,081	54
Upper Sprague River	206,807	Fremont-Winema	181,926	88
Sycan River	202,049	Fremont-Winema	155,084	77
Methow River	1,374,200	Okanogan-Wenatchee	1,188,845	87
Entiat River	336,988	Okanogan-Wenatchee	269,392	80
Upper Skagit River	464,094	Okanogan-Wenatchee	199,142	43
Yakima River	3,923,894	Okanogan-Wenatchee	1,037,136	26
Wenatchee River	877,172	Okanogan-Wenatchee	787,307	90
Lower Skagit River	1,377,372	Mt. Baker-Snoqualmie	726,208	53
Chester Morse Lake	52,309	Mt. Baker – Snoqualmie	52,155	100
Stillaguamish	450,870	Mt. Baker-Snoqualmie	178,367	40
Chilliwack River	152,822	Mt. Baker-Snoqualmie	41,621	27
Nooksack River	499,318	Mt. Baker-Snoqualmie	165,792	33
Snohomish &	1,171,243	Mt. Baker –	525,474	45

<b>Core Area</b>	<b>Acres</b>	<b>Forest</b>	<b>Acres of Forest in Core Area</b>	<b>% Core Area in Forest</b>
Skykomish Rivers		Snoqualmie		
Puyallup River	663,536	Mt. Baker-Snoqualmie	169,694	26
		Gifford Pinchot	4,672	1
Lewis River	530,689	Gifford Pinchot	347,227	65
Queets River	288,144	Olympic	45,864	16
Dungeness River	130,824	Olympic	55,972	43
Quinault River	279,477	Olympic	42,342	15
Skokomish River	152,816	Olympic	80,405	53
Elwha River	205,551	Olympic	11,176	5
Malheur River	1,569,703	Malheur	378,190	24
Hood River	217,296	Mt. Hood	131,461	60
Imnaha River	534,022	Wallowa-Whitman	424,320	78
Little Minam River	18,990	Wallowa-Whitman	18,990	100
Powder River	1,089,944	Wallowa-Whitman	371,637	34
North Fork John Day River	1,179,629	Malheur	43,319	4
		Wallowa-Whitman	95,225	8
		Umatilla	616,138	52
Grande Ronde River	2,240,488	Wallowa-Whitman	752,791	34
		Umatilla	333,364	15
Touchet River	483,119	Umatilla	33,417	7



<b>Core Area</b>	<b>Acres</b>	<b>Forest</b>	<b>Acres of Forest in Core Area</b>	<b>% Core Area in Forest</b>
Umatilla River	1,606,457	Umatilla	199,638	12
Walla Walla River	640,247	Umatilla	71,645	11
Tucannon River	321,308	Umatilla	79,711	25
Asotin Creek	249,517	Umatilla	65,292	26
Upper Willamette River	1,732,532	Willamette	1,264,202	73
Lower Deschutes River	2,577,669	Ochoco	223,140	9
		Deschutes	264,154	10
		Mt. Hood	172,682	7
Lake Koocanusa	781,209	Kootenai	682,611	87
Bull Lake	126,545	Kootenai	109,348	86
Upper Stillwater Lake	82,086	Kootenai	39,308	48
		Flathead	12,942	16
Holland Lake	7,228	Flathead	7,227	100
Doctor Lake	9,389	Flathead	9,338	100
Flathead Lake	2,195,902	Flathead	1,142,801	52
Lindbergh Lake	25,762	Flathead	25,738	100
Hungry Horse Reservoir	1,000,808	Flathead	1,000,602	100
Cyclone Lake	6,619	Flathead	6,619	100
Swan Lake	435,875	Flathead	367,885	84
Big Salmon Lake	49,953	Flathead	49,953	100
Frozen lake	1,911	Flathead	1,904	100
Whitefish Lake	81,478	Flathead	7482	9



<b>Core Area</b>	<b>Acres</b>	<b>Forest</b>	<b>Acres of Forest in Core Area</b>	<b>% Core Area in Forest</b>
Sheep Creek	25,950	Nez Perce	25,950	100
Lake Pend Oreille	1,138,718	Idaho Panhandle	526,871	46
Pend Oreille River	674,669	Idaho Panhandle	4,612	1
		Colville	547,309	81
Priest Lakes	376,576	Idaho Panhandle	239,463	64
Kootenai River	1,759,936	Idaho Panhandle	482,326	27
		Kootenai	890,507	51
Lower Clark Fork River	2,643,206	Idaho Panhandle	11,166	1
		Kootenai	493,033	16
		Lolo	553,238	21
		Flathead	8,845	1
Upper Clark Fork River	1,790,008	Helena	112,608	6
		Bitterroot	14	0
		Lolo	87,100	5
		Beaverhead-Deerlodge	493,375	28
Rock Creek	568,306	Lolo	191,884	34
		Beaverhead-Deerlodge	289,107	51
Clearwater River & Lakes	211,111	Lolo	176,714	84
West Fork Bitterroot	201,290	Bitterroot	197,325	98
Bitterroot River	1,624,051	Lolo	196,532	12
		Bitterroot	993,300	61

<b>Core Area</b>	<b>Acres</b>	<b>Forest</b>	<b>Acres of Forest in Core Area</b>	<b>% Core Area in Forest</b>
Pine Indian & Wildhorse Creeks	423,341	Payette National Forest	153,162	36
		Wallowa-Whitman	145,912	34
Selway River	1,283,557	Bitterroot	387,911	30
		Clearwater	25,357	2
		Nez Perce	870,145	68
Upper Salmon River	1,554,606	Sawtooth	571,312	37
		Salmon-Challis	537,390	35
Middle Fork Salmon River	1,839,244	Boise	156,249	9
		Salmon-Challis	1,330,432	72
		Payette	424,162	2
Middle Salmon River-Panther	1,376,845	Bitterroot	23,024	2
		Payette	61,552	5
		Salmon-Challis	1,122,415	82
Middle Salmon River-Chamberlain	866,611	Bitterroot	56,326	7
		Payette	386,840	45
		Nez Perce	411,631	48
Little-Lower Salmon River	1,124,731	Payette	273,769	24
		Nez Perce	273,370	24
South Fork Salmon River	835,583	Boise	257,310	31
		Payette	576,924	69
Lake Creek	11,245	Salmon-Challis	10,893	97
Pahsimeroi River	536,793	Salmon-Challis	247,886	46

<b>Core Area</b>	<b>Acres</b>	<b>Forest</b>	<b>Acres of Forest in Core Area</b>	<b>% Core Area in Forest</b>
Little Lost River	609,877	Salmon-Challis	266,734	44
Lemhi River	807,844	Salmon-Challis	322,888	40
Opal Lake	1,277	Salmon-Challis	1,277	100
Middle-Lower Clearwater River	1,638,860	Clearwater	156,768	10
		Nez Perce	57,242	4
South Fork Clearwater	755,776	Nez Perce	528,358	70
Fish Lake (North Fork Clearwater River)	3,586	Clearwater	3,580	100
North Fork Clearwater River	1,559,416	Clearwater	890,313	57
		Idaho Panhandle	175,631	11
Lochsa River	751,402	Clearwater	750,331	99.9
		Nez Perce	1,047	0.1
Fish Lake (Lochsa River)	5,104	Clearwater	5,021	98
		Nez Perce	83	2
Granite Creek	21,434	Payette	6,939	32
		Nez Perce	14,502	68
Weiser River	606,723	Payette	321,036	53
North Fork Payette River	395,157	Boise	55,434	14
		Payette	150,525	38
Middle Fork Payette River	218,470	Boise	193,140	88
Arrowrock Reservoir	780,369	Boise	691,315	89

Core Area	Acres	Forest	Acres of Forest in Core Area	% Core Area in Forest
		Sawtooth	88,795	11
Lucky Peak Reservoir	301,906	Boise	279,078	92
Squaw Creek	218,195	Boise	90,537	42
Deadwood River	70,228	Boise	70,228	100
Anderson Ranch Reservoir	636,979	Boise	262,378	41
		Sawtooth	358,217	56
Jarbidge River	308,576	Humboldt-Toiyabe	86,034	28

Though wide ranging in parts of Oregon, Washington, Idaho, and Montana, bull trout in the interior Columbia River basin presently occur in only about 45 percent of the historical range (Quigley and Arbelbide 1997; Rieman et al. 1997). Declining trends due to the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment into diversion channels and dams, and introduced nonnative species (e.g., brook trout, *Salvelinus fontinalis*) have resulted in declines in range-wide bull trout distribution and abundance (Bond 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993; Newton and Pribyl 1994; Idaho Department of Fish and Game in litt. 1995). Several local extirpations have been reported, beginning in the 1950s (Rode 1990; Ratliff and Howell 1992; Donald and Alger 1993; Goetz 1994; Newton and Pribyl 1994; Berg and Priest 1995; Light et al. 1996; Buchanan and Gregory 1997). Land and water management activities such as dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development continue to degrade bull trout habitat and depress bull trout populations (Fish and Wildlife Service 2002a).

Changes in hydrology and temperature caused by changing climate have the potential to negatively impact aquatic ecosystems throughout the northwest, with salmonid fishes being especially sensitive. Average annual temperature increases due to increased carbon dioxide are affecting snowpack, peak runoff, and base flows of streams and rivers (Mote et al. 2003). Increases in water temperature may cause a shift in the thermal suitability of aquatic habitats (Poff et al. 2002). For species that require colder water temperatures to survive and reproduce, warmer temperatures are likely to lead to significant decreases in available suitable habitat. Increased frequency and severity of flood flows during winter can affect incubating eggs and alevins in the streambed and over-wintering juvenile fish. Eggs of fall spawning

fish, such as bull trout, may suffer high levels of mortality when exposed to increased flood flows (Independent Scientific Advisory Board 2007).

### *Bull Trout Critical Habitat*

#### Status of Bull Trout Critical Habitat and Factors Affecting Critical Habitat within the Action Area

The Service published a final rule designating critical habitat for bull trout rangewide on October 18, 2010 (effective November 17, 2010). The Service designated 32 Critical Habitat Units for bull trout in the final rule. The action area currently provides spawning and rearing habitat and foraging, migratory, and overwintering habitat. Table 5, below, shows the status of bull trout critical habitat on each of the National Forests considered as part of the action area for bull trout for this proposed action. Bull trout critical habitat on National Forests ranges from 1,856 miles on the Salmon-Challis National Forest to 25 miles on the Helena National Forest. For more information regarding bull trout critical habitat, assessments, and threats, see: <http://www.fws.gov/pacific/bulltrout/CriticalHabitat.html>

**Table 5. Summary of bull trout critical habitat on National Forests within the action area**

National Forest	Spawning & Rearing Critical Habitat (Miles)	FMO Habitat (Miles)	Total Critical Habitat (Miles)
Beaverhead-Deerlodge	161	2	163
Bitterroot	401	75	476
Boise	749	495	1,244
Clearwater	391	275	666
Colville	120	11	131
Deschutes	39	32	71
Flathead	400	233	633
Fremont-Winema	87	62	148
Gifford Pinchot	12	19	32
Helena	22	3	25
Humboldt-Toiyabe	31	20	50
Idaho Panhandle	427	217	645

National Forest	Spawning & Rearing Critical Habitat (Miles)	FMO Habitat (Miles)	Total Critical Habitat (Miles)
Kootenai	167	90	258
Lolo	358	161	519
Malheur National Forest	189	43	232
Mt Baker-Snoqualmie	380	72	452
Mt. Hood	14	28	42
Nez Perce	427	339	766
Ochoco	-	26	26
Okanogan-Wenatchee	667	140	807
Olympic	38	51	89
Payette	625	596	1,221
Salmon-Challis	1,348	508	1,856
Sawtooth	389	200	590
Umatilla	226	139	365
Wallowa-Whitman	446	255	700
Willamette	15	89	103

Habitat components that particularly influence bull trout distribution and abundance include water temperature, cover, channel form and stability, spawning and rearing substrate conditions, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Watson and Hillman 1997). Large patches of these components are necessary to support robust populations. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (63 FR 31647, June 10, 1998; 64

FR 17112, April 8, 1999). Climate change may exacerbate some of these impacts.

Essential to the conservation of the species, critical habitat for bull trout provides the following key features, which make up the primary constituent elements (PCEs): (1) Space

for individual and population growth and for normal behavior; (2) Food, water, air, light, minerals, or other nutritional or physiological requirements; (3) Cover or shelter; (4) Sites for breeding, reproduction, or rearing (or development) of offspring; and (5) Habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species.

### ***Beaverhead-Deerlodge National Forest***

The Beaverhead-Deerlodge National Forest (BDNF) is located in southwest Montana. It contains portions of two core areas Rock Creek (51% of the core area, or 289,107 acres) and Upper Clark Fork (28% of the core area, or 493,375 acres). The lower section of these core areas are shared with the Lolo National Forest. Within the BDNF portion of these core areas there are 7 local populations of bull trout. The BDNF contains 4,501 miles of stream, approximately 4.7% (210 miles) is occupied, and 3.6% (163 miles) is critical habitat.

While assessing the environmental baseline and effects to bull trout as a species, agency biologists concurrently provide a companion analysis of effects to the Primary Constituent Elements (PCEs) of bull trout critical habitat and related habitat indicators (see USDA 2008a). The majority of the matrix analysis consists of specific consideration of the 19 habitat indicators. Thus, analysis of the matrix habitat indicators provides a very thorough analysis of the existing habitat condition and impacts to bull trout habitat. Based on the site specific environmental baseline habitat conditions of bull trout and linkage to the PCEs and other factors as necessary, all PCEs in the action area are less than optimal condition. Based on the matrix crosswalk, at least one habitat indicator in each of the eight PCEs is rated as functioning at unacceptable risk (FUR).

There were 575 fires reported during the period from 2000-2010, with fire retardant dropped on the Forest 402 times during this period. Other factors influencing aquatic habitat and native fish populations that are within BDNF control includes timber management, road and trail management, livestock grazing, fish passage barriers, irrigation diversion, dispersed recreation sites, and riparian conditions. Mining activities can affect local habitat conditions. Other factors, such as non-native fish populations (brook and brown trout), land development, fishing pressure, and private land management, have a significant effect on aquatic resources throughout the action area. However, the Forest has limited control over these activities.

### ***Bitterroot National Forest***

The Bitterroot National Forest is located in Idaho and Montana. It contains all of the West Fork Bitterroot River core area (98% or 197,325 acres) and a large portion of the Bitterroot River core area (61% or 933,300 acres). The Bitterroot Forest contains 2,865 miles of streams 529 miles are occupied bull habitat and 419 miles are designated as critical habitat (spawning rearing 401 miles and foraging, migrating, and overwintering 75 miles).

The Bitterroot River critical habitat subunit (CHSU) is essential to bull trout conservation because it is one of several occupied major watersheds that form the headwaters of the Clark Fork River Basin CHU (Fish and Wildlife Service 2009). Though the migratory form of bull trout is seriously reduced in the Bitterroot River CHSU, an artificially adfluvial population occurs in the Painted Rocks Reservoir (West Fork Bitterroot River core area) at the head of the West Fork Bitterroot River and is relatively secure.

The Forest reviewed 74 sub-watersheds within the Forest boundary. Of these, 62 have at least one habitat indicator that is not functioning appropriately. Of the 62 sub-watersheds, 47 sub-watersheds are occupied by bull trout and have at least one of the four primary habitat indicators (barriers, sediment, temperature, pool frequency/quality) FUR or functioning acceptable risk. Of the 47 occupied sub-watersheds, 26 sub-watersheds contain critical habitat that supports 11 of the 14 local populations in the Bitterroot River and West Fork Bitterroot River Core Areas. At least one of the nine PCEs in each of these sub-watersheds is not fully supporting its recovery role. These sub-watersheds provide spawning, rearing, foraging, migratory, and overwintering habitats for the survival and recovery of the species.

There were 1,016 fires reported during the period from 2000-2010, with fire retardant dropped on the Forest 233 times during this period, which may indicate that fires are smaller and require less management than other dryer areas. Additional factors influencing aquatic habitat and bull trout recovery in the Bitterroot River and West Fork Bitterroot River core areas include recreational fishing, nonnative species, irrigation withdraws and forestry practices (i.e., sedimentation from roads) (Fish and Wildlife Service 2008a; MTDEQ 2005; Fish and Wildlife Service 2002f; Forest Service 2000; MBTSG 1995a).

### ***Boise National Forest***

The Boise National Forest is located in southwest Idaho. It contains portions of the following core areas: Anderson Ranch Reservoir (41% or 262,040 acres); the North Fork Payette (14% or 55,289 acres); Squaw Creek (41% or 90,303 acres); Upper South Fork Payette River (83% or 357,255 acres); Arrowrock Reservoir (89% or 690,181 acres); Middle Fork Salmon River (8% or 155,907 acres); South Fork Salmon River (31% or 256,685 acres); Middle Fork Payette (88%, or 192,691 acres); and the Deadwood River (100%, 70,068 acres). The Boise National Forest contains approximately 5,000 miles of streams of which 1,244 of which are designated as critical habitat (spawning rearing 749 miles and foraging, migrating, and overwintering 495 miles). There are 11,148 acres of reservoir and lake critical habitat on the Forest.

There were 1,495 fires reported during the period from 2000-2010, with fire retardant dropped on the Forest 750 drops times during this period. Factors affecting bull trout on the Boise National Forest include sedimentation due to roads from forestry, mining and recreation, livestock grazing in some watersheds, brook trout, angling, full and partial migration barriers including dams and culverts, and large transportation networks.



### ***Clearwater National Forest***

The Clearwater Forest is located in north central Idaho. There are 666 miles (representing approximately 16 percent of the total streams on the Forest) of bull trout streams on the Forest of which 391 miles are spawning and early rearing and 275 are foraging, migratory, and overwintering (FMO) habitat. These streams are distributed among five core areas: the North Fork Clearwater River, Fish Lake (North Fork Clearwater River), the Lochsa River, Fish Lake (Lochsa River), and the Middle Fork/Lower Clearwater River. There are 718 acres of lake critical habitat on the Forest.

There were 814 fires reported during the period from 2000-2010, with fire retardant dropped on the Forest 70 times during this period. Factors affecting bull trout on the Clearwater National Forest include sedimentation due to roads from forestry and mining, livestock grazing, brook trout, angling pressure (including hooking mortality and illegal harvest), migration barriers (including Dworshak Dam), and large transportation networks – including US Highway 12. Historically, adult bull trout routinely used the North Fork Clearwater River in the winter and early spring prior to ascending the river to spawning tributaries in the summer and fall. Dworshak Dam, constructed in 1971, isolated North Fork Clearwater River bull trout populations from other populations in the Clearwater recovery unit. Adult bull trout are now known to overwinter in Dworshak Reservoir and migrate upstream to spawning areas during the summer (Hanson et al. 2006); a once-fluvial population is now adfluvial. Brook trout are distributed throughout much of the forest and threaten bull trout through competition, hybridization and predation. Incidental angling pressure and illegal harvests are possible threats in this area.

### ***Colville National Forest***

The Colville National Forest contains 81% of the Pend Oreille River Core Area, or 547,309 acres of the core area. There are approximately 2,250 miles of perennial streams on the forest, of which 131 miles are designated critical habitat. Within the Northeast Washington Recovery/Management Unit, the Pend Oreille River is the only core area, with one extant local population (the LeClerc Creek complex). The Pend Oreille Core Area includes the Pend Oreille River from the Canadian Border to Albeni Falls Dam (Service 2002a). The Pend Oreille River supports FMO habitat, and spawning and rearing likely occurs in tributaries. The Pend Oreille Core area has been degraded through forest management, grazing, human-made fish passage barriers (such as culverts) on tributaries, non-native fish species introductions that compete with or prey on bull trout, existence of three hydroelectric facilities without fish passage and resultant fragmentation of populations, and changed hydrology due to management of dams and reservoirs (Fish and Wildlife Service 2002a).

The Clark Fork River Basin Critical Habitat Unit (CHU) includes habitat in western Montana, northern Idaho, and northeastern Washington (Fish and Wildlife Service 2010). The Clark Fork River Basin CHU includes 5,356.0 km (3,328.1 mi) of streams and 119,620.1 ha (295,586.6 ac) of lakes and reservoirs designated as critical habitat (FR:75:63942). The CHU includes 12 Critical Habitat Subunits (CHSU), one of which is the Lake Pend Oreille CHSU. The Lake Pend Oreille CHSU includes the Pend Oreille River from the crest of Boundary

Dam in Washington upstream to Lake Pend Oreille, and also includes the lower portion of the Priest River Drainage and portions of the Clark Fork River and tributaries. A total of 440 miles of stream/rivers and 82,980 acres of lake surface area are included in this CHSU (Fish and Wildlife Service 2010 p.835).

On the Colville National Forest, there are 131 miles of stream designated as critical habitat, and of those miles 120 miles are likely spawning/rearing habitat, and 11 miles FMO habitat (Druliner 2011 *in litt.*). Many of the subwatersheds have high road densities, and some subwatersheds have dams blocking fish passage (for example, Sullivan Creek). Road culverts also impair passage. Grazing has impacted riparian habitats in some subwatersheds, including LeClerc Creek, Ruby Creek, and Calispell Creek (FWS 2002a). Non-native species, including brook trout, brown trout, northern pike are an issue in the Pend Oreille River and some tributary streams (Fish and Wildlife Service 2002a).

The Colville National Forest has varying vegetation and supports both low-severity fire regime/dry forest types, and high-severity fire regime/cold moist forest types. Forest landscape structure and composition have been altered significantly due to management and fire exclusion in the low severity fire regime, changing from a frequent (<35 years) fire regime which maintained open, park-like stands on the majority of the landscape (Agee 1993, 1994; Everett et al. 2000, all cited in Catlin et al. 2005), to a forest composition with more shade-tolerant and fire-intolerant species with higher densities with multiple canopy layers. As a result, lethal crown fires are now possible in dry and mesic forests on the Colville National Forest. In the High severity fire regime/cold, moist forest type, the forest landscape structure and composition is less altered (Agee 1994). Historically, the cold, moist forest types within this regime underwent infrequent fires with return intervals usually greater than 100 years, and fires were typically intense and largely stand-replacing. Large severely burned patches of landscape were typical for lodgepole pine/subalpine fir forests (Agee 1993, 2002, cited in Catlin et al. 2005).

The Colville National Forest has a history of large fire activity that, to a general extent, reflects what has occurred throughout the Western United States. There have been a significant number of acres burned by large fires during the period of 1910-1940, relatively few large fires during the period 1940-1988, and a significant increase in large fire occurrence since 1988 (Catlin et al. 2005). The White Mountain fire (1988) burned over 20,000 acres, the Copper Butte fire (1994) burned approximately 8,000 acres; the Mount Leona fire (2001) burned over 6,000 acres, and the Togo fire (2003) burned over 5,000 acres. Fire suppression has allowed litter to build up, tree density to increase and fuels to increase greater than historically (Catlin et al. 2005). Fires that occur in such fuels are more intense and more difficult to control. Insect and disease-caused tree mortality increase the risk of fire and result in more high severity fires.

The Colville National Forest has moderately frequent fires; from the years 2000 to 2010 there were 531 fires, and 147 retardant drops (approximately 134 drops per 10 years; BA p. 239).

### ***Deschutes National Forest***

The Deschutes National Forest is located on the east slope of the Cascade Mountains in Central Oregon. This region is dominated by mixed conifer and ponderosa pine (*Pinus ponderosa*) forests at mid to lower elevations and by true fir forests at higher elevations. Forests in this region are highly fragmented due to logging and wildfires and a variety of natural factors (poor soils, lava flows, high fire frequencies, high elevation). Wildfires played a major role in shaping the forests of this region before large scale fire suppression. Fire suppression efforts in the last several decades have resulted in shifts in tree species composition and accumulations of fuel. These changes may have made forests more susceptible to uncharacteristic fires and large scale insect and disease outbreaks.

On the Deschutes NF, bull trout occur in the Odell Lake watershed and in the Metolius River watershed in the Odell Lake Core Area (entirely on the Deschutes) and Lower Deschutes River Core Area (264,154 acres or 10%), respectively. In 2003, both of these watersheds experienced large fires, the Davis and B&B Complex, respectively. Although bull trout habitat was affected by these fires, bull trout populations did not change. There are approximately 4,300 adult spawning bull trout within three distinct populations that occur on the Deschutes NF. From 2000-2010 there were 2,192 reported fires with 772 retardant drops.

Within the Odell Lake Unit (Unit 7) the designation includes 17 miles of stream (Odell, Trapper, Crystal, and Unnamed tributary Creeks) and 3,427 acres of habitat associated with Odell Lake. This unit provides spawning and rearing habitat. The critical habitat designation in the Lower Deschutes River Unit (Unit 6) includes 85.2 miles of habitat in the Metolius River, and 2.7 miles of Street Creek. This unit provides spawning, rearing, foraging, migratory, connecting, and overwintering habitats.

### ***Flathead National Forest***

The Flathead National Forest (FNF) is located in Montana and contains all or portions of 12 Bull Trout core areas. These include the Hungry Horse Reservoir (100%, or 1,000,602 acres); Doctor Lake (100% or 9,388 acres); Big Salmon Lake (100%, 49,953 acres); Flathead Lake (52%, 1,142,801 acres); Upper Stillwater Lake (16%, 12,942 acres); Whitefish Lake (9%, 7,482 acres); Upper Whitefish Lake (46%, 4,633 acres); Cyclone Lake (100%, 6,619); Frozen Lake (100%, 1,904 acres); Swan Lake (84%, 367,885 acres); Holland Lake (100%, 7,227 acres); and Lindbergh Lake (100%, 25,738). There are approximately 3,758 miles of perennial streams located with the FNF of which bull trout occupy 936 miles. There are 633 miles of designated critical habitat on the forest, 400 miles of spawning and rearing habitat and 233 miles of FMO habitat. There are 29,375 acres of lake and reservoir critical habitat.

For bull trout on the FNF non-native fish species are the primary limiting factor, including brook trout and lake trout. The Flathead Lake food web was significantly altered in the 1980's, with the introduction of Mysis, resulting in tremendous increases in lake trout and lake whitefish populations in this core area and the extirpation of a formerly robust kokanee population. These changes had significant negative effects on populations of native bull trout

and westslope cutthroat trout, which were already below historical levels of the early 1900's. The status and trend of bull trout in this core area was considered "depressed" and "declining" based on information available at the time of listing (Fish and Wildlife Service 1998a). Based on recent analysis, there are fewer than 1,000 adult bull trout in this core area and the redd count trend, which temporarily increased in the late 1990's from historic lows reached in 1996, has again declined by nearly half since 2000. Predation, competition, or other forms of negative interaction with lake trout is the single factor most responsible for the decline of bull trout in this core area (MFWP and CSKT 2000, Fish and Wildlife Service 1992f). Eutrophication of the lake is a concern due to increasing human population and unmanaged growth and development which pose a serious threat to water quality throughout the basin (MT DHES 1994).

Water quality impacts from land management activities (road construction, log skidding, riparian tree harvest, clearcutting, splash dams) have also impacted the system by increasing erosion, sedimentation, and water yield associated with timber harvest and road building activities (MBSTG 1995b). This includes agricultural runoff of which there are 128 miles of streams in the Flathead watershed that suffer impaired water quality due to agriculture. Past forestry practices are considered a major contributing factor in the decline of bull trout. With timber harvest that occurred in the 1960's and 1970's still impacting bull trout due to the remaining road systems, increased water yields, and increased efficiency of water delivery to the streams has resulted in changes in the timing of runoff. As a result of silvicultural activities there are 202 miles of 17 streams in the drainage with impaired water quality (MT DHES 1994).

There were 806 fires reported during the period from 2000-2010, with 722 fire retardant drops.

### ***Fremont-Winema National Forest***

The Fremont-Winema National Forest has approximately 1,300 miles of perennial streams and contains portions of three core areas, including the Upper Klamath Lake (54% or 226,081 acres), Upper Sprague River (88%, 181,926 acres) and Sycan River (77%, 155,084 acres) core areas. There are 276.6 miles (445.2 kilometers) and 9329.4 acres (3775.5 hectares) of designated bull trout critical habitat within the Klamath River basin (75 FR 63898). On the Fremont-Winema National Forests, there are 118 miles (190 kilometers) of designated critical habitat. More specific information related to critical habitat and bull trout occupancy can be found at <http://www.fws.gov/pacific/bulltrout/>.

Within the Klamath Basin Recovery Unit, bull trout are recognized as evolutionarily and genetically distinct due to physical isolation from other bull trout populations (Fish and Wildlife Service 2008b). Bull trout in the Klamath Basin Recovery Unit have been isolated from other bull trout populations for the past 10,000 years (Minckley et al. 1986; Fish and Wildlife Service 2002b; Fish and Wildlife Service 2008a). As such, there is no opportunity for bull trout in another recovery unit to naturally re-found the Klamath Basin Recovery Unit if it were to become extirpated. The Klamath Basin Recovery Unit lies at the southern edge of

the species range and occurs in an arid portion of the range of bull trout. Bull trout were once widespread within the Klamath River basin (Gilbert 1897; Dambacher et al. 1992; Ziller 1992; Fish and Wildlife Service 2002b), but habitat degradation and fragmentation, past and present land use management practices, agricultural water diversions, and past fisheries management practices have greatly reduced their distribution. Bull trout abundance has been severely reduced and the remaining populations are highly fragmented and vulnerable to natural or manmade factors that place them at a high risk of extirpation (Fish and Wildlife Service 2002b).

Within the Klamath River basin, bull trout occur within eight isolated, local populations of three core areas. In the Upper Klamath Lake core area, bull trout occur within Threemile Creek and Sun Creek. In the Sycan River core area, bull trout occur in Long Creek. In the Upper Sprague River core area, bull trout occur within Dixon Creek, Boulder Creek, Deming Creek, Leonard Creek, and Brownsworth Creek. Fluvial bull trout have been documented to seasonally use the North Fork Sprague River and lower Long Creek. Occurrence of the Fremont-Winema National Forests is primarily limited to extreme headwater portions of occupied habitat.

### ***Gifford Pinchot National Forest***

The Gifford Pinchot National Forest (GPNF) is located in southwest Washington. With an area of 1.37 million acres, it extends primarily along the western slopes of Cascade Range from Mount Rainier National Park south to the Columbia River. The GPNF is managed under the Aquatic Conservation Strategy established for the Northwest Forest Plan (USDA and USDI 1994). The Forest includes over 835,000 acres (61 percent) of designated Wilderness areas and other reserved land use allocations as designated by the Northwest Forest Plan.

The information provided in the BA (Appendix Table B4) indicates there were 357 fires reported during the period from 2000 – 2010. Relatively few large wildfires have occurred on the GPNF over the past 10 years. Most wildfires occur as a result of lightning strikes in the subalpine zone between 4,000 and 6,000 ft. elevation, and generally have small burn areas (< 500 acres). Recent fire history includes the Cold Springs Fire, which burned over 8,000 acres in the upper White Salmon River watershed in July 2008.

There are approximately 2,881 miles of perennial streams located within the GPNF. Of these, bull trout occupy approximately 25 miles of streams (0.87 percent). The GPNF includes portions of three bull trout core areas and one core habitat area. These include the Lewis River, Klickitat River, and Puyallup River core areas, as well as the White Salmon River core habitat area. Of these areas, the Lewis River core area is the only watershed with known bull trout presence and designated critical habitat within the administrative boundary of the GPNF. The other core areas have relatively few acres within the Forest boundary (less than 1 percent), or the National Forest lands within the core area (e.g. White Salmon River) are located several miles above the known distribution of bull trout and/or designated bull trout critical habitat.



### ***Helena National Forest***

The Helena National Forest (HNF) contains a small portion of the Blackfoot Core Area (23%, 296,068 acres). The Copper Creek drainage, predominantly managed by the Helena National Forest, has been affected by timber harvest, roading, recreation and fires that occurred in the early 1980s and a small fire in the Red Creek area in the 1990s. Copper Creek and its tributaries are included in one 6<sup>th</sup> code hydrologic unit (HUC #170102032801) and it is a major tributary to Landers Fork. Copper Creek supports the only major spawning migration of fluvial bull trout in the upper Blackfoot Basin

2003 Post-Fire Condition Update- Stream substrate conditions still remain good in Copper Creek after spring runoff of 2004 since no large erosion causing storms have occurred since the Snow-Talon Fire. However, the majority of the streamside shading has been removed due to the intense fires in 2003. There will be a large increase in the recruitment of large woody debris as many of the trees over the next couple of decades. The fire resulted in substantial mortality of the fish population of Copper Creek where the fire burned intensely through the riparian conservation areas. Some additional level of mortality of bull trout occurred for approximately 2 miles upstream from Copper Creek campground due to accidental inputs of fire retardant during aerial operations in early attempts to control the fire. Between 10 and 40% of the bull trout in this 2.5 mile reach above the campground were projected as killed due to retardant effects. Since the 2003 fire redd counts have returned to pre fire levels and or increased.

All of the 6th hydrologic units to the Blackfoot within this sub-population that are currently known to support bull trout are functioning at unacceptable risk. In general, most of the streams supporting bull trout within this sub-population are suffering from elevated levels of sedimentation, past mining effects, agricultural activities on private lands, and temperature increases. In regard to the main stem Blackfoot River, portions of the main-stem suffer from higher water temperatures and elevated levels of sedimentation.

### ***Humboldt-Toiyabe National Forest***

Approximately 28% of the Jarbidge River core area, or 86,000 acres, occurs within the Humboldt-Toiyabe National Forest. The Jarbidge River in southwest Idaho and northern Nevada is a tributary to the Bruneau River in the Snake River Basin and contains the southernmost habitat occupied by bull trout. Of the 4,000 stream miles on the Forest, only 50 miles are critical habitat. This population of bull trout is geographically segregated from other bull trout in the Snake River Basin by more than 241 km (150 mi) of seasonally-unsuitable habitat, an impassible diversion structure on the lower Bruneau River, and several impassable dams on the mainstem Snake River and other tributaries. Habitat degradation and fragmentation from past and ongoing land management activities such as road construction and maintenance, mining, and grazing; natural events; and past fisheries management practices were identified as the primary threats at the time of listing (Fish and Wildlife Service 1998a, b; 1999). No specific new threats have been identified since listing.

### ***Idaho Panhandle National Forest***

Bull trout are found throughout the Idaho Panhandle National Forest (IPNF) in spawning and early rearing habitat (local populations) as well as in habitat used for feeding, migrating, and overwintering (FMO). Spawning and early rearing habitat is typically found in headwater (often roadless) areas while mainstem rivers provide FMO habitat. The following bull trout recovery units are in the IPNF: Clearwater River Basin, Coeur d'Alene Lake Basin, Clark Fork Basin, and Kootenai River Basin. There are 10 bull trout core areas in the IPNF: Middle-Lower Clearwater River (86 acres), Clark Fork River (section 2) (523 acres), Clark Fork River (section 3) (11,166 acres), Bull Lake, Kootenai River (51%, 890,507 acres), North Fork Clearwater River (11%, 175,277 acres), Lake Pend Oreille (46%, 526,871 acres), Pend Oreille River (1%, 4,612 acres), Priest Lakes (64%, 239,463), and Coeur d'Alene Lake, totaling 1,440,344 forest acres (57.6% of the total IPNF acres). Of the close to 4,700 miles of stream on the Forest, 645 are designated critical habitat and there are 70,301 acres of lake and reservoir critical habitat.

Bull trout populations in the IPNF are variable, with redd surveys showing some increasing population trends (e.g. St. Joe River), stable trends (e.g. Kootenai River), and decreasing trends (e.g. upper Priest River). Of the 10 core areas in the IPNF with a designated threat ranking, 4 are at High risk, 5 are At risk, and 1 is at Potential risk.

### ***Kootenai National Forest***

The Kootenai National Forest contains all or portions of the following core areas Kootenai River (51%, 890,507 acres), Bull Lake (86%, 109,348 acres), Lake Koocanusa (87%, 682,611 acres), Sophie Lake (4%, 184 acres), Upper Stillwater Lake (48%, 39,308 acres) and the Lower Clark Fork (19%, 493,033 acres). Bull trout are found throughout the Forest: of the approximately 2400 miles of stream on the Forest, 258 are designated critical habitat (167 miles of spawning and rearing and 90 miles of FMO habitat). There are 25,978 acres of lake and reservoir critical habitat. Over the period of 2000-2011 there have been 1,424 fires on the Forest with 80 retardant drops.

### ***Lolo National Forest***

The Lolo National Forest (LNF) contains all or portions of eight Bull Trout Core Areas. These include the Lower Clark Fork Complex (21%, 553,238 acres); Middle Clark Fork (87%, 1,106,368 acres); Upper Clark Fork (5%, 87,100 acres); Rock Creek (34%, 191,884); Blackfoot River (24%, 303,550 acres); Bitterroot River (12%, 196,532 acres); and Clearwater (84%, 176,714 acres). Of these, the Middle Clark Fork and Clearwater are the only two that lie entirely within the boundaries of the LNF. The Lower Clark Fork, Rock Creek, and Blackfoot Core Areas are shared with the Kootenai, Beaverhead-Deerlodge, and Helena National Forests, respectively. Only small portions of the Upper Clark Fork and Bitterroot Core Areas are on the LNF. The LNF contains 2,693 miles of perennial stream, approximately 19.3% is designated critical habitat, and 26.3% is occupied by bull trout, and

2,000 acres of lake/reservoir habitat. Over the period of 2000-2011 there have been 1,427 fires on the Forest with 287 retardant drops.

### ***Malheur National Forest***

The Malheur National Forest (NF) contains approximately 1.7 million acres of land. Approximately 678,153 acres are located within the John Day River Core Area (43,319 acres, 281,376 and 353,458 in the North Fork, Middle Fork, and Upper Mainstem John Day River, respectively) and 378,190 acres are located within the Malheur River Core Area. National Forest System (NFS) lands comprise around 92% of the John Day River Core Area (4%, 56%, and 32% of the North Fork, Middle Fork and Upper Mainstem John Day River, respectively) and 24% of the Malheur River Core Area. There are approximately 2,583 miles of perennial stream within the Malheur NF boundaries, with 174 miles occupied by bull trout. Over the period of 2000-2011 there have been 1,592 reported fires on the Forest with 231 retardant drops.

### ***Mt. Baker-Snoqualmie National Forest***

The Mt. Baker-Snoqualmie National Forest (MBSNF) is located in northwest Washington. With an area of 1.74 million acres, it extends primarily along the western slopes of Cascade Range from Mount Rainier National Park north to the Canadian border. The MBSNF is managed under the Aquatic Conservation Strategy established for the Northwest Forest Plan (USDA and USDI 1994). The Forest includes over 1.33 million acres (76 percent) of designated Wilderness areas and other reserved land use allocations as designated by the Northwest Forest Plan.

There were 439 fires reported during the period from 2000 – 2010, but fire retardant was dropped on the Forest only three times during this period, indicating most wildfires are small, and managed without the use of fire retardant. Relatively few large wildfires have occurred on the MBSNF over the past 10 years. Most wildfires occur as a result of lightning strikes in the subalpine zone between 4,000 and 6,000 ft. elevation, and generally have small burn areas (< 500 acres). Recent fire history includes the Mineral Springs Fire, which burned over 3,000 acres in the Lower Skagit River watershed in July 2003.

There are approximately 7,134 miles of perennial streams located within the MBSNF. Of these, bull trout occupy approximately 418 miles of streams (5.86 percent). The MBSNF includes significant portions of six bull trout core areas in the Coastal Recovery Unit. These include the Chilliwack River, Nooksack River, Lower Skagit River, Stillaguamish River, Snohomish-Skykomish Rivers, and the Puyallup River. There are also a few acres of MBSNF lands that occur within the Chester Morse Lake core area (6 acres), the Wenatchee River core area (1 acre), and the Yakima River core area (3 acres). Because these core areas contain few acres and no bull trout streams within the MBSNF, these core areas are discounted from further discussion in this analysis.



**Table 6. Summary of bull trout core areas and bull trout critical habitat (BTCH) on the MBSNF**

Bull Trout Core Area	Total Watershed Acres in Core Area	Total Core Acres on MBSNF	Percent of Core Area Acres on MBSNF	Total BTCH in Core Area (stream miles)	Total BTCH on MBSNF (stream miles)	Percent of BTCH Streams on MBSNF
Chilliwack River	164,094	43,568	26.55%	30.84	6.3	20.43%
Nooksack River	499,301	157,553	31.55%	277.02	43.43	15.68%
Lower Skagit River	1,377,335	717,659	52.10%	490.58	205.66	41.92%
Stillaguamish River	450,857	171,814	38.11%	230.53	53.58	23.24%
Snohomish-Skykomish Rivers	1,171,249	486,299	41.52%	309.35	65.51	21.18%
Chester Morse Lake	52,308	29	0.06%	16.58	0	0.00%
Puyallup River	663,541	68,537	10.33%	306.52	43.25	14.11%
Totals	4,378,685	1,645,459	37.58%	1661.42	417.73	25.14%

Note: All stream miles are approximate values based on the Fish and Wildlife Service 2010 final bull trout critical habitat designation.

### ***Mt. Hood National Forest***

The Mt. Hood National Forest contains approximately 1,067,043 acres of land. Approximately 131,461 acres are located within the Hood River Core Area. National Forest System lands comprise around 60% of the Core Area. There are approximately 2,555 miles of perennial streams within the Mt. Hood NF boundaries, with 42 miles occupied by bull trout. Presently, bull trout in the Hood River basin are believed to be at substantial risk, numbering around 100 adult fish, emphasizing the need to establish additional local populations. The majority of the bull trout population has been isolated in upper Clear Branch and Laurance Lake by the construction of Clear Branch Dam in 1968. Laurance Lake is primarily used for foraging and overwintering, while spawning occurs in the tributaries. Spawning of the Hood River local population has been confirmed in the Middle Fork Hood River and Compass Creek, although a debris flow altered this channel and it is unknown

whether Compass Creek continues to provide suitable spawning habitat. Over the period of 2000-2011 there have been 994 reported fires on the Forest with 167 retardant drops.

### ***Nez Perce National Forest***

There are 766 miles of bull trout streams on the Forest (representing approximately 16 percent of the total streams on the Forest) of which 427 miles are spawning and early rearing and 339 are FMO habitat. These streams are distributed among five core areas in the Salmon River and Clearwater River management units: the Little-Lower Salmon River, Middle Salmon River-Chamberlain, the South Fork Clearwater River, the Selway River, and the Middle Fork/Lower Clearwater River. A portion of the Granite Creek core area (Imnaha-Snake River management unit) is also located within the Forest boundary. Over the period of 2000-2011 there have been 1,305 reported fires on the Forest with 194 retardant drops.

### ***Ochoco National Forest***

Bull trout distribution on the Ochoco NF is limited to approximately 6 miles of lower Whychus Creek and 11.1 miles of the mainstem Deschutes River below Big Falls. There are no bull trout in the Crooked River on the Ochoco NF. Only the lower 0.5 mile of the Crooked River, below Opal Springs dam is occupied, and this segment of river is not within the Ochoco NF. The Lower Deschutes River Core Area encompasses these segments of bull trout habitat, which are all foraging, migratory and overwintering habitat. The Lower Deschutes River Core Area contains five populations of bull trout, none of which spawn or rear in the segments of river on the Ochoco NF. Over the period of 2000-2011 there have been 921 reported fires on the Forest with 76 retardant drops.

### ***Okanogan-Wenatchee National Forest***

The Okanogan and Wenatchee National Forest (OWNF) encompasses more than 4-million acres in Washington and stretches north to south from the Canadian border to the Goat Rocks Wilderness - a distance of about 180 miles. The forest lies east of the Cascade Crest, which defines its western boundary. The eastern edge of the forest extends into the Okanogan highlands, then south along the Okanogan and Columbia Rivers, and then to the Yakima River valley. Because of this wide geographic range, the forest is very diverse - from the high, glaciated alpine peaks along the Cascade Crest and the numerous mountain ranges extending eastward from the crest, through deep, lush valleys of old growth forest, to the dry and rugged shrub-steppe country at its eastern edge. Precipitation varies widely - from more than 140 inches along the crest to less than 10-inches at its eastern edge. Over the period of 2000-2011 there have been 1,702 reported fires on the Forest with 1,458 retardant drops.

Bull trout on the OOWNF are known primarily to 5 core areas: the Methow, Entiat, Wenatchee, Yakima, and Upper Skagit. Relatively minor amounts of OOWNF lands occur in other core areas (Druliner 2011 *in litt.*): Klickitat (19 acres), Chester Morse Lake (31 acres), Puyallup (155 acres), Lower Skagit (165 acres), Snohomish and Skykomish (232 acres). The 19 acres of OOWNF lands in the Klickitat core area are located in the upper portions of the basin adjacent to the Yakama Nation, and are not within proximity of perennial or intermittent

streams. As a result, we expect no effects to bull trout or its designated critical habitat in the Klickitat core area to result from implementation of the proposed action.

***Olympic National Forest***

The Olympic National Forest (ONF) is located on the Olympic Peninsula in northwest Washington. With an area of 630,000 acres, the forest encompasses portions of all the major watersheds on the Olympic Peninsula and borders Olympic National Park. The ONF is managed under the Aquatic Conservation Strategy established for the Northwest Forest Plan (USDA and USDI 1994). The Forest includes over 507,000 acres (80 percent) of designated Wilderness areas and other reserved land use allocations as designated by the Northwest Forest Plan.

There were 91 fires reported during the period from 2000 – 2010, but fire retardant was dropped on the Forest only four times during this period, indicating most wildfires are small, and managed without the use of fire retardant. Precipitation levels vary greatly across the Forest, from extremely wet, temperate rainforest conditions on the west side of the Olympic Peninsula, to relatively dry areas in certain “rain shadow” zones on the east side of the Peninsula. Few large wildfires have occurred on the ONF over the past 10 years. Most wildfires generally have small burn areas. Recent fire history includes the Bear Gulch II Fire, which burned over 1,000 acres in the Skokomish River watershed in July 2006.

There are approximately 2,280 miles of perennial streams located within the ONF. Of these, bull trout occupy approximately 82 miles of streams (3.60 percent) and 2,033 acres of lakes. The ONF includes portions of six bull trout core areas in the Coastal Recovery Unit, and additional streams outside core areas that provide foraging, migration, and overwintering (FMO) habitat. These include the Dungeness River, Elwha River, Hoh River, Queets River, Quinault River, Skokomish River core areas, and the Chehalis River/Grays Harbor FMO area (Table 7).

**Table 7. Summary of bull trout core areas and bull trout critical habitat (BTCH) on the ONF**

Bull Trout Core Area	Total Watershed Acres in Core Area	Total Core Acres on ONF	Percent Core Area Acres on ONF	Total BTCH in Core Area (stream miles)	Total BTCH on ONF (stream miles)	Percent of BTCH Streams on ONF
Hoh River	191,088	413	0.22%	116.99	1.04	0.89%
Queets River	288,409	53,373	18.51%	154.49	21.79	14.10%
Quinault	279,795	45,983	16.43%	103.45	4.40	4.25%

River						
Skokomish River	152,990	81,505	53.27%	75.23	27.88	37.06%
Dungeness River	130,886	56,004	42.79%	41.20	19.12	46.40%
Elwha River	205,663	11,180	5.44%	78.41	1.42	1.81%
Chehalis River/Grays Harbor FMO	1,100,684	181,274	16.47%	207.14	6.15	2.97%
Totals	2,349,515	429,732	18.29%	776.91	81.79	10.53%

Note: All stream miles are approximate values based on the Fish and Wildlife Service 2010 final bull trout critical habitat designation.

***Payette National Forest***

There are 1,221 miles (representing approximately 28.3 percent of the total streams on the Forest) of bull trout streams on the Forest of which 625 miles are spawning and early rearing and 596 are FMO. This distribution is based on mapped critical habitat as designated in the October 18, 2010 Final Rule. These streams are distributed among nine core areas in the Imnaha-Snake, Salmon River, Southwest Idaho, and Brownlee management units: Middle Salmon River Chamberlain, Middle Salmon River Panther, Middle Fork Salmon, North Fork Payette, Granite Creek, Weiser River, Little Lower Salmon, South Fork Salmon, and Pine-Indian-Wildhorse. Over the period of 2000-2011 there have been 889 reported fires on the Forest with 1007 retardant drops.

***Salmon-Challis National Forest***

The Salmon-Challis National Forest manages approximately 4.3 million acres of land that include the headwaters of the Salmon, Lemhi, Pahsimeroi Rivers and Little Lost Rivers. The Salmon, Lemhi and Pahsimeroi River watersheds are strongholds for bull trout containing an estimated 260,000 bull trout (± approximately 80,000) (Idaho Department of Fish and Game 2005 and High et al. 2008). The Little Lost River watershed is an isolated watershed with approximately 45,000 bull trout (± approximately 23,000).

The Salmon-Challis National Forest’s lands overlap eight core areas established by the Draft Bull Trout Recovery Plan (Fish and Wildlife Service, 2002a). Their names and percentages of their area managed by the Salmon-Challis National Forest are: Upper Salmon River (35%), Middle Fork Salmon River (72%), Little Lost River (44%), Pahsimeroi River, Lemhi River

(40%), Opal Lake (100%), Middle Salmon River – Panther (81%) and Lake Creek (97%). These cores include approximately 88 local populations of bull trout. Over the period of 2000-2011 there have been 842 reported fires on the Forest with 375 retardant drops.

### ***Sawtooth National Forest***

There are 590 miles (representing approximately 16.9 percent of the total streams on the Forest) of bull trout streams on the Forest of which 389 miles are spawning and early rearing and 200 are FMO. This distribution is based on mapped critical habitat as designated in the October 18, 2010 Final Rule. These streams are distributed among five core areas: Arrowrock Reservoir, the Middlefork Salmon, the Upper Salmon, Anderson Ranch Reservoir, and the Upper South Fork Payette. There are 3,104 acres of lake critical habitat on the Forest. Over the period of 2000-2011 there have been 398 reported fires on the Forest with 338 retardant drops.

### ***Umatilla National Forest***

The Umatilla National Forest (NF) contains approximately 1.4 million acres of land. Approximately 250,065 acres are located within the Walla Walla River Core Area and 199,638 acres are located within the Umatilla River Core Area. Umatilla NF-managed lands comprise approximately 14.8% of the Walla Walla River Core Area and 12.4% of the Umatilla River Core Area. There are approximately 2,401 miles of perennial stream within the Umatilla NF boundary, with 365 miles occupied by bull trout. Limited portions of the John Day and Grande Ronde River Core Areas are also located on the Umatilla NF; however, for ease of calculating, the affects to these two core areas are analyzed in the Malheur and Wallowa-Whitman National Forest portion of this document. Over the period of 2000-2011 there have been 992 reported fires on the Forest with 392 retardant drops.

In the final listing rule, June 10, 1998 (Fish and Wildlife Service 1998c), two bull trout subpopulations in the Umatilla River Basin were identified (Meacham Creek and the North Fork/South Fork Umatilla River), and three subpopulations were identified in the Walla Walla River Basin (North Fork/South Fork Walla Walla River, Mill Creek, and Touchet River) (Fish and Wildlife Service 2004d).

Abundance of adult bull trout within the Walla Walla Core Area is estimated to be 4,098 fish (P.Budy, Utah State University, pers.comm. 2011; D.Crabtree, Umatilla NF, pers.comm. 2011; and P. Howell, USFS, Pacific Northwest Research Station, pers.comm. 2010). Abundance of adult bull trout within the Umatilla River Core Area was estimated to be 58 (P. Howell, USFS, Pacific Northwest Research Station, pers.comm. 2010). The total adult bull trout estimate for the Umatilla NF is 4,156 adults. The primary method used to estimate adult bull trout abundance is redd surveys.

### ***Wallowa-Whitman National Forest***

The Wallowa-Whitman National Forest (NF) contains approximately 2.3 million acres of land. Approximately 18,990 acres are located within the Little Minam River Core Area, 371,637 acres are located in the Powder River Core Area, 424,320 acres are located in the Imnaha River Core Area, 752,791 acres are located in the Grande Ronde River Core Area, and 145,912 acres are located within the Pine Creek Core Area. This Forest also contains the Little Lower Salmon River, John Day, Umatilla and Malheur rivers which area analyzed in other Forest descriptions. Wallowa-Whitman NF-managed lands comprise 100% of the Little Minam River Core Area, about 34.1% of the Powder River Core Area, about 78.1% of the Imnaha River Core Area, about 33.6% of the Grande Ronde River Core Area, and an unknown percent in the Pine Creek Core Area (acres unavailable). There are approximately 4,398 miles of perennial stream within the Wallowa-Whitman NF boundaries, with 700 miles occupied by bull trout. The Forest also has 2,217 acres of lake and reservoir critical habitat. Over the period of 2000-2011 there have been 1,134 reported fires on the Forest with 730 retardant drops.

There is one resident, isolated population of bull trout in the Little Minam River Core Area (Little Minam River and tributary streams) and eight local bull trout populations in the Grande Ronde Core Area (Upper Grande Ronde and tributaries, Catherine Creek, Indian Creek, Minam River/Deer Creek complex, Lostine River/Bear Creek complex, Upper Hurricane Creek, Wenaha River, and Lookingglass Creek). Pine Creek Core Area contains four local populations (Upper Pine Creek, Clear Creek, East Pine Creek, and Elk Creek) and the Powder River Core Area contains 10 populations (Upper Powder River, North Powder River, Anthony Creek, Indian Creek, Wolf Creek, Lake Creek, Salmon Creek, Pine Creek, Rock Creek, and Big Muddy Creek) and one potential population (Eagle Creek) (Fish and Wildlife Service 2002e). The Imnaha River Core Area contains four local populations (Big Sheep Creek and tributaries, Little Sheep Creek and tributaries, McCully Creek, and the Imnaha River and Upper Imnaha tributaries) (Fish and Wildlife Service 2004e). The original local population of bull trout in the Wallowa River complex is believed to have been extirpated (Buchanan *et al.* 1997). In 1997, 600 bull trout from Big Sheep Creek, a tributary to the Imnaha River, were introduced into the Wallowa River above Wallowa Lake. Currently, these fish are still present in the system, but their exact population numbers are not known.

The abundance of adult bull trout within the Wallowa-Whitman NF is estimated to be 3,800 adults based on redd count data, electrofishing data, core area status assessment templates, and professional opinion (Crabtree pers. comm. 2011, Bailey pers. comm. 2011, Bridges pers. comm. 2011, Sausen 2011, ODFW 2002, Doyle 2011).

### ***Willamette National Forest***

The Willamette National Forest (NF) contains approximately 1,732,532 acres of land. Approximately 1,264,202 acres are located within the Upper Willamette Core Area. National Forest System (NFS) lands comprise around 73% of the Core Area. There are approximately 4,150 miles of perennial stream within the Willamette NF boundaries, with 78.3 miles occupied by bull trout. The Forest also has 5,693 acres of lake and reservoir critical habitat.



Over the period of 2000-2011 there have been 1,176 reported fires on the Forest with 332 retardant drops.

There are four local populations of bull trout in the Upper Willamette Core Area. They include the Mainstem McKenzie local population, South Fork McKenzie local population, Trail Bridge (upper McKenzie) local population, and the Middle Fork Willamette local population. All four are migratory. There is no evidence for a resident life history form in the Willamette Basin. One of the four local populations (mainstem McKenzie River) is fluvial whereas the other three are isolated above dams and thus utilize reservoirs for portions of their life cycle (artificially adfluvial). These historically fluvial migratory fish have adopted an adfluvial life history expression due to the presence of the dams and reservoirs in the Upper Willamette Core Area (Fish and Wildlife Service 2008a).

Abundance of adult bull trout within the Upper Willamette Core Area was estimated to be 300 fish. The primary method used to monitor adult bull trout abundance in the McKenzie and Middle Fork Willamette subbasins is redd surveys. Redd surveys have been conducted in the McKenzie Subbasin since 1989 and in the Middle Fork Willamette Subbasin since approximately 2002. Abundance data are further supported by monitoring adult migration into spawning areas and movement during other times of the year using VAKI River Watchers, digital video, and Passive Integrated Transponder (PIT) tag technology (Fish and Wildlife Service 2008a).

### Effects of the Action

Effects of the action for purposes of a section 7(a)(2) analysis refer to the permanent or temporary direct and indirect effects caused by a proposed Federal action on a listed species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by the proposed action, occur later in time, but are still reasonably certain to occur.

In this section, we present general discussion of how the proposed use of fire retardant affects bull trout and bull trout critical habitat as a result of chemical contamination of aquatic resources through misapplication and/or purposeful intrusion into the aquatic avoidance area. The effects herein only consider the aerial delivery of retardant and do not address ground based application of retardants, foams, gels or other fire suppression activities.

To minimize rate of exposure to effects to bull trout and bull trout critical habitat, the National Forests will have Forest specific aquatic avoidance areas. These areas are defined as: –All waterbodies with a 300 foot buffer, this includes perennial, intermittent streams, lakes, ponds, identified springs, reservoirs” (BA p. 6). In addition, the Forest Service will follow the 2011



Retardant Use Guidelines for Aircraft Operation; conduct annual pre-season coordination and training on the guidelines and avoidance maps; and complete monitoring requirements, as described in the BA (pp. 7-9). Implementation of the Guidelines is intended to minimize instances of retardant entering aquatic systems.

#### *Direct and Indirect Effects of the Proposed Action*

Retardant formulations in use today are primarily inorganic fertilizers, the active compound being ammonia polyphosphates. Currently approved retardant used by the Forest Service include: Phos-Chek P100F, Phos-Chek D75-R, Phos-Chek LC-95A, Phos-Chek 259F. Although retardant is approximately 85% water, the ammonia compounds constitute about 60-90% of the remainder of the product. Other ingredients include thickeners, such as guar gum, suspending agents, such as clay, dyes, and corrosion inhibitors (BA p.15). The current mix of approved retardants does not include retardants that contain sodium ferrocyanide, due to the toxicity of the compound to fish. In addition, the Forest Service has moved away from products that contained ammonia sulfate salts to inorganic phosphate salts only, which reduces the level of ammonia from 3.1% to 2.2% which results in a 33% reduction of ammonia content in the retardants (BA p. 16).

Although streams and lakes will be mapped as avoidance areas, the Forest Service, as discussed on page 118 of the BA, and the Service agree that misapplications into water or the buffer area will occur. In the context of this consultation, misapplication is an accidental application of retardant into a waterway or mapped avoidance area. In addition, to protect life and/or property, the Forest Service may intentionally drop retardant in waterways or mapped avoidance areas. Based on information regarding misapplications presented in the BA, p. 118, the Service assumes that 0.42% of drops on a forest are likely to result in a misapplication of fire retardant to a stream or buffer area around the stream. When these retardants are released into the environment by helicopters or airplanes, these chemicals may enter into the aquatic systems such as lakes, ponds, or streams. If this occurs in occupied bull trout stream or critical habitat it will result in adverse effects to bull trout and/or critical habitat. As described in the BA, retardants are likely to enter the waterway through accidental delivery, drift, surface run-off and leaching.

#### Mechanisms of Exposure

Of the likely mechanisms for retardant to reach a waterway and thereby affect bull trout and critical habitat, accidental delivery is likely to result in adverse effects. Several laboratory studies concluded that the exposure of fish and other aquatic organisms to ammonia can result in mortality (Little and Calfee 2000, 2004, and 2005, Buhl and Hamilton 2000). Gaikowski et al. (1996) studied Phos-Chek D75-F and concluded that if we consider the concentration of the retardants used in field mixtures, which is much higher than the lab studies, an accidental spill in a waterway would lead to substantial mortality. We recognize that several environmental factors influence the likely adverse effects of accidental delivery, as discussed below.

Drift occurs after the retardant has been released from the aircraft and wind directs particles of the retardant into a waterway. The amount and how drift occurs and effects the aquatic ecosystem depends on many site specific environmental conditions, including wind direction, speed, canopy cover, topography, amount of retardant, dilution, and elevation of the aircraft. The effect of drift may not be as significant to aquatic organisms as accidental delivery but adverse effects such as mortality are likely to occur.

Surface run-off occurs after the retardant is applied to the ground outside of the 300-foot waterway buffer and is carried into a waterway by precipitation and stormwater runoff. Retardant applied outside of the 300-foot waterway buffer may have adverse effects to aquatic organisms; however, the level of toxicity depends on the surface or soil type (rock, sand, soils with high or low organic matter, etc), persistence in the environment, timing of a rainfall event, and the amount of retardant on the ground. Little and Calfee (2005) found that the substrate upon which the chemicals are applied are important when assessing the resultant environmental persistence. In a study where fire chemicals (including D75-R) were weathered on non-porous surfaces at recommended application levels, fire retardants remained toxic for more than 21 days. Additional tests showed the persistence of toxicity was dependent on soil type and quality and that toxicity was often eliminated on soils with high organic content (Little and Calfee 2002). Although the highest toxicity was in formulations that included cyanide, D75-R caused up to 20% mortality in fathead minnows, depending on soil surface, after 21 days of weathering (Little and Calfee 2002). Because of the various soil types and topography found within the range of the bull trout (action area), toxicity levels from surface runoff as a result of the proposed action will vary.

#### Reactions of Retardant Chemicals in Water

As described in the BA, pp. 118-119, chemical components of the retardant Phos-Chek D75-R, and presumably all members in the Phos-Chek family, include un-ionized ammonia and total ammonia. Un-ionized ammonia is neutrally charged (Emerson et al. 1975) and easily crosses the gill membranes of fish, and presumably mussel gills as well. Because of this, it is considered the most toxic form of ammonia. A primary function of the gills is to rid the body of waste material in the form of ammonia. If enough un-ionized ammonia is in the surrounding water, ammonia will diffuse into the organism, creating a buildup of ammonia. Ammonia buildup can occur to such an extent that it becomes lethal to the organism. When retardant enters the stream, there is an immediate spike in ammonia concentrations, the severity of which depends on the stream volume, turbulence, ultraviolet levels, and volume of retardant and smoke absorption.

When fire retardant enters a stream and causes the initial spike in ammonia, it immediately begins to form a chemical equilibrium between un-ionized ammonia, which is the more toxic form, and ionized ammonia. The chemical balance between these two forms of ammonia is determined by pH, temperature, and total ammonia concentration. In most streams, the pH is sufficiently low that ionized ammonia predominates. However, in highly alkaline waters, un-ionized ammonia concentrations increase and can reach toxic levels.

Norris *et al.* (1978) applied Phos Chek directly to a California stream but the maximum allowable application was 0.5 mg/l. In the natural environment, after 30 minutes, the concentration had been reduced by 90% at the point of entry, but there was no determination of whether there could be similar expectations in the speed of dilution of extremely large introductions of retardant or under actual fire conditions with heat, smoke, and ash. The highest concentrations of ammonia were detected 148 feet downstream of the point of contact and had dissipated to 1% of their peak concentration (in Buhl and Hamilton's [1998] research, 50.26 mg/l) after almost four hours. After one year, there were still detectable, albeit slight, changes to the stream's water chemistry (Norris *et al.* 1978). Discernable levels of ammonia were detected at the farthest downstream (as much as 2730 meters) sampling sites when only a fraction of an actual load was placed in the stream (Norris *et al.* 1978). Simulations run by Norris and Webb (1989) showed ammonia concentrations are likely to remain at lethal levels between 0 and 6.2 miles downstream, depending on stream characteristics and the size of the retardant load. Van Meter and Hardy (1975) also found that concentrations of retardant high enough to kill 10% of the fish population were measurable over 4 miles downstream.

Fire retardants and the ammonia plume that develops when retardants enter a stream do not persist above the lethal concentrations for long periods of time. Buhl and Hamilton (1998) showed that when 267 gallons of fire retardant enters a stream, a relatively small amount, the ammonia concentration reaches 5,026 mg/l. At such extreme levels, mortality would be nearly immediate, but downstream as the plume is diluted, longer exposure to LC50 levels can be lethal. Buhl and Hamilton (1998) provide a case study of a 1995 Fire-Trol LCG-F misapplication in which 23,000 fish were killed, and although the retardant contained sodium ferrocyanide, the cause of mortality was determined to be ammonia concentrations. Their research concluded that fire retardant misapplications have biologically significant effects to aquatic communities.

#### Direct and Indirect Effects to Bull Trout

Fire retardants are known to kill many aquatic species, including salmonids, due to the presence and interaction of ammonia compounds. For this analysis, we rely on toxicity studies conducted on a variety of fishes, mostly other salmonids, because we do not have toxicity studies specific to bull trout. The responses of rainbow trout to fire retardant have been studied by various researchers.

For rainbow trout, most mortality occurs in the first 24 hours (Johnson and Sanders 1977). As a result, the 24 hour and 96 hour LC50s (the concentration at which half of the effected population will die in an established time period) were not significantly different, meaning that the values given below represent both the 24 hour and 96 hour LC50s. The LC50 for rainbow trout varies depending on the type of retardant used. When exposed to Phos Chek 259, their LC50 was between 94 and 250 mg/l (Johnson and Sanders 1977). Buhl and Hamilton (2000) found the LC50 of rainbow trout to Phos Chek 259-F was 168 mg/l. In research on Phos Chek D75-R, the rainbow trout 96 hour LC50 was 168 mg/l (between 142

and 194 mg/l) (Calfee and Little 2003). Phos Chek D75-F has a 96 hour LC50 of 228 mg/l (between 184 and 271 mg/l) (Calfee

and Little 2003). The rainbow trout LC50s in response to Phos Chek 259-R, G75-F, G75-W, LV-R, and LC-95A-R have not been researched. Phos Chek LC-95A-R was the main fire retardant used in 2006 by the USFS and accounted for 13.5 million gallons spread applied over 11,383 loads.

Another study involved applying Phos Chek directly to a California stream at a maximum allowable application level of 0.5 mg/l (Norris *et al.* 1978). In the natural environment, after 30 minutes, the concentration had been reduced by 90% at the point of entry, but there was no determination of whether there could be similar expectations in the speed of dilution of extremely large introductions of retardant or under actual fire conditions with heat, smoke, and ash. The highest concentrations of ammonia were detected 148 feet downstream of the point of contact and had dissipated to 1% of their peak concentration after almost four hours. After one year, there were still detectable, albeit slight, changes to the stream's water chemistry as a result of the retardant's application (Norris *et al.* 1978). Discernable levels of ammonia were detected at the farthest downstream (as much as 1.7 miles) sampling sites when only a fraction of an actual load was placed in the stream (Norris *et al.* 1978). Ammonia concentrations could remain at lethal levels for fish species between 0 and 6.2 miles downstream depending on stream characteristics and the size of the retardant load (Norris and Webb 1989). Concentrations of retardant high enough to kill 10 percent of the fish population were measurable over 4 miles downstream (Van Meter and Hardy 1975).

The delivery of retardant (from accidental delivery, drift, or surface run-off) into a waterway occupied by bull trout can cause mortality by exposing fish to ammonia (Little and Calfee 2000, 2004, and 2005, Buhl and Hamilton 2000). In simulations of only 267 gallons (a normal load being approximately 1,500 gallons) of fire retardants hitting the surface of a stream, peak ammonia concentrations reached 5,026 mg/l (Buhl and Hamilton 1998). When the volume of retardant hitting the stream is doubled, the zone of mortality is extended 10 times farther downstream (Norris *et al.* 1991). These studies looked at only the ammonia concentration caused directly by the fire retardant, but in a natural situation during a fire, ammonia levels will also be elevated due to smoke adsorption (Gresswell 1999). Furthermore, the application of fire retardants increases the amount of smoke produced by a fire (Kalabokidis 2000), which ultimately leads to more ammonia in the system.

Discernable levels of ammonia were detected as much as 2,730 meters downstream when only a fraction of an actual retardant load was placed in the stream (Norris *et al.* 1978). As described in the BA (p. 119), ammonia concentrations are likely to remain at lethal levels between 0 and 6.2 miles downstream, depending on stream characteristics and the size of the retardant load (Norris and Webb 1989). Van Meter and Hardy (1975) found that concentrations of retardant high enough to kill 10 percent of the fish population were measurable over 4 miles downstream.

The delivery of retardant outside the 300-foot buffer of a waterway (except for drift mentioned above) will not cause immediate adverse effects to fish; however, effects from ammonia are likely to result from surface run-off during a rainfall event. Little and Calfee (2002) found that on a nonporous surface fire retardants remained toxic for more than 21 days. Again the environmental factors such as surface or soil type (rock, sand, soils with high or low organic matter, etc), persistence in the environment, timing of a rainfall event, and the amount of retardant on the ground play a significant role in determining adverse effects to fish.

Also if there is run-off, it may reconnect intermittent streams and provide significant dilution. In rough water, aeration may also help to reduce ammonia levels during the flooding event.

Fire retardants and the ammonia plumes that develop when retardants enter a stream do not persist above the lethal concentrations for long periods of time. Even when relatively small amounts of fire retardant enter a stream, the ammonia concentration reaches levels that are likely to cause immediate mortality. The plume is diluted downstream, but longer exposure is likely to also prove lethal (Buhl and Hamilton 1998). While there has been a fair amount of research conducted in laboratory environments, the response of fish to an accidental fire retardant drop in the natural environment with additional stressors, such as low dissolved oxygen, ash, hot water, and other conditions expected as the result of the nearby fire, has not been studied.

When a stream is exposed to a fire retardant, the life stage of the fish present is an important factor in the severity of effects to the species affected. Some studies have found that swim-up fry are most sensitive to fire retardants and are clearly less capable of vacating an impacted area (Johnson and Sanders 1977, Gaikowski *et al.* 1996, Poulton *et al.* 1997, Kalabokidis 2000). Other studies have found that swim-up fry are just as susceptible as juveniles and adult fish, but eggs and alevins are clearly more resistant (Rice and Stokes 1975). The risk of various life stages being exposed to fires, and, therefore, fire retardants is variable because of the vegetation type, wind direction and speed, fire season length, and many other factors.

While there has been a fair amount of research conducted in laboratory environments, the response of fish to an accidental fire retardant drop in the natural environment with additional stressors, such as low DO, ash, hot water, and other conditions expected as the result of a nearby fire, has not been studied. Salmonids, such as bull trout, are particularly sensitive to elevated temperatures and are not very tolerant of water with low DO, and because warm water holds less oxygen, encountering water with low DO is a distinct possibility during a wildfire. Due to the interactive effects of ammonia and DO, the LC50s of rainbow trout fall dramatically when DO is low (Alabaster *et al.* 1983). Studies showed that at 10 ppm DO, rainbow trout would survive until concentrations of un-ionized ammonia reached 0.2 mg/l, but when the DO fell to 3.5ppm, the lethal concentration of un-ionized ammonia became only 0.08 mg/l (Alabaster *et al.* 1983). Another study showed that when DO dropped from 8.5ppm to 5ppm, rainbow trout became 30 percent less tolerant of ammonia (Thurston *et al.* 1981).

The hardest to measure and likely most significant effects of fire retardant are expected to be long-term, sub-lethal impacts to fish. The distance and the extent of sub-lethal effects from elevated ammonia levels is not known, but may extend further downstream than has been previously recognized and is an area of research that should be analyzed in the future.

Laboratory studies show that rainbow trout exposed to ammonia levels over 0.1 mg/l developed skin, eye, and gill damage (Norris *et al.* 1978). Other reactions to sub-lethal levels of ammonia include reduced hatching success, reduced growth rate; impaired morphological development; injury to gill tissue, liver, and kidneys; and the development of hyperplasia. Hyperplasia in fingerling salmonids can result from exposure of ammonia levels as low as 0.002 mg/l for six weeks (Norris *et al.* 1978). Considering the research in California (Norris *et al.* 1978) that showed detectable levels of ammonia for an entire year following retardant introduction, it is likely that hyperplasia is likely to be a concern for bull trout. The presence of ammonia in the water can also lead to suppression of normal ammonia excretion and a buildup of ammonia on the gills.

Current studies analyzing the risk of runoff only used mortality as the endpoint measurement.

#### Direct and Indirect Effects to Bull Trout Critical Habitat

In the action area, the Service has designated over 12,000 miles of critical habitat. Chemical contamination of habitat is the primary mechanism of effect on critical habitat. The changes in water chemistry will result in adverse effects to the PCEs of critical habitat if a misapplication should occur to critical habitat.

The effects from changes in water chemistry and the aquatic ecosystem due to retardant entering a waterway affect bull trout, the species, through direct and indirect effects of chemical contamination. The bull trout primary constituent elements (PCEs) affected by the action include:

- PCE 2 (*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*);
- PCE 3 (*An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish*);
- PCE 8 (*Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited*).
- PCE 9 (*Sufficiently low levels of occurrence of nonnative 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*) may be beneficially affected by retardant if a fish kill occurs eliminating non-native species.



Critical habitat PCE 2 (*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*) will be affected by chemical contamination that is likely to present a partial, intermittent, or seasonal barrier to bull trout migration. The ability to migrate is important to the persistence of bull trout local populations (Rieman and McIntyre 1993; Rieman and Clayton 1997). Bull trout may delay migration if water is contaminated or bull trout may avoid chemicals as they enter a waterbody, as has been documented in recent studies. Little et al. (2006) studied the behavior of rainbow trout to Phos-Chek D75-R and found that avoidance of the retardant was significant at low concentrations and that the magnitude of rainbow trout avoidance response also showed an increase with an increase of the D75-R concentration. The study concluded that when rainbow trout were presented with a choice between the treated (D75-R) and untreated water the trout were able to detect and avoid the contaminated water (Little et al. 2006). The interpretation of these avoidance tests should consider field variables such as water temperature, water quality, pH, hardness, and dissolved carbon content, which can influence the response by altering the sensory stimuli of the chemical substance (Little et al. 2006). Although avoidance of the retardant is possible in flowing streams, avoidance may not be possible in bodies of water where there is no running water.

Avoidance of retardant chemicals is possible when drift occurs but is less likely with accidental delivery into a waterway. Both scenarios must consider the amount of retardant dropped from the aircraft, the height at which the retardant was dropped, the wind direction and speed, and size of the waterbody in order to make an appropriate effects determinations as these factors play a significant role in determining the level of toxicity and the relative dilution factor in a waterbody. Depending on environmental variables, avoidance behavior of fish may be more effective downstream of a drop while mortality may occur at the initial drop site due to the concentration of chemical and the inability of bull trout to avoid the area quickly enough. The level of mortality downstream is uncertain and will depend on the field variables.

Critical habitat PCE 3 (*An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish*) is likely to be adversely affected by killing of macroinvertebrates and forage fish should misapplication occur. Fire retardants have been shown to have negative direct impacts to many resources on which bull trout depend. The application of retardants composed on inorganic fertilizers is likely to temporarily degrade water quality, impair light penetration, decrease dissolved oxygen and harm macroinvertebrate populations. When fire retardant hits the water and ammonia concentrations increase quickly, macroinvertebrates, an important food source for bull trout, exhibit highly variable responses from no response to high mortality (Adams and Simmons 1999; McDonald *et al.* 1997). Almost all macroinvertebrates will drift in the presence of elevated ammonia, but even then, many die (NMFS 2007). Macroinvertebrate drift increased during a 30 minute dose period and was elevated for some taxa for 30 minutes after the chemical application (Finger *et al.* 1997). It can take years for macroinvertebrates to recolonize a stretch of stream that is negatively impacted during a wildfire (Minshall *et al.* 1997). Macroinvertebrates that react similarly to small amounts of ammonia have up to a four-fold difference in their resistance to acute toxicity (Williams *et al.* 1986). Mayflies and



stoneflies in Australia were not affected by Phos Chek D75-F (Adams and Simmons 1999). A study on the retardant D75-F evaluated *Hyalella azteca*, typically a very chemically tolerant species of macroinvertebrate, found that the 96 hr LC50 was between 53 and 394 mg/l depending on pH, which is not only lethal, but more lethal than for many species of fish. The loss of a macroinvertebrate community in a bull trout stream would adversely affect the local population.

Critical habitat PCE 8 (*Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited*) is likely to be affected by chemical contamination, temporary barriers and changes in the bull trout food base as a result of misapplication of fire retardant. The net result of a misapplication would be changes in normal reproduction, growth and survival of local populations of bull trout due to the immediate changes in water quality. Water quality will be altered as the fire retardant mixes with water to form ammonia compounds toxic to aquatic life.

Based on misapplication rates reported in the BA, the Service estimates that each misapplication would affect up to 6.2 miles of stream. However, not all misapplications would occur in critical habitat, as not all streams on each forest is designated critical habitat. The section below describes the extent of effects to critical habitat.

#### Extent of the Effects to Bull Trout and Bull Trout Critical Habitat

Effects to bull trout from fire retardant can be deleterious, particularly if retardant directly enters small, headwater, spawning and rearing streams. Because of this, the Forest Service has proposed establishing buffers around waterbodies and whenever practical, as determined by the fire incident, the Forest Service will use water or less toxic fire retardants in areas occupied by or designated critical habitat for threatened, endangered and proposed species. Incident Commanders and pilots are required to avoid aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways (including perennial, ephemeral, and intermittent streams as well as lakes, ponds, identified springs, and reservoirs). The only exception to this is when human life or safety is threatened and the use of retardant can be reasonably expected to alleviate the threat. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application or receive less precise placement of the fire retardant relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams. Bull trout are not known to occur in ephemeral or intermittent streams.

Although many current bull trout core areas occur entirely on Forest Service administered lands, there are some core areas that have substantial acreage located off forest service lands, reducing the likely impact from fire retardant misapplication. However, because of the isolated nature of the local bull trout populations, any effects to bull trout or their habitat may

be especially deleterious, particularly if effects continued downstream from the point of contact with the waterbody.

In order to determine the linear extent of effects of misapplication of fire retardant to bull trout and bull trout critical habitat, the following assumptions, as derived from the BA, were followed:

- Aquatic Avoidance Areas: All waterbodies, perennial, intermittent streams, lakes, ponds, identified springs and reservoirs, will have a 300 foot buffer area where retardant drops will be avoided (see BA, page 6, 7, 15, 104, 114).
- The effects analysis in this Opinion is based on misapplication rates as provided in the BA. The BAs estimates that .42% of all retardant drops will result in misapplication to a waterway or buffer area. Therefore, the Service expects that over the life of the consultation, 0.42% of all drops on each Forest will result in delivery to a waterway with likely adverse effects to bull trout, if the stream is occupied, or designated critical habitat. Using the percentage of perennial streams that are occupied/critical habitat we then multiply that by the percentage of expected misapplications on a given forest to extent of effects.
- Although waterbodies will be mapped for avoidance, misapplication of retardant into waterbodies can and does occur.
- To capture the extent of exposure risk, our analysis relies on using historical fire data provided in the BA (Table B-3, pp. 228-236) and using the total drops from 2000-2010 to determine the number of drops expected over the life of this consultation (10 years). Although the BA does point to increasing frequency and severity of fires in the northwest, it is assumed, for this consultation, that fire retardant drop frequency per forest is not likely to change during the timeframe for this consultation.
- Because of the variance of population densities, and because we cannot determine which populations of bull trout are most likely to be affected given the extent of the action area, in order to determine the extent of effects, we will use habitat as a surrogate. Because the level of toxicity of the fire retardant depends on many variables, including retardant concentrations, stream flow volume, stream chemistry, gradient, riparian vegetation, slope, soils, wind direction, ultraviolet exposure, etc., and in order to be conservative for the species, we will assume effects to bull trout and bull trout critical habitat extend 6.2 miles downstream of a misapplication site. Fish within this area are likely to be adversely affected by retardant (see BA p. 119 and p. 123).
- Many National Forests have occupied lake and reservoir habitat. No data was presented in the BA regarding misapplication of fire retardant into lakes occupied by bull trout. However, the probability of an accidental drop into a lake is extremely low since lakes and reservoirs are easily seen from the air. The volume of water in a lake is much greater compared to a small stream; consequently, if fire retardant were introduced into a lake, it should dilute quickly. Fish are capable of avoiding exposure if an avenue of escape is available (Calfee and Little 2002), bull trout may be capable of swimming to another part of the lake, depending on size of the lake, that is not affected by retardant. For these reasons an accidental retardant drop into a lake is

highly unlikely to occur and would have insignificant and discountable impacts to bull trout in the unlikely event that a misapplication into a lake occurs. Therefore, no exemption from take for LCT in lake habitat is authorized in this BO.

As discussed in more detail below, the extent of the effects on each Forest varies given the miles of occupied stream and the frequency of retardant drops on the Forest. Not every stream on a Forest is occupied by bull trout. Therefore we look at the percentage of occupied streams or critical habitat streams and the likelihood for misapplication given the history of retardant use on the forest to determine the extent of exposure.

#### EFFECTS OF INTERRELATED OR INTERDEPENDENT ACTIONS

The implementing regulations for section 7 define interrelated actions as those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The Service has not identified any actions that are interrelated or interdependent with the proposed action.

#### CUMULATIVE EFFECTS

The implementing regulations for section 7 define cumulative effects to include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Illegal and inadvertent harvest of bull trout is considered a cumulative effect. Harvest can occur through both misidentification and deliberate catch. Schmetterling and Long (1999) found that only 44 percent of the anglers they interviewed in Montana could successfully identify bull trout. Being aggressive piscivores, bull trout readily take lures or bait (Ratliff and Howell 1992). Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Hooking mortality rates range from 4 percent for non-anadromous salmonids with the use of artificial lures and flies (Schill and Scarpella 1997) to a 60 percent worst-case scenario for bull trout taken with bait (Cochner et al. 2001). Thus, even in cases where bull trout are released after being caught, some mortality can be expected.

An additional cumulative effect to bull trout across the range is global climate change. Warming of the global climate seems quite certain. Changes have already been observed in many species' ranges consistent with changes in climate (Independent Scientific Advisory Board 2007; Hansen et al. 2001). Future climate change may lead to fragmentation of

suitable habitats that may inhibit adjustment of plants and wildlife to climate change through range shifts (Independent Scientific Advisory Board 2007; Hansen et al. 2001). Changes due to climate change and global warming could be compounded considerably in combination with other disturbances such as fire and invasive species. Fire frequency and intensity have already increased in the past 50 years, particularly in the past 15 years, in the shrub steppe and forested regions of the west (Independent Scientific Advisory Board 2007). Larger climate-driven fires can be expected in Idaho and Montana in the future. Small isolated bull trout populations will be at increased risk of extirpation in the event of larger and more numerous fires. In addition, the preference of bull trout for colder water temperatures gives them a competitive disadvantage over invasive species, such as brook trout, inhabiting warmer stream reaches. Rahel et al. (2008) state that “Climate change will produce a direct threat to bull trout through thermally stressful temperatures and an indirect threat by boosting the competitive ability of other trout species present.”

While across the range of bull trout it is difficult to anticipate what climate change will mean for bull trout. Spawning and rearing habitat may be reduced in the headwaters of many tributaries. Summer flows, when bull trout are migrating to spawning habitats, may be reduced and the timing of the hydrograph may be altered, so that flows come off earlier. As the vegetation in the watersheds regrow after fires, it may offset any climate change impacts to the hydrograph that would be observed. At some point in the future, however, effects to stream habitat from climate change will likely occur.

Bull trout historically relied on steelhead and Chinook salmon as a food source. Chinook salmon and steelhead returns are at a fraction of historic numbers. Low populations of these fish limit the prey base for bull trout and negatively impact the productivity of the aquatic habitat, as those ocean derived nutrients are reduced. Harvest by commercial, sport and tribal fisheries will continue to affect the food base of bull trout.

A myriad other state, tribal and private actions occur throughout the range of bull trout, cumulatively affecting the species and critical habitat, and are too broad to conduct a meaningful cumulative effects analysis here. Such activities include transportation and energy networks, hydroelectric, flood control, and irrigation dams and reservoirs, non-native fish stocking, road maintenance, invasive species management, and other land management actions. A more detailed account of activities that affect bull trout can be found on the bull trout page <http://www.fws.gov/pacific/bulltrout/>. Although many cumulative effects can be identified, we cannot quantify the magnitude of their impacts on bull trout populations over the next 10 years.

## CONCLUSION

The Service has reviewed the current status of the bull trout and bull trout critical habitat, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, and it is our conclusion that the proposed action is not likely to jeopardize the continued existence of the bull trout nor destroy or adversely modify designated critical habitat for bull trout. The Service concludes that direct effects to adult, subadult, and juvenile

bull trout and critical habitat in the action area will occur, and will include short-term disturbance, behavioral effects, mortality, increased predation risk, physiological distress and temporary impairment of primary constituent elements 2, 3 and 8.

The Service expects that the numbers and distribution of bull trout in the action area, the coterminous United States population of the bull trout, will not be significantly changed as a result of this proposed action; action related impacts will not reduce appreciably the likelihood of both the survival and recovery of bull trout. Also, most of the bull trout within the listed range are not likely to be exposed to the effects of the proposed action. Therefore, although the proposed action is likely to have some local adverse effects to bull trout, these effects are not likely to cause a measurable response to bull trout at the scale of the core area, recovery unit, or coterminous U.S. listing. It is the Service's biological opinion that the proposed action will not jeopardize the continued existence of the coterminous population of bull trout nor will it result in the destruction or adverse modification of critical habitat.

The Service reached these conclusions because the proposed action: (1) includes minimization measures to reduce the potential for retardant to enter occupied bull trout streams and critical habitat; and (2) the scale of effects on bull trout core areas and bull trout critical habitat primary constituent elements will be small, and therefore are not expected to result in significant long-term impacts to the species or to the intended function of critical habitat to support conservation of the species.

### **Showy stickseed (*Hackelia venusta*)**

*Species Team Lead:* Vince Harke (Species Lead) – Jeff Krupka (Field Office)

#### Environmental Baseline

The world-wide distribution of *Hackelia venusta* is known to consist of one population in the Tumwater Canyon Botanical Area, located in Chelan County, Washington. The final recovery plan characterized this population as a scattered distribution across roughly 16 hectares (40 acres) in Tumwater Canyon, Washington, almost entirely on Federal lands of the Okanogan-Wenatchee National Forest (OWNF). This restricted population consisted of between approximately 572 and 772 plants in 2004 (USFWS 2007).

The primary loss of habitat for *Hackelia venusta* has resulted from changes in habitat due to plant succession in the absence of fire. Fire suppression has been a factor in reducing the extent of the Tumwater Canyon population (Gamon 1988a, b; D. Werntz, *in litt.* 2000), and most likely the few hundred acres of occupied habitat recorded in 1968 (Gentry and Carr 1976) represented a population that had already been reduced in both numbers and range due to fire suppression activities that had been ongoing for many years. Historically, fuels in the forest type where *Hackelia venusta* is found were rarely at high levels because of the frequent

fires that consumed forest floor fuels and pruned residual trees (Agee 1993). In the past, fires suppressed the encroachment of woody vegetation and maintained open areas presumably more conducive to *Hackelia venusta* reproduction and growth. As described above, wildfires play a role in maintaining open, sparsely vegetated sites as suitable habitat for this shade-intolerant species (R. Carr, pers. comm. 1998; D. Werntz, *in litt.* 2000).

*Hackelia venusta* prefers habitat that has been burned, has little competing vegetation (D. Werntz, *in litt.* 2000), and has low levels of organic matter in the soil (R. Carr, pers. comm. 1998). During the 1994 Hatchery Fire, much of the understory vegetation and trees within this population burned, but no visible harm to *Hackelia venusta* was observed (Harrod 1994). The species has expanded its distribution into canopy openings created by a wildfire in 1994, where it was not previously found (T. Thomas, U.S. Fish and Wildlife Service, pers. obs. 1998; P. Wagner, Washington Department of Transportation, *in litt.* 2000). The continued suppression of fires in this forest type could bring about additional losses to suitable habitat for the species (Barrett *et al.* 1985; Gamon 1997; D. Werntz, *in litt.* 2000). Habitat surveys to date have identified some locations within Tumwater Canyon that appear to have the habitat attributes necessary to support *Hackelia venusta* and may be suitable for reintroduction; the carrying capacity of these locations has yet to be determined. Other suitable locations may exist, as only a small proportion of Tumwater Canyon has been surveyed for suitable habitat.

Two nonnative, Washington State-listed noxious weeds (Washington Administrative Code Chapter 16-750 and Revised Code of Washington Chapter 17-10) occur within the habitat of *Hackelia venusta* in Tumwater Canyon. *Linaria dalmatica* (dalmatian toadflax) and *Centaurea diffusa* (diffuse knapweed) are present along the roadside, and the former also occurs above the main portion of the population (F. Caplow, pers. obs. 2004). During visits to the *Hackelia venusta* population in 1995 through 1998, U.S. Fish and Wildlife Service staff noted that the cover and distribution of the noxious weeds had increased over this time period (T. Thomas, pers. obs. 1998). Both of these noxious weeds out-compete many native plant species through uptake of water and nutrients, interference with photosynthesis and respiration of associated species, and production of compounds that may directly affect seed germination and seedling growth and development. Without intervention, these species have the ability to out-compete *Hackelia venusta* and replace native vegetation, and eventually dominate the site (J. Wentworth, King County Noxious Weed Control Board, *in litt.* 2001).

Low seed production is a factor in the decline of *Hackelia venusta*. At the Tumwater Canyon site, an estimated high proportion (60 to 70 percent) of *Hackelia venusta* seeds did not develop in 1984 (Barrett *et al.* 1985). Fruit development was poor on many plants; only a few individuals exhibited mature fruit development. Low fruit production has been observed in other years as well (L. Malmquist, pers. comm. 2002). This low or variable reproductive potential may be a major factor in the small number of plants at the type locality. The age structure of the extant population at Tumwater Canyon, poor seed production and germination of new seedlings, and historical estimates of population size indicate that the population has been in decline (Barrett *et al.* 1985; Gamon 1997). Recent monitoring of the population shows an increase during the period from 1995 to 2004. The increase in population size can



likely be attributed to the improved habitat conditions brought on by restoration activities and the effects of a wildfire that burned through Tumwater Canyon in 1994.

The small size of the only known population of *Hackelia venusta* is a major problem for recovery. Seedling establishment is most critical, and trampling may significantly affect the germination of seedlings (R. Carr, pers. comm. 1998, *in litt.* 2000; K. Robson, *in litt.* 2001). The small number of individuals (roughly 600 plants) remaining in the sole population located in Tumwater Canyon makes *Hackelia venusta* vulnerable to extinction due to random events such as slope failure (mass wasting or surface erosion) or drought. A single random environmental event could extirpate a substantial portion or all of the remaining individuals of this species, leading to extinction. Also, changes in gene frequencies within small, isolated populations can lead to a loss of genetic variability and a reduced likelihood of long-term viability (Franklin 1980; Soulé 1980; Lande and Barrowclough 1987; R. Carr, *in litt.* 2000). Experimental outplantings have been attempted with very limited success. Recent surveys have revealed nine additional small clusters of *Hackelia venusta* within 0.5 mile of the known population. Plants were also found downslope of the known population. Due to their proximity to the known population, these newly found clusters are considered part of the one existing population, and not separate populations. In sum, the between 572 and 772 plants (F. Caplow, pers. comm. 2004) comprise the worldwide distribution of *Hackelia venusta*.

#### Effects of the Action

Based on the information in the BA, the potential for adverse effects to *Hackelia venusta* is relatively low due to its limited distribution and the low probability of misapplication into the mapped avoidance area where the extant population exists. However, the magnitude of effect may be large, as only a single population exists and a single misapplication would have significant impacts.

The OWNF averages the third most retardant drops in the nation, averaging 133 drops annually over the 2000-2010 fire seasons. The total number of retardant drops in 2000-2010 fire seasons, 1,458, will be used to assess effects during the 10-year term of the proposed action. Even with a low misapplication probability (estimated as 0.01% annually), the BA stated additional concerns (National screens) when small isolated populations like *Hackelia venusta* are involved. Isolated populations were defined as an area where individuals or population(s) occur within a small isolated area where the application of retardant could reduce viability, or jeopardize the further existence of the species.

The single known population of *Hackelia venusta* is located in a steep and rocky area in the Tumwater Canyon Botanical Area. Under normal circumstance, it is extremely unlikely that retardant would be applied with an air tanker in Tumwater Canyon due to the aviation hazards of flying in very confined terrain (P. Jones, pers. comm.. 2011). However, the area is part of the wildland urban interface, is adjacent to the primary highway in the area (US Highway 2), and retardant use may be of strategic importance in this area if extreme fire behavior occurs. Considering the aviation hazards, we expect the only fire retardant use in Tumwater Canyon would be through helicopter delivery.



Helicopter application of retardant is more precise by nature, since pilots have the ability to hover their ship into the target location overhead and can control the height of each drop. As a result, the misapplication rate is likely very low. Even with the shifting down-slope and down-valley air currents in Tumwater Canyon, we expect the retardant to be dispersed on target with minimal drift. For the purposes of this consultation, we will assume that retardant drops that result in a misapplication (likely through drift) will impact *Hackelia venusta* through the following mechanisms: phytotoxicity, fertilizer effects, and physical damage.

#### Phytotoxicity

Phytotoxicity can result when excessive amounts of salts (e.g., nitrogen, phosphorous, etc.) are in contact with or absorbed by plants. Effects can be variable, depending on the concentration of the salts, individual species sensitivity, duration of exposure, and a wide variety of site specific conditions (e.g., soil type, pH, amount and timing of precipitation after application). Effects can include foliar damage, leaf death, shoot or root die back, reduced germination, and even mortality. Information provided in the BA suggests that in general, phytotoxic effects generally only last 1-2 years.

#### Fertilizer Effects

Changes in plant communities can occur after retardant applications. Although the BA cites there are few examples in the literature, decreases in species richness, increase in forage that attracts herbivores, alterations of the structure of the vegetation community, and enhancement of noxious weeds have been reported in areas subjected to retardant. Retardants serve as a source of plant nutrients when not phytotoxic. This may have both positive and negative effects to *Hackelia venusta*; stimulating its own growth but also that of competing species. Fertilizer effects are variable among plant species, with some more responsive than others, leading to a wide range of outcomes based on the existing plant community.

#### Physical Damage

Physical damage can result from direct impact, and a variety of indirect impacts such as tree tops, branches, and even trees falling onto plants, surface and rill erosion from retardant being channeled across the ground, and even uprooting of individuals in extreme cases. This may be of greater concern on steep and incised terrain where retardant may be concentrated or rapidly run off the slope. However, the area impacted should be limited since fire retardant has a high viscosity (i.e., it has a high resistance to flowing across a surface). For example, water has a low viscosity of about 1 centipoise (at 70 °F), Phos-Chek formulations range from 1,000-1,600 centipoise ([http://phos-chek.com/uploads/images/Product\\_Profile\\_D75\\_ICL.pdf](http://phos-chek.com/uploads/images/Product_Profile_D75_ICL.pdf)), and molasses has a high viscosity of 5,000 centipoise. Nonetheless, in the event of a concentrated misapplication directly on *Hackelia venusta*, some physical damage is anticipated since retardant drops are known to break branches and tree tops.

#### Species Response to the Proposed Action

With the precise nature of helicopter delivery of retardant, we expect only minor amounts (up to 5% of the population) to be likely impacted by the mechanism of phytotoxicity in the event of a misapplication. Misapplication through drift suggests fire retardant is unlikely to be of concentrations high enough to result in extensive amounts of phytotoxic effects. By mid-June, the lowest flowers have nearly mature fruits and dispersal (by wind, gravity, or perhaps

animals) continues for several weeks into mid-June (USFWS 2007). This suggests that any phytotoxic effects would be limited to the early fire season (June to mid-July, about 6 weeks) before *Hackelia venusta* has senesced, with few to no impacts the remainder of the fire season (mid-July to October, about 11 weeks). Phytotoxic effects anticipated include localized foliar damage, leaf death, shoot or root die back, over as much as 5% of the population. Impacts to germination are not expected due to low concentration levels and the small overlap between the fire season and fruit production. Death of individual plants is also not anticipated due to low concentration levels. Physical damage is not anticipated to occur due to drift, which suggests low coverage levels and little opportunity for retardant to be channelized by terrain. Coupled with the high viscosity of retardant, even when considering the steep slopes, we expect any run-off and surface erosion to be insignificant.

Fertilizer effects may be the largest anticipated impact. Misapplication by drift would likely favor *Hackelia venusta*, especially in the following spring when it emerges from dormancy, but it would also stimulate the growth of all competitive species in the area, some of which may not have senesced at the time of the misapplication. This may lead to increased competition for space, water, and nutrients. *Hackelia venusta* prefers disturbed areas, typically by fire and hill slope erosion. Maintaining open, sparsely vegetated sites is important to this shade-intolerant species. Two nonnative, Washington State-listed noxious weeds (Washington Administrative Code Chapter 16-750 and Revised Code of Washington Chapter 17-10) occur within the habitat of *Hackelia venusta* in Tumwater Canyon. *Linaria dalmatica* (dalmatian toadflax) and *Centaurea diffusa* (diffuse knapweed) are present along the roadside, and the former also occurs above the main portion of the population (F. Caplow, pers. obs. 2004). Expansion of competitive species due to fire retardant misapplication, including these noxious weeds, could have serious implications to the only population known population of *Hackelia venusta*.

Since *Hackelia venusta* will be senesced for the majority of the fire season, competitive species including snowberry (*Symphoricarpos* spp.), ceanothus (*Ceanothus* spp.), serviceberry (*Amelanchier alnifolia*), and ocean-spray (*Holodiscus discolor*) will immediately benefit from misapplication. *Hackelia venusta* however, will benefit mostly the following spring, on whatever residual salts remain after months of uptake from competitive species and was not weathered and run-off following precipitation and snow-melt. As a result, we expect the majority of fertilizer effects to benefit competitive species, and may reduce the amount and distribution of growing space for *Hackelia venusta*.

Although we believe the site is nutrient poor, fertilizer effects from fire retardant misapplication may not lead to extensive inter-specific competition with *Hackelia venusta*. The current plant community is distributed across this steep, rocky, and constantly eroding slope as a function of abiotic factors but also depends on a species ability to persist on a disturbed site. Frequent substrate movement limits the number of species that can establish, persist, and expand their distribution in such an environment. Those that do persist typically are found in more stable areas (e.g., behind large rocks, near large trees, small benches, etc.) instead of areas prone to hill slope erosion. As a result, we expect increased vigor and seed production of competitive species but not extensive expansion of their distribution due to the

difficulties of establishing new individuals on a constantly disturbed site. Although there is great uncertainty in this estimate, we do not expect more than a 5% expansion of competitive species.

### Summary

We anticipate that only helicopter delivery of fire retardant will likely occur in Tumwater Canyon and the likely cause of misapplication is drift. Physical damage is not anticipated, and sub-lethal phytotoxic effects will affect about 5% of the population. Fertilizer effects are expected to benefit *Hackelia venusta* and its competitors, but should only result in a 5% expansion of competitive species due to the inherent difficulties of increasing their distribution on a steep rocky slope prone to chronic hill slope erosion. Because we cannot anticipate the spatial nature of these effects, we will conservatively assume sub-lethal and competitive effects occur in different areas so a total of up to 10% of the *Hackelia venusta* population will be impacted.

We believe these impacts are likely to result in both sub-lethal phytotoxic effects and fertilizer effects that lead to increased competition. *Hackelia venusta* is anticipated to recover from phytotoxic effects after one growing season so the nature of this mechanism of adverse effects is likely to be short-term and not have a lasting impact on the overall population viability. Fertilizer effects are anticipated to increase competitive interactions and may result in less growing space for *Hackelia venusta*.

However, we believe increasing competitive interactions to 5% of the population may not be significant to the overall persistence of the species. As described above, we expect limited expansion of competitive species because of the inherent difficulties of increasing their distribution on a steep rocky slope prone to chronic hill slope erosion. Our best example of relatively large changes in the species distribution followed the 1994 fires. Here, fire burned a portion of the *Hackelia venusta* population, its competitors, and the surrounding areas. While all species were adversely affected by the fire, *Hackelia venusta* responded favorably by re-establishing itself in occupied areas and expanding its distribution into areas it was not previously found. Once established, it appears that *Hackelia venusta* is able to persist on disturbed sites until tree and shrub cover increases shading, and reduces site suitability. Thus, frequent disturbance that removes competitors and maintains open areas appear to be key to persistence of *Hackelia venusta*. While the proposed action may increase the vigor of trees, shrubs, and other competitors over a small portion of the population of *Hackelia venusta*, we do not believe this will cause a large-scale change in the distribution of this imperiled species since little expansion of competitive species is anticipated.

Many assumptions were required to assess the effects of a proposed action with many uncertainties. Therefore we have identified the following triggers for reinitiation:

1. If more than one retardant drop occurs on or near (0.25 mile) the *Hackelia venusta* population.

2. If any lethal effects are observed and are likely attributable to phytotoxic effects from retardant misapplication.
3. If the expansion of competitive species due to retardant misapplication is greater than the 5% anticipated or if tree and shrub cover exceeds that present in 2007 (see the recovery criteria in the final recovery plan, page 27; USFWS 2007).

## Conclusion

After reviewing the current status of *Hackelia venusta*, the environmental baseline, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the Project, as proposed, is not likely to jeopardize the continued existence of *Hackelia venusta*.

The range-wide status of *Hackelia venusta* is comprised of a single population in Chelan County, Washington. The baseline conditions suggest a population of 572 and 772 plants threatened by habitat loss due to fire suppression, inter-specific competition, highway maintenance (de-icer), and landslides; collection pressures; potential impacts from the biocontrol agent *Mongulones cruciger*; inadequacy of existing regulatory mechanisms; low seed production and small population size.

Based on recovery planning to date, conservation of *Hackelia venusta* is dependent on reducing the threats/reasons for listing. In particular, maintaining open, sparsely vegetated sites as suitable habitat for *Hackelia venusta* is important for the conservation of this shade-intolerant species. Therefore, proposed Federal actions that are compatible with achieving those objectives are not likely to jeopardize the continued existence of *Hackelia venusta*.

The proposed Project is likely to cause phytotoxic effects and fertilizer effects to a small proportion of the species. Phytotoxic effects are expected to be sub-lethal and will not last beyond one growing season. Fertilizer effects to *Hackelia venusta* and its competitors are expected to increase plant vigor, but are not anticipated to result in large changes in any species' distribution.

No significant interrelated or interdependent actions or cumulative effects are anticipated to occur during the term of the proposed Project.

Although we expect adverse effects, we do not anticipate the effects of the proposed action will appreciably reduce the likelihood of survival and recovery of *Hackelia venusta*. Reintiation triggers have been provided to ensure the effects of the proposed action do not exceed the amount of extent of effects considered in this BO, and to ensure that recovery criteria for the maintenance of suitable habitat are not impaired.

## **MacFarlane's Four-o'clock (*Mirabilis macfarlanei*)**

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### Environmental Baseline

More information on the species can be found at:

<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?sPCODE=Q1ZF>

*Mirabilis macfarlanei* (MacFarlane's four-o'clock) was originally listed as endangered in 1979 (44 **FR** 61912). Since that time, additional populations have been discovered and some populations on Federal lands are being actively managed and monitored. As a result of on-going recovery efforts, MacFarlane's four-o'clock was downlisted to threatened in March 1996 (61 **FR** 10693).

A revised recovery plan for the plant was published on 6/30/2000

(<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?sPCODE=Q1ZF#recovery>).

The species has a recovery priority number of 2 on a scale of 1 to 18, reflecting a high degree of threat, a high potential for recovery and reflects that this plant has a taxonomic rank as a full species, which has a higher priority than a subspecies. All currently known populations occur in two counties: Idaho County, Idaho and Wallowa County, Oregon. The twelve known populations are found in the Snake River Canyon area, the Salmon River drainage, and the Imnaha River drainage (USDA Forest Service 2003).

### ***Nez Perce National Forest (2.2 million acres)***

There are 15.7 acres of occupied habitat on the Forest near Pittsburg Landing along the Snake River. Virtually all suitable habitat in the Salmon Basin is on low elevation private or BLM land, with only trace levels of habitat occurring at a few locations on Forest Service land. The Island Ecosystem Analysis at the Watershed Scale (EAWS) (USFS 2006) modeled potentially suitable habitat between the Salmon River and the Salmon/Snake divide in the vicinity of the Nez Perce National Forest. Of the 10,707 acres of modeled habitat in this area, only about 535 acres (5%) of marginal potential habitat occurs on Nez Perce Forest Service land; almost all of which is located in the lower Rapid River canyon, which would be mapped as avoidance area due to the proximity to water. During the period 2000-2011 there have been 1,305 reported fires on the Forest with 194 retardant drops. Less than 0.002% of the Forest lands have been treated with fire retardant. Of the 15.7 acres of *Mirabilis macfarlanei* occupied habitat, 14.4 acres have burned in the past 10 years, at least once.

### ***Wallowa-Whitman National Forest (2.3 million acres)***

*Mirabilis macfarlanei* occurs on the Wallowa-Whitman National Forest and grows in mid-elevation river canyon grassland habitats characterized by regionally warm and dry

conditions. Precipitation occurs during winter and spring. Sites are generally open, with scattered shrubs. Habitat generally consists of bunchgrass communities, most often on steep slopes. A habitat analysis study conducted in Oregon showed that distribution appeared to be influenced by slope aspect, soil development, topographic position, and the density of non-native plants (Kaye 1992). Plants are found on all aspects as well as slopes ranging from steep to flat. Elevations range from 300 to 900 meters (1,000 to 3,000 feet). Soils vary from sandy to talus substrate. Over the period of 2000-2011 there have been 1,134 reported fires on the Forest with 730 retardant drops. Approximately 0.006% of the forest has been treated with retardant during that time. Of the 47.5 acres of *Mirabilis macfarlanei* occupied habitat, 19.3 acres have burned in the past 10 years.

According to the LANDFIRE database (<http://www.landfire.gov>), approximately 9,242 acres have burned within 1 mile of *Mirabilis macfarlanei* on USFS land in the last 10 yrs. (of 13,228 acres within 1 mile of MM on USFS). Thirteen populations of *Mirabilis macfarlanei* are currently known.

Within the action area, *Mirabilis macfarlanei* occurrences cross into different ownerships. The Snake River occurrences are all located on Forest Service land. The Salmon River occurrences are on both BLM and private land, while one site out of two in the Imnaha drainage is about half on Forest Service land, half on private land.

The best description of populations within the action area can be found in the Hells Canyon National Recreation Area (HCNRA) Final Environmental Impact Statement Comprehensive Management Plan (USDA Forest Service 2003). The following descriptions are from that document, but only discuss the Snake River and Imnaha populations.

The Snake River occurrences include the largest *Mirabilis macfarlanei* population in Oregon. This population (called Tryon Bar) is estimated at 3,000 plants. It is one continuous colony spread over approximately 300 acres. Another population, Pleasant Valley, Oregon is located in the Hells Canyon Wilderness along the lower slopes of the Snake River about one mile north of Pittsburg Landing (an area known for invasive plants). The population size is estimated at 100 plants distributed in clumps over one acre. The Island Gulch population on the Idaho side is a short distance north of Pittsburg Landing with an estimated 40 plants over 0.1 acre. The Mine Gulch site is just north and east of Island Gulch with a population estimated at 150 plants over two acres. The West Creek site in Idaho is estimated at 250 plants over two acres, while a grouping of several occurrences in the same Pittsburg grazing allotment are located nearby with an estimated 1,584 plants.

The Imnaha population is on both private and Forest Service land. The population estimate does not split between ownership, but about 350 plants are located on approximately 20 acres. Given the above distribution descriptions, roughly 6,000 plants occur on Forest Service land out of the current estimate of 8,000 to 9,000 individuals.

*Factors Affecting Species Environment within the Wallowa-Whitman National Forest*



The invasion of non-native plant species continues to be a major threat to *Mirabilis macfarlanei*. Colket et al. (2006) report all Element Occurrences (EOs) of this species in Idaho also contain one or more species of invasive nonnative plants, especially *Bromus tectorum*. While these descriptive notes may be helpful in interpreting or comparing photographs taken over time or at different monitoring sites, or documenting management issues at a site, the lack of quantitative monitoring data makes it difficult to evaluate or document the success of weed control, presently one of the main *Mirabilis macfarlanei* management efforts (Mancuso and Shepherd 2008).

The threat from non-native weed invasions into *Mirabilis macfarlanei* sites could adversely impact the species and its recovery. There are many negative ecological impacts associated with noxious weeds which include, but not limited to: displacement of native plants, reduced biodiversity, altered normal ecological processes (e.g., nutrient cycling, and water cycling), decrease in wildlife habitat value, and increased soil erosion and stream sedimentation potential.

The effects of wildfire on the habitat of *Mirabilis macfarlanei* encompass several categories, most of which are interrelated and often difficult to isolate from each other and equates to the loss of habitat for *Mirabilis macfarlanei* and other native species (Billings 1994). For example, the invasion and establishment on non-native annual grasses and forbs following wildfire increases the amount and continuity of fine fuels across the landscape, which in turn increases the likelihood of frequent and intense wildfires in habitats that support *Mirabilis macfarlanei*.

Organisms adapt to disturbances such as historical wildfire regimes (fire frequency, intensity, and seasonality) with which they have evolved (Landres et al. 1999), and different rare species respond differently to wildfires (Hessel and Spackman 1995). In general, fire regimes within forest and steppe habitats in the western United States have been highly disrupted (Whisenant 1990). In some instances, fire suppression has allowed grasslands to be invaded by trees (Lesica and Martin 2003). At the same time, in many grassland and shrub habitats fire frequencies have increased due to the expansion and invasion of annual nonnative grasses (Whisenant 1990). These invasive annual nonnative grasses fill gaps that would naturally occur between native vegetation, dramatically increasing the ability of wildfire to spread. At least six *Mirabilis macfarlanei* EOs on the Wallowa-Whitman National Forest have been burned since 1990 (Idaho EO#1, EO#2, EO#6, and EO#7; in Oregon EO#1 and EO#5). Almost all of the EOs have become infested with non-native plants such as *Bromus tectorum* and *Centaurea solstitialis*, making them more vulnerable to wildfires (Mancuso and Shepherd 2008; Colket et al. 2006).

Wildfires that occur during summer and fall months when *Mirabilis macfarlanei* plants are dormant may have minimal direct effects on this species since the underground rhizomes will be largely insulated from fire (Fish and Wildlife Service 2000). However, the effects of wildfires often result in adverse changes in the ecological conditions of sites that can lead to



the subsequent invasion of exotic species. Additionally, increased concentrations of ungulates grazing within the burned areas might result in increased trampling of *Mirabilis macfarlanei* plants. The primary concern from wildfires appears to be during the active growing period (April through June) when the aboveground plants would be susceptible to fire kill or injury (Fish and Wildlife Service 2000). Finally, while there is information that there is higher seed-set in *Mirabilis macfarlanei* plants with larger inflorescence displays than those with smaller displays (Barnes 1996), there is no information available about seed production and set in a post-wildfire setting.

Grazing by native herbivores and domestic livestock grazing on *Mirabilis macfarlanei* was identified as a potential threat to the species in the 1996 reclassification from endangered to threatened status (Fish and Wildlife Service 1996). *Mirabilis macfarlanei* has been able to persist in areas presently in poor ecological condition and historically grazed by livestock since the 1870's. Preliminary data suggests grazing may have a negative effect on plant height, but additional research is needed (Johnson 1984; Kaye and Meinke 1992). Currently, the most serious impacts from livestock grazing are likely indirect, most notably related to habitat degradation.

Although it is uncertain whether most or all *Mirabilis macfarlanei* populations were grazed by domestic livestock in the past, livestock grazing still occurs at some sites (Fish and Wildlife Service 2000). Livestock impact this species directly by trampling or consuming plants (Kaye 1995), and can result in reduced reproduction (i.e., seed set) for *Mirabilis macfarlanei* plants. All known *Mirabilis macfarlanei* EOs in Idaho and Oregon have had some level of sheep and/or cattle grazing in the past (Craig Johnson, BLM, pers. comm. 2008). In Oregon, the Forest Service has excluded grazing with fencing in Hells Canyon (EO#6) and one Forest Service administrative site (EO#5) in the Imnaha River Canyon (Yates 2007). The Forest Service fenced off Idaho EO#6 (Pittsburg Allotment) and Oregon EO#5 during the 1990s. This allotment has been vacant (not stocked) since 2003 (Gene Yates, Forest Service, pers. comm. 2008).

Since 1996, the Forest Service in Oregon has modified domestic livestock grazing to protect known *Mirabilis macfarlanei* populations. The Forest Service has taken actions that include measures to remove domestic livestock from *Mirabilis macfarlanei* sites before the plant starts to grow in April (Fish and Wildlife Service 1996). The Forest Service portion of Oregon EO#3 has been fenced to exclude grazing. EO#1 and EO#5 (Oregon side of the Snake River) have not been grazed in over 20 years because these allotments are closed (Yates, pers. comm., 2008).

Livestock grazing was moderate to heavy at several *Mirabilis macfarlanei* sites when monitoring first began in the early 1980s. Stocking rates have been greatly reduced over the years, with overall use now rated moderate to light at most sites (Mancuso and Shepherd 2008). Although direct impacts from livestock can occur, the indirect impacts that adversely affect habitat conditions and ecological integrity are likely more problematic for the long-term persistence of *Mirabilis macfarlanei* (Mancuso and Shepherd 2008).

Herbicide and pesticide spraying in areas where *Mirabilis macfarlanei* is present could also lead to adverse effects if not carefully implemented. One population (which is located outside of the action area) is directly adjacent to a major highway where roadside vegetation spraying is routinely conducted by the BLM after flagging to avoid the population. An unauthorized aerial herbicide spraying incident affected the species in the vicinity of the Salmon River in Idaho County, Idaho. Plants on both federal and private lands were affected. At least 2,750 stems on BLM land exhibited foliar kill as a result of spraying in 1997. Subsequent monitoring in 1998 found that most of the plants did survive, although long term effects on the population are unknown (USDA Forest Service 2003).

### Effects of the Action

Our working assumptions for the effects analysis follow:

- Although the Wallowa-Whitman NF has relatively low retardant use annually, the habitat for the plant (grasslands) has a relatively high potential for retardant use, and undetected and undocumented populations are at risk (as described in the Assessment pg. 68)
- Many acres of potential habitat have not been surveyed, particularly on the Wallowa-Whitman, therefore, there is potential for retardant drops to occur in potential habitat with effects to undocumented *Mirabilis macfarlanei*.
- Mapped avoidance areas around known populations will be prepared by the Forests prior to implementation of the proposed action. Forests will take precautions to prevent application of fire retardant in mapped avoidance areas.
- Potential for retardant misapplications on known populations are the pathway for the LAA determination. The mechanism of adverse effects is the fertilizer effects and the potential for increased invasive species.

There are 15.7 acres of occupied habitat on the Nez Perce National Forest, and 535 additional acres of modeled suitable habitat in the lower Rapid River drainage. Although the Forest treats less than 0.01 percent of its land-base annually with retardants, according to the BA, fire retardant drops are considered likely in the grassland habitat of Hells Canyon Natural Research Area, where this plant occurs. It is not known at this time how many retardant drops have occurred on the occupied habitat or near the occupied habitat, but nearly all the habitat on this Forest has burned at least once during the past 10 years. The indirect fertilizer-like effect of fire retardant is the main mechanism of effect for *Mirabilis macfarlanei*. Invasive plants may increase as a result of fire retardant application.

Invasive non-native plant species are an identified threat to populations of *Mirabilis macfarlanei* and increases in the abundance of non-native plants could exacerbate this threat. Some non-native plants (e.g., *Bromus diandrus*) have been shown to respond favorably to retardant applications due to the associated fertilizer effect. On the Wallowa-Whitman National Forest, known numbers of plants and acres of habitat on this forest for *Mirabilis macfarlanei* is approximately 6,000 plants and 325 acres including some private along the

Imnaha (currently being sold between TNC and the Forest) and undocumented acres within Pittsburg allotment near the West Creek Idaho occurrence (refer to baseline description). Nearly half of the occupied habitat on the Wallowa Whitman National Forest has burned in the past 10 years.

Through a cooperative venture with the Forest Service, the Oregon Natural Heritage program modeled probable habitat for *Mirabilis macfarlanei* in the Hells Canyon National Recreation Area (HCNRA). The predictive model identified 39,090 acres of habitat in the HCNRA that may support *Mirabilis macfarlanei*. The Forest treats less than 0.01 percent of its land-base (2.3 million acres) annually with retardants but because the grassland habitat (where the plant occurs) is prone to fire, *Mirabilis macfarlanei* habitat is likely to receive a disproportionate amount of retardant applications.

The time of year when activities are most likely to directly impact this species is during the spring and early summer, when the plants are actively growing, flowering, or fruiting. Wildfires, and associated use of fire retardant, occur typically in late summer and fall when this plant is dormant. Wildfires may have minimal direct effects on this species since the underground rhizomes will be largely insulated from fire (Fish and Wildlife Service 2000).

Changes in plant communities can occur after retardant applications. Although the BA cites few examples from in the literature, decreases in species richness, increase in forage that attracts herbivores, alterations of the structure of the vegetation community, and enhancement of noxious weeds have been reported in areas subjected to retardant. Retardants serve as a source of plant nutrients when not phytotoxic. This may have both positive and negative effects to *Mirabilis macfarlanei*; stimulating its own growth but also that of competing species. Fertilizer effects are variable among plant species, with some more responsive than others, leading to a wide range of outcomes based on the existing plant community.

Invasive non-native plants alter various attributes of ecosystems including geomorphology, fire regime, hydrology, microclimate, nutrient cycle, and productivity (Pyke and Novak 1994). Additionally, invasive non-native plants can negatively affect native plants, including *Mirabilis macfarlanei* through competitive exclusion, niche displacement, competition for pollinators, and changes in insect predation (Monsen 1994).

Invasive non-native plant species are an identified threat to populations of *Mirabilis macfarlanei* and increases in the abundance of non-native plants could exacerbate this threat. Some non-native plants (e.g., *Bromus diandrus*) have been shown to respond favorably to retardant applications due to the associated fertilizer effect, as described in the BA (pp. 31-33). Twelve occurrence locations, 325 known acres, and 39,090 acres of modeled habitat occur in the Canyon grasslands on the Forest. The Canyon grasslands are susceptible to fire and may be impacted by associated retardant drops. When these factors are considered, a direct retardant application resulting from a misapplication into the core of the mapped avoidance area during implementation of the proposed action is likely to cause localized

increases in the populations of both *Mirabilis macfarlanei* and non-native plant species, however, the beneficial effects are likely to substantially favor the non-native invasive species and thereby increase competitive pressure and significantly impact population viability for *Mirabilis macfarlanei*.

As noted above in the Environmental Baseline discussion for the Wallowa-Whitman National Forest, habitat for *Mirabilis macfarlanei* generally consists of bunchgrass communities, most often on steep slopes. Adverse effects of misapplication of retardant within *Mirabilis macfarlanei* habitat are reasonably certain to occur because the habitat that the plant is found has a higher probability of fire, based on recent fire history, and a higher likelihood of being sprayed with retardant due to the presence of private lands immediately adjacent to the mapped avoidance areas. Also due to the steepness of the terrain, the USFS is more likely to apply retardant than install line crews. Although a misapplication(s) may minimize the extent of fire within *Mirabilis macfarlanei* habitat as well as cause some other beneficial effects to the species due to the fertilizer in the retardant, adverse effects are likely to occur to *Mirabilis macfarlanei* due to the fertilizer effect of enhancing populations of invasive plant species within affected areas of habitat. Overall, the proposed action is likely to cause localized adverse effects to *Mirabilis macfarlanei* that are not compatible with its local conservation needs, but also not expected to appreciably reduce the worldwide population.

#### Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Service is not aware of any cumulative effects to this species that should be considered as part of this consultation.

#### Conclusion

After reviewing the current status of *Mirabilis macfarlanei*, the environmental baseline, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the Project, as proposed, is not likely to jeopardize the continued existence of *Mirabilis macfarlanei*.

As discussed in the *Mirabilis macfarlanei* 5-Year Review Summary and Evaluation (January 2009, [http://ecos.fws.gov/docs/five\\_year\\_review/doc2614.pdf](http://ecos.fws.gov/docs/five_year_review/doc2614.pdf)), in general, monitoring data suggests that the species "population size" has neither increased nor decreased on Forest Service lands in Oregon since 1981 (Mancuso and Shepherd 2008, in Fish and Wildlife Service 2009). The invasion of non-native species continues to be a major threat, which is exacerbated by wildfires. The effects of retardant application is likely to result in adverse changes in the ecological conditions of the species habitat that can lead to the subsequent

invasion of non-native plant species, or reduction of suitable habitat due to changes in the soil chemistry and disturbance.

Implementation of the proposed action is likely to result in localized adverse effects to *Mirabilis macfarlanei* due to the presence of adjacent private lands, and steepness of terrain, both factors increasing the likelihood of core misapplications, and resulting in the fertilizer effect of enhancing populations of invasive plant species within affected areas of habitat. Overall, the proposed action is likely to cause only localized adverse effects to *Mirabilis macfarlanei* that are not compatible with its conservation needs, but also not expected to appreciably reduce the worldwide population.

### **Marbled Murrelet (*Brachyramphus marmoratus*)**

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#### Environmental Baseline

This species is listed as threatened in California, Oregon, and Washington only. All National Forests within the listed range of the murrelet are managed under the provisions of the Northwest Forest Plan which provides a long-term conservation strategy for the management of habitat for late-successional and old-growth forest related species, including the murrelet (USDA and USDI 1994). Current monitoring estimates indicate there are over 2.35 million acres of potential murrelet nesting habitat located on all Federal lands within the Northwest Forest Plan area (Raphael et al. 2011). Over 2 million acres of murrelet nesting habitat (89 percent) are located in designated Wilderness areas and other reserved land use allocations as designated by the Northwest Forest Plan (Raphael et al. 2011). Approximately 1.37 million acres of potential murrelet nesting habitat is distributed across eight National Forests in the Pacific Northwest (Table 8).

The recovery plan for the murrelet established six Conservation Zones for murrelet recovery, and identifies the protection and restoration of murrelet nesting habitat as the primary strategy for murrelet recovery (USFWS 1997). The Northwest Forest Plan provides a substantial contribution towards protecting nesting habitat on Federal lands, especially habitat that is currently occupied by murrelets, and represents the backbone of the recovery strategy for the species (USFWS 1997). National Forest lands contain the majority of murrelet nesting habitat on Federal lands in Conservation Zones 1 through 4.

Murrelet nesting habitat is generally located within close proximity to coastal areas with a relatively low risk of catastrophic wildfire. However, long-term monitoring for the Northwest Forest Plan indicates that wildfire has been the single largest cause of murrelet nesting habitat loss on Federal lands since 1994. From 1994 to 2007, approximately 76,800 acres of murrelet nesting habitat were lost on Federal lands, 56,900 acres due to wildfires (74 percent), 15,400 acres due to timber harvest (20 percent), and 4,500 acres from other disturbances, such as insects, disease, or windthrow (6 percent) (Raphael et al. 2011). This represents a total loss of

approximately 3.2 percent of the murrelet habitat on Federal lands since 1994 (Raphael et al. 2011).

All National Forests within the range of the murrelet have documented aerial application of fire retardant during 2000 -2011 (USFS 2011). Regional interagency monitoring and mapping of wildfire perimeters in the Pacific Northwest document significant wildfires have occurred on all National Forests within the range of the murrelet, with the exception of the Siuslaw National Forest in coastal Oregon (GeoMAC 2011). We have no information regarding the amount of suitable murrelet habitat within each Forest that has been exposed to fire retardant drops over the past 10 years.

**Table 8. Summary of potential murrelet nesting habitat on National Forests (NF).**

State / Murrelet Conservation Zone	Administrative Unit	National Forest acres	NF lands within the range of the murrelet (acres)	Percent of NF lands within the range of murrelet	Total murrelet habitat on NF lands (acres)	Percent of murrelet range on NF that is suitable murrelet habitat
WA Zones 1, 2	Olympic National Forest	630,830	630,830	100.00%	194,880	30.89%
WA Zone 1	Mt. Baker-Snoqualmie National Forest	1,746,290	1,690,520	96.81%	434,880	25.72%
WA Zone 1	Okanogan-Wenatchee National Forest	4,260,000	283,810	6.66%	6,680	2.35%
WA Zone 1	Gifford Pinchot National Forest	1,370,210	170,140	12.42%	30,550	17.96%
OR Zone 3	Siuslaw National Forest	626,400	626,400	100.00%	242,860	38.77%
OR/CA Zone 4	Rogue River-Siskiyou National Forest	1,719,500	968,650	56.33%	239,310	24.71%



CA Zone 4	Klamath National Forest	1,573,950	203,170	12.91%	67,860	33.40%
CA Zones 4	Six Rivers National Forest	964,620	541,180	56.10%	155,940	28.81%
	Totals	12,891,800	5,114,700	39.67%	1,372,960	26.84%

Notes: Acres for all values have been rounded to the nearest 10th. All acreage figures are estimates derived from GIS data. National Forest acres are from spatial data for Federal lands developed for the Northwest Forest Plan 10-year monitoring report ([www.reo.gov](http://www.reo.gov)), non-federal lands within the administrative boundaries of National Forests are not included in these totals. Murrelet habitat estimates are derived from the Expert Judgment Model, Class 3 (moderately high suitability) and Class 4 (highest suitability) developed by Raphael et al. (2006).

## EFFECTS OF THE ACTION

### Assumption Used for the Effects Analysis

Effects to murrelets are based on the expected exposure of murrelet nesting habitat (acres) to aircraft noise disturbance and direct retardant impacts.

The average area directly affected by each retardant drop is 800 ft long by 75 ft wide = 60,000 sq. ft. or 1.38 acres. This is based on information provided in the BA, p. 13.

For aircraft noise disturbance, we assume a disturbance zone of 0.25 mile surrounding the retardant drop zone. This zone is (1320 ft + 800 ft + 1320 ft long) x (1320 ft + 1320 ft wide) = 9,081,600 sq. ft., or 208 acres.

To calculate the area of murrelet habitat likely to be exposed to retardant and noise disturbance, we applied simple percentages and calculated the total area exposed to retardant drops divided by the percentage of National Forest acres located within the range of the murrelet, and the percentage of suitable murrelet habitat present on the Forest.

### Potential Effects of the Aerial Application of Fire Retardant to Murrelets

Fire retardant is delivered by airtankers, single engine airtankers, and helicopters. Retardant is typically applied to fuels in front of an advancing fire, not directly to the fire. Most retardant delivery occurs on ridge tops and adjacent to human-caused or natural fire breaks, such as roads, meadows, old fire scars, and rock outcrops. Applying retardant adjacent to these human-caused or natural fire breaks enhances the effectiveness of fire breaks by widening the fire break (USFS 2011). In the May, 2011, *Draft Environmental Impact Statement for Aerial Application of Fire Retardant* (USFS 2011, p. 116), the Forest Service provides the following description of aerial application of fire retardant:



—Retardant coverage level is a unit of measure used to describe the thickness of retardant on the ground and is expressed in gallons per 100 square feet (gpc). Application rates range between 1 and 8 gpc with the majority of applications between 4 and 8 gpc... Usually, the width and length of a retardant drop swath varies based on the type of aircraft used for delivery, drop height, and surface wind speeds and direction. An average drop is 50 to 75 ft wide by up to 800 ft long. Depending on firefighting tactics, retardant drop width and length might be strung together, creating a continuous path of retardant on the ground or used to create a barrier in combination with other naturally occurring barriers to the advancement of fires (i.e., ridgetops, roads, waterways, old burn scars).”

The Forest Service identified the following effects for terrestrial wildlife species that are applicable to this analysis of effects to murrelets (USFS 2011, pp. 130-131):

—...direct impacts from the application of retardant may occur ...if nest trees or breeding sites are occupied at the time of the wildland fire incident or the mobility of the individual species is such that it cannot avoid the area of potential application.”

—...disturbance associated with low-flying aircraft that could stress animals; disrupt calving, rearing, or nesting; or displace animals to areas of less suitable habitat. Although short in duration, this activity does cause a change in behavior for any wildlife that may be present or within the vicinity of the retardant drops. This may affect an area up to ½-mile from an occupied site, a common accepted distance from raptor and bird nests for most species (northern spotted owl, marbled murrelet, and bald eagle in the Pacific Northwest.”

—Another possible direct effect to habitat is the breaking off of tree tops/vegetation by a low, fast drop of a large load (2,500 gallons). It is possible that retardant drops could adversely affect components of critical habitat (or required breeding and rearing habitat) either with a direct hit, thus covering vegetation, or by breaking vegetation for nesting, foraging, or perching.”

Murrelets have a long, asynchronous nesting season that extends from April through mid-September in Washington and Oregon, and from late March through mid-September in California (Nelson 1997). Nesting murrelets are present at inland nest sites in July, August, and September during the highest incidence of wildfire events and fire retardant applications in the Pacific Northwest.

Based on the documented use of fire retardant on National Forests within the range of the murrelet, and the overlap of the murrelet nesting season with the fire season in the Pacific Northwest, we expect that nesting murrelets, including eggs and chicks, have the potential to

be exposed to direct effects from the aerial application of fire retardant, including direct retardant impacts to murrelet nests, disturbance to nesting murrelets from low-flying aircraft, and nesting habitat degradation from retardant impacts.

#### Potential Effects of Direct Impact of Fire Retardant on Murrelet Nest Sites

Fire retardant dropped on suitable murrelet nesting habitat during the nesting season has the potential to directly injure or kill murrelet eggs or chicks. As described by the Forest Service, the direct impact of a large load of fire retardant can cause tree tops and tree branches to break (USFS 2011). We assume that a fire retardant drop that has sufficient force to break tree tops and branches has the potential to cause murrelet eggs or chicks to be physically injured from falling debris or retardant, or dislodged from the nest, resulting in the direct injury or death of the egg or chick.

After murrelet chicks have hatched (from May to mid-August), they remain on the nest for a period of 27 to 40 days prior to fledging and departure from the nest (Nelson 1997). Murrelet chicks can be present at inland sites well into September prior to fledging, making them especially vulnerable to the direct impacts from aerial application of fire retardant. Unlike adult murrelets, pre-fledged chicks are unable to fly and escape either an approaching wildfire or the oncoming approach of a load of fire retardant dropped from an airtanker.

The likelihood that fire retardant will be dropped directly onto occupied murrelet nesting habitat is considered to be very low. Most fire retardant applications occur on ridge tops and adjacent to human-caused or natural fire breaks, such as roads, meadows, old fire scars, and rock outcrops, which suggests that most fire retardant applications are not likely to occur directly in murrelet nesting habitat, and are more likely to occur in non-suitable habitats adjacent to older-forest habitat. Additionally, not all fire retardant applications are likely to result in canopy damage or be of sufficient force to injure murrelets, but we assume that some retardant drops could result in physical damage to tree canopies, and potentially result in direct injury of murrelet chicks or eggs. In contrast, we assume that adult murrelets are highly mobile and are capable of escaping direct injury from the aerial application of fire retardant.

#### Potential Disturbance Effects to Nesting Murrelets from Low-flying Aircraft

Large airtankers and helicopters used to deliver fire retardant will potentially expose areas of murrelet nesting habitat to high levels of noise and visual disturbance during the murrelet nesting season. The Service has previously completed analyses for noise and visual disturbance to murrelets (USFWS 2006). In these analyses we concluded that normal murrelet nesting behaviors will be disrupted by loud noises that occur in close proximity to an active nest, or when the activity occurs within the line-of-sight for a nesting murrelet. We have determined that the following situations indicate a significant disruption of nesting behaviors (USFWS 2006):

- An adult or juvenile is flushed from a nest during the incubation, brooding, or fledging period, that potentially results in egg failure or reduced juvenile survival.
- An adult abandons a feeding attempt of a dependent juvenile for an entire daily feeding period, creating a likelihood of malnutrition or starvation of the young.
- An adult delays feeding attempts of dependent juveniles on multiple occasions during the breeding season, creating a likelihood of reduced growth or a likelihood of reduced survival of young.

Adult murrelets typically incubate for a 24-hour period, then exchange duties with their mate at dawn. Hatchlings are brooded by an adult for 1-2 days and are then left alone at the nest for the remainder of the rearing period, except during feedings. Both parents feed the chick, which receives 1-8 meals per day (Nelson 1997). Most meals are delivered early in the morning, while about a third are delivered at dusk and a few meals are sometimes scattered throughout the day (Nelson 1997). Based on the limited disturbance literature for murrelets, it appears that adult murrelets are most likely to exhibit a flush response while attempting to deliver food to the chick (USFWS 2006).

Aircraft noise disturbance that occurs in close proximity to occupied nests has the potential to cause adult murrelets to flush and abort a feeding attempt. The abortion of a single feeding trip could deprive the chick of 25-50 percent of its daily energy and water intake, which could have a significant negative impact on fledging success (Hebert and Golightly 2006). It is also reasonable to assume that a murrelet responding to a noise by moving or shifting position would increase the chance that it will be detected by a predator. Additionally, the energetic cost of increased vigilance to protracted disturbance events could have negative consequences for murrelet nesting success (Hebert and Golightly 2006).

Based on our review of the available literature, it is likely these behaviors will occur when murrelets are subjected to aircraft noise and visual detection of aircraft near their active nests. The above behavioral responses of murrelets are anticipated to create a likelihood of injury to murrelet chicks or eggs by increasing the risk of premature fledging, reduced fitness of juveniles, or increased risk of nest predation (USFWS 2006). Under a worst-case scenario, the disturbance would result in a failed nesting attempt. However, the behavioral responses to noise disturbance are generally considered to be non-lethal, and do not automatically lead to failed reproduction or injury.

#### Potential Degradation of Murrelet Nesting Habitat from Fire Retardant Impacts

Fire retardant drops that damage tree crowns, break branches, and reduce canopy cover have the potential to reduce the quality of murrelet nesting habitat at the scale of individual nest trees and adjacent trees that provide canopy cover for nest trees. Murrelets nest in live conifer trees with large branches that provide suitable nest platforms and have live crowns that provide vertical and horizontal canopy cover to provide shade, protection from the elements, and hiding cover from avian predators. Murrelet nests sites generally have a high level of overstory canopy cover (>70 percent) and a high density of suitable nest platforms (Nelson et al. 2006). If crown damage from the application of fire retardant is severe enough to break platform branches or reduce canopy cover to less than 70 percent, the habitat quality for murrelet nesting will be degraded

The likelihood that fire retardant will be dropped directly onto murrelet nesting habitat is considered to be low, but not extremely unlikely. Most fire retardant applications occur on ridge tops and adjacent to human-caused or natural fire breaks, such as roads, meadows, old fire scars, and rock outcrops, which suggest that most fire retardant applications are not likely to occur directly in murrelet nesting habitat, and are more likely to occur in non-suitable habitats adjacent to older-forest habitat. Additionally, not all fire retardant applications are likely to result in canopy damage, but it is reasonable to we assume that some retardant drops will result in physical damage to tree canopies. Given the small scale of these direct impacts, we do not anticipate that entire stands will be rendered unsuitable.

Murrelets in some areas are known to reuse to the same nest trees from year to year, but this appears to be most common in landscapes that have limited nesting habitat, and less common in landscapes with large tracts of available nesting habitat (Burger et al. 2009). Because there are large stands of suitable nesting habitat on National Forest lands, we do not expect the scattered loss of individual tree tops or platform branches would result in a long-term abandonment of nesting stands, and that any local displacement of murrelets from individual trees damaged by fire retardant would not result in a loss of reproduction within the National Forests in subsequent years.

#### Potential Exposure of Murrelet Nesting Habitat to Direct Impacts from Fire Retardant

Based on previous analyses, we assume that large airtankers and large helicopters are extremely loud (>100 decibels) and have a disturbance zone that extends out to a radius of approximately 400 meters (0.25 mile) (USFWS 2006). The average retardant drop zone is described as 50 to 75 ft wide by 800 ft long (USFS 2011). For aircraft noise disturbance, we assume a disturbance zone of 0.25 mile surrounding each retardant drop zone. This zone is  $(1320 \text{ ft} + 800 \text{ ft} + 1320 \text{ ft long}) \times (1320 \text{ ft} + 1320 \text{ ft wide}) = 9,081,600 \text{ sq. ft.}$ , or 208 acres.

For direct retardant impacts to nesting habitat and potential murrelet nests, we assumed that the average area of direct retardant impact is 800 ft long by 75 ft wide = 60,000 sq. ft. or 1.38 acres.

To estimate the area of suitable murrelet nesting habitat potentially exposed to aircraft noise disturbance and direct retardant impacts, we applied simple percentages and calculated the total area exposed to retardant impacts divided by the percentage of National Forest within the range of the murrelet, and the percentage of suitable murrelet nesting habitat present on the Forest.

*Example:*

Gifford Pinchot National Forest = 1,368,300 acres (100 percent).

National Forest lands located within the range of the murrelet = 170,140 acres (12.43 percent)

Total murrelet nesting habitat on the Forest = 30,550 acres, or 17.96 percent of the murrelet range.

Number of retardant drops on the Forest (2000-2010) = (65 drops) ÷ (11 years) = (5.9 drops per year) x (10 years) = 59 drops over a 10 year period for the entire National Forest.

(59 retardant drops) x (12.43 percent of the Forest within murrelet range) = 7 potential retardant drops within the murrelet range on the Forest.

(7 retardant drops in murrelet range) x (208 acres of aircraft noise disturbance per drop) = 1,456 total acres exposed to aircraft noise disturbance.

(1458 acres) x (17.96 percent suitable murrelet habitat) = 261 acres of murrelet nesting habitat potentially exposed to noise disturbance over 10 years

(7 retardant drops in murrelet range) x (1.38 acres of retardant impact per drop) = 9.66 total acres exposed to retardant impacts.

(9.66 acres) x (17.96 percent suitable murrelet habitat) = 1.7 acres of murrelet nesting habitat potentially exposed to direct retardant impacts.

Our estimates of murrelet habitat potentially exposed to direct retardant impact and aircraft noise disturbance are in fact rough estimates based on several simplifying assumptions. We have no accurate way to predict the actual number of acres of murrelet habitat that will be

exposed due to the random and stochastic nature of wildfire events. However, given the scope and scale of this Nation-wide programmatic consultation, we believe these are reasonable assumptions for the purpose of evaluating the effects of the proposed action to murrelets.

## **Effects to Murrelets on National Forests**

### Olympic National Forest

The Olympic National Forest encompasses over 630,000 acres located on the Olympic Peninsula in northwest Washington. The entire Forest is located within the range of the murrelet, within the Puget Sound (Zone 1) and Washington Coast (Zone 2) murrelet conservation zones. There are approximately 194,880 acres of murrelet nesting habitat located on the Forest (30.89 percent of the Forest) (Table 9). There were 91 fires documented during the period from 2000 – 2010, but fire retardant was dropped on the Forest only four times during this period, indicating most wildfires are small, and managed without the use of fire retardant (USFS 2011).

Based on the past history of fire retardant use, we assume there will be a total of 4 retardant drops on the Forest over the next 10 years, most likely associated with a single fire event. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance. Four retardant drops will expose a total of 832 acres to noise disturbance. Applying the percentage of suitable murrelet habitat on the Forest (30.89 %), we estimate that approximately 257 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each retardant drop impacts 1.38 acres. Four retardant drops will expose a total of 5.52 acres to direct retardant impacts, but based on the percentage of suitable habitat on the Forest (30.89 %) we expect only 1.7 acres of nesting habitat will likely be exposed to direct retardant impacts.

Raphael et al. (2002) used radar survey data to estimate an average density of >370 acres of nesting habitat per murrelet detected in their study on the Olympic Peninsula (each bird detected represents a potential nesting pair), indicating very low densities of murrelets are present relative to the total available nesting habitat on the Olympic Peninsula. This figure overestimates average density, because not all murrelets detected by radar during inland surveys are breeding adults (Peery et al. 2004), and the murrelet population in Conservation Zones 1 and 2 has declined significantly over the past 10 years (Falxa et al. 2011).

Considering the small area of nesting habitat likely to be exposed to direct retardant impacts (1.7 acres), and the low density of murrelets relative to the total available nesting habitat on the Forest, the likelihood of direct injury to murrelets is extremely unlikely, and therefore considered to be discountable. Due to the extremely small area of habitat potentially exposed

to direct retardant impacts, the potential effects to murrelets associated with habitat degradation associated with retardant impacts is considered to be insignificant.

Considering the average density of murrelets on the Olympic Peninsula (370 acres of nesting habitat per pair), and the small area of nesting habitat likely to be exposed to aircraft noise disturbance (257 acres), the likelihood of disturbance to nesting murrelets from aircraft noise is low, but not entirely discountable. Although there is a potential for disturbance impacts to occur, the mere potential for adverse effects to occur is not sufficient to anticipate that such effects are reasonably certain to occur. Therefore, we conclude that although there is a potential for murrelet nesting to be disrupted by aircraft noise disturbance, we are not able to demonstrate that exposure of nesting murrelets to aircraft noise is reasonably certain to occur because the total acres likely to be exposed to noise disturbance is less than the average density of murrelets on the Forest.

### Mt. Baker-Snoqualmie National Forest

The Mt. Baker-Snoqualmie National Forest encompasses over 1.74 million acres in northwest Washington, on the west slopes of the Cascades Range. Over 96 percent of the Forest is located within the Puget Sound (Zone 1) murrelet conservation zone. There are approximately 434,880 acres of murrelet nesting habitat located on the Forest (25.72 percent of the Forest) (Table 9). There were 439 fires documented on the Forest during the period from 2000 – 2010, but fire retardant was dropped on the Forest only three times during this period, indicating most wildfires are small, and managed without the use of fire retardant (USFS 2011).

Based on the past history of fire retardant use, we assume there will be a total of 3 retardant drops on the Forest over the next 10 years, most likely associated with a single fire event. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance. Three retardant drops will expose a total of 624 acres to noise disturbance. Applying the percentage of suitable murrelet habitat on the Forest (25.72 %), we estimate that approximately 161 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each retardant drop impacts 1.38 acres. Three retardant drops will expose a total of 4.14 acres to direct retardant impacts, but based on the percentage of suitable habitat on the Forest (25.72 %) we expect only 1.1 acres of nesting habitat will likely be exposed to direct retardant impacts.

In some areas, radar studies have been used to estimate the average density of nesting murrelets (Raphael et al. 2002), but most areas across the range are lacking this type of information. To estimate an average density on the Forest, we used the total murrelet population estimate for Murrelet Conservation Zone 1 (Puget Sound/Straits of Juan de Fuca) Washington (4,393 murrelets) (Falxa et al. 2011) and the total potential nesting habitat in Conservation Zone 1 (1,077,900 acres) (based on spatial data from Raphael et al. 2006).



These figures indicate an average of density of 245 acres of nesting habitat for each murrelet in the Zone 1 population, or approximately 490 acres of nesting habitat for each pair of murrelets (e.g., 1,077,900 acres divided by 4,393 murrelet equals 245 acres per murrelet). This figure overestimates average density, because not all murrelets in the population are breeding age, and only a portion of the breeding age birds attempt to nest in any given year (McShane et al. 2004), indicating very low densities of murrelets are present relative to the total available nesting habitat in Zone 1. This is particularly true in the Washington Cascades, where there are many thousands of acres of murrelet nesting habitat present in the far inland zone (from 40 miles to 55 miles inland), and very few murrelets present in these far inland areas (Raphael et al. 2011).

Considering the small area of nesting habitat likely to be exposed to direct retardant impacts (1.1 acres), and the very low density of murrelets relative to the total available nesting habitat on the Forest, the likelihood of direct injury to murrelets is extremely unlikely, and therefore considered to be discountable. Due to the small area of habitat likely to be exposed to direct retardant impacts, the effects to murrelets from nesting habitat degradation associated with direct retardant impacts are considered to be insignificant.

Considering the average density of murrelets in Zone 1 (490 acres of nesting habitat per pair), and the small area of nesting habitat likely to be exposed to aircraft noise disturbance (161 acres), the likelihood of disturbance to nesting murrelets from aircraft noise is low, but not entirely discountable. Although there is a potential for disturbance impacts to occur, the mere potential for adverse effects to occur is not sufficient to anticipate that such effects are reasonably certain to occur. Therefore, we conclude that although there is a potential for murrelet nesting to be disrupted by aircraft noise disturbance, we are not able to demonstrate that exposure of nesting murrelets to aircraft noise is reasonably certain to occur because the total acres likely to be exposed to noise disturbance is less than the average density of murrelets on the Forest.

### Okanogan-Wenatchee National Forest

The Okanogan-Wenatchee National Forest encompasses more than 4 million acres in north-central Washington. The Forest extends 180 miles from the Canadian border south to Yakama Indian Reservation along the eastern slopes of the Washington Cascades. A relatively small portion of the Forest (approx. 6.7 percent) is located within the Puget Sound (Zone 1) murrelet conservation zone. There are approximately 6,680 acres of murrelet nesting habitat located on the Forest, which represents only 2.35 percent of (Table 9). This section of the Forest is located on the outer edge of the murrelet nesting range, from 40 to 55 miles inland, in steep, mountainous terrain with relatively few acres that are “habitat capable” for supporting murrelet nesting habitat.

The Forest has a history of multiple, large wildfires that have burned thousands of acres. There were 1,702 fires documented on the Forest during the period from 2000 – 2010, and fire retardant was dropped on the Forest 1,458 times (USFS 2011). No significant fires have occurred on the portion of the Forest located within the range of the murrelet (MTBS 2010).

Based on the past history of fire retardant use, we assume there will be a total of 1,325 retardant drops on the Forest over the next 10 years. Only 6.66 percent of the Forest is located within the range of the murrelet, so we assume up to 88 retardant drops are likely to occur with the range of the murrelet. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance. Eighty-eight retardant drops will expose a total of 18,304 acres to noise disturbance. Applying the percentage of suitable murrelet habitat within the murrelet range on the Forest (2.35 %), we estimate that approximately 431 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each retardant drop impacts 1.38 acres. Eighty-eight retardant drops will expose a total of 121 acres to direct retardant impacts, but based on the percentage of suitable habitat on the Forest (2.35 %) we expect only 2.8 acres of nesting habitat will likely be exposed to direct retardant impacts.

In some areas, radar studies have been used to estimate the average density of nesting murrelets (Raphael et al. 2002), but most areas across the range are lacking this type of information. To estimate an average density on the Forest, we used the total murrelet population estimate for Murrelet Conservation Zone 1 (Puget Sound/Straits of Juan de Fuca) Washington (4,393 murrelets) (Falxa et al. 2011) and the total potential nesting habitat in Conservation Zone 1 (1,077,900 acres) (based on spatial data from Raphael et al. 2006). These figures indicate an average of density of 245 acres of nesting habitat for each murrelet in the Zone 1 population, or approximately 490 acres of nesting habitat for each pair of murrelets in the population. This figure overestimates average density, because not all murrelets in the population are breeding age, and only a portion of the breeding age birds attempt to nest in any given year (McShane et al. 2004), indicating very low densities of murrelets are present relative to the total available nesting habitat in Zone 1. This is particularly true in the Washington Cascades, where there are many thousands of acres of murrelet nesting habitat present in the far inland zone (from 40 miles to 55 miles inland), and very few murrelets present in these far inland areas (Raphael et al. 2011).

Considering the small area of nesting habitat likely to be exposed to direct retardant impacts (2.8 acres), and the very low density of murrelets on the Forest, the likelihood of direct injury to murrelets is extremely unlikely, and therefore considered to be discountable. Due to the small area of habitat likely to be exposed to direct retardant impacts, the effects to murrelets from nesting habitat degradation associated with direct retardant impacts are considered to be insignificant.

Considering aircraft noise disturbance, a total of 1,325 retardant drops on the Forest over 10 years is expected to expose 431 acres of potential murrelet nesting habitat to noise disturbance. This area is less than the average density for murrelet nesting in Zone 1.

Considering the very low densities of murrelets likely to be present on the Forest, and the past fire history which indicates fires on the Forest generally do not occur within the murrelet range, the likelihood of murrelet exposure to noise disturbance on the Forest is very low. Although there is a potential for exposure of murrelets to aircraft noise disturbance, the mere potential for adverse effects to occur is not sufficient to anticipate the effects are reasonably certain to occur. Therefore, we conclude that although there is a potential for murrelet nesting to be disrupted by aircraft noise disturbance, we are not able to demonstrate that exposure of nesting murrelets to aircraft noise is reasonably certain to occur because the total acres likely to be exposed to noise disturbance is less than the average density of murrelets on the Forest.

### Gifford Pinchot National Forest

The Gifford Pinchot National Forest is located in southwest Washington. With an area of over 1.37 million acres, it extends primarily along the western slopes of Cascade Range from Mount Rainier National Park south to the Columbia River. A relatively small portion of the Forest (approx. 12.4 percent) is located within the Puget Sound (Zone 1) murrelet conservation zone. This section of the Forest is located on the outer edge of the murrelet nesting range, generally from 40 to 55 miles inland. There are approximately 30,550 acres of murrelet nesting habitat located on the Forest (17.96 %) (Table 9). There were 357 fires documented on the Forest from 2000 – 2010, and fire retardant was dropped on the Forest 65 times (USFS 2011). There have been no major fires documented in the past twenty years within the range of the murrelet (MTBS 2010).

Based on the past history of fire retardant use, we assume there will be a total of 59 retardant drops on the Forest over the next 10 years. Only 12.42 percent of the Forest is located within the range of the murrelet, so we assume up to 7 retardant drops are likely to occur within the range of the murrelet. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance. Seven retardant drops will expose a total of 1,456 acres to noise disturbance. Applying the percentage of suitable murrelet habitat within the murrelet range on the Forest (17.96 %), we estimate that approximately 261 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each retardant drop impacts 1.38 acres. Seven retardant drops will expose a total of 9.66 acres to direct retardant impacts, but based on the percentage of suitable habitat within the murrelet range on the Forest (17.96%) we expect only 1.7 acres of nesting habitat will likely be exposed to direct retardant impacts.

In some areas, radar studies have been used to estimate the average density of nesting murrelets (Raphael et al. 2002), but most areas across the range are lacking this type of information. To estimate an average density on the Forest, we used the total murrelet population estimate for Murrelet Conservation Zone 1 (Puget Sound/Straits of Juan de Fuca) Washington (4,393 murrelets) (Falxa et al. 2011) and the total potential nesting habitat in Conservation Zone 1 (1,077,900 acres) (based on spatial data from Raphael et al. 2006). These figures indicate an average of density of 245 acres of nesting habitat for each murrelet in the Zone 1 population, or approximately 490 acres of nesting habitat for each pair of murrelets in the population. This figure overestimates average density, because not all murrelets in the population are breeding age, and only a portion of the breeding age birds

attempt to nest in any given year (McShane et al. 2004), indicating very low densities of murrelets are present relative to the total available nesting habitat in Zone 1. This is particularly true in the Washington Cascades, where there are many thousands of acres of murrelet nesting habitat present in the far inland zone (from 40 miles to 55 miles inland), and very few murrelets present in these far inland areas (Raphael et al. 2011).

Considering the small area of nesting habitat likely to be exposed to direct retardant impacts (2.8 acres), and the very low density of murrelets on the Forest, the likelihood of direct injury to murrelets is extremely unlikely, and therefore considered to be discountable. Due to the small area of habitat likely to be exposed to direct retardant impacts, the effects to murrelets from nesting habitat degradation associated with direct retardant impacts are considered to be insignificant.

Considering aircraft noise disturbance, a total of 59 retardant drops on the Forest over 10 years is expected to expose 261 acres of potential murrelet nesting habitat to noise disturbance. This area is less than the average density for murrelet nesting in Conservation Zone 1. Considering the very low densities of murrelets likely to be present on the Forest, and the past fire history which indicates fires on the Forest generally do not occur within the murrelet range, the likelihood of murrelet exposure to aircraft noise disturbance on the Forest is very low. Although there is a potential for exposure of murrelets to aircraft noise disturbance, the mere potential for adverse effects to occur is not sufficient to anticipate that such effects are reasonably certain to occur. Therefore, we conclude that although there is a potential for murrelet nesting to be disrupted by aircraft noise disturbance, we are not able to demonstrate that exposure of nesting murrelets to aircraft noise is reasonably certain to occur because the total acres likely to be exposed to noise disturbance is less than the average density of murrelets on the Forest.

### Siuslaw National Forest

The Siuslaw National Forest is located along the central Oregon coast. With an area of over 626,000 acres, it extends from Tillamook Bay south to Coos Bay, and encompasses much of the Oregon Coast Range. The entire Forest is located within the Oregon Coast Range (Zone 3) murrelet conservation zone. There are approximately 242,860 acres of murrelet nesting habitat located on the Forest (38.77 percent) (Table 9). There were 135 fires documented on the Forest from 2000 – 2010, and fire retardant was dropped on the Forest 95 times (USFS 2011). There have been no major fires that have resulted in significant habitat losses on the Forest in the past ten years in (GeoMAC 2011).

Based on the past history of fire retardant use, we assume there will be a total of 123 retardant drops on the Forest over the next 10 years. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance, so 123 retardant drops will expose a total of 25,584 acres to aircraft noise disturbance. Applying the percentage of suitable murrelet habitat on the Forest (38.77 %), we estimate that approximately 9,919 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each retardant drop impacts 1.38 acres, so 123 retardant drops will expose a total of 169.7 acres to direct retardant impacts, but

based on the percentage of suitable habitat within the murrelet range on the Forest (38.77%) we expect only 65.8 acres of nesting habitat will likely be exposed to direct retardant impacts.

In some areas, radar studies have been used to estimate the average density of nesting murrelets (Raphael et al. 2002), but most areas across the range are lacking this type of information. To estimate an average density on the Forest, we used the total murrelet population estimate for Murrelet Conservation Zone 3 (Oregon Coast Range) (7,223 murrelets) (Falxa et al. 2011) and the total potential nesting habitat in Conservation Zone 3 (936,000 acres) (Raphael et al. 2011). These figures indicate an average of density of 130 acres of potential nesting habitat for each murrelet in the Zone 3 population, or approximately 260 acres of nesting habitat for each pair. This figure overestimates average density, because not all murrelets in the population are breeding age, and only a portion of the breeding age birds attempt to nest in any given year (McShane et al. 2004), indicating low densities of murrelets are present relative to the total available nesting habitat in Zone 3.

Considering the average density of murrelets in Zone 3 (>260 acres of nesting habitat per pair), and the small area of nesting habitat likely to be exposed to direct retardant impacts (65.8 acres over 10 years), the likelihood of direct injury to murrelets from retardant is low. Although there is a potential for direct injury from retardant impacts to occur, the mere potential for adverse effects to occur is not sufficient to anticipate that such effects are reasonably certain to occur. Due to the small area of habitat likely to be exposed to direct retardant impacts, the effects to murrelets from nesting habitat degradation associated with direct retardant impacts are considered to be insignificant.

Considering aircraft noise disturbance, a total of 123 retardant drops on the Forest over 10 years is expected to expose 9,919 acres of potential murrelet nesting habitat to noise disturbance. This represents approximately 4 percent of the total murrelet nesting habitat on the Forest. Considering the average density of murrelets in the Zone 3 (>260 acres of nesting habitat per pair), the total area exposed to aircraft noise, and the occurrence of wildfires during the murrelet nesting season, we assume that exposure of nesting murrelets to aircraft noise disturbance is reasonably certain to occur.

If we apply the average density of murrelets relative to nesting habitat (>260 acres of nesting habitat per pair), the total number of murrelet nests exposed to noise disturbance would be < 38 nests (9,919 acres divided by 260 equals 38). However, we know this average overestimates the actual density of breeding murrelets in Zone 3, and murrelets are not evenly distributed in nesting habitat across the landscape. Therefore, the total number of murrelets likely to be exposed to aircraft noise disturbance is unknown. As described above, aircraft noise disturbance is anticipated to create a likelihood of injury to murrelet chicks or eggs by increasing the risk of premature fledging, reduced fitness of juveniles, or increased risk of nest predation (USFWS 2006). Under a worst-case scenario, the disturbance would result in a failed nesting attempt. However, the behavioral responses to noise disturbance are generally considered to be non-lethal, and do not automatically lead to failed reproduction or injury.

Rogue River - Siskiyou National Forest



The Rogue River – Siskiyou National Forest is located in southwestern Oregon and extends into northwest California. With an area of over 1.7 million acres, the Forest ranges from the crest of the Cascades Mountains west into the Siskiyou Mountains, nearly to the Pacific Ocean. Approximately 56.33 percent of the Forest is located within the Siskiyou Coast Range (Zone 4) murrelet conservation zone. There are approximately 239,310 acres of murrelet nesting habitat located on the Forest (approximately 34.25 % of the murrelet range) (Table 9). There were 755 fires documented on the Forest from 2000 – 2010, and fire retardant was dropped on the Forest 284 times (USFS 2011). The Biscuit Complex Fire burned over 500,000 acres on the Forest and adjacent lands in 2002 (GeoMAC 2011), resulting in the loss of over 50,000 acres of murrelet nesting habitat (Raphael et al. 2011).

Based on the past history of fire retardant use, we assume there will be a total of 258 retardant drops on the Forest over the next 10 years. Only 56.33 percent of the Forest is located within the range of the murrelet, so we assume up to 145 retardant drops are likely to occur with the range of the murrelet. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance, so 145 retardant drops will expose a total of 30,160 acres to aircraft noise disturbance. Applying the percentage of suitable murrelet habitat within the range of the murrelet on the Forest (24.71 %), we estimate that approximately 7,452 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each retardant drop impacts 1.38 acres, so 145 retardant drops will expose a total of 200.1 acres to direct retardant impacts, but based on the percentage of suitable habitat within the murrelet range on the Forest (24.71%) we expect only 49.4 acres of nesting habitat will likely be exposed to direct retardant impacts.

In some areas, radar studies have been used to estimate the average density of nesting murrelets (Raphael et al. 2002), but most areas across the range are lacking this type of information. To estimate an average density on the Forest, we used the total murrelet population estimate for Murrelet Conservation Zone 4 (Siskiyou Coast Range) (3,668 murrelets) (Falxa et al. 2011) and the total potential nesting habitat in Conservation Zone 4 (494,000 acres) (Raphael et al. 2011). These figures indicate an average of density of 135 acres of potential nesting habitat for each murrelet in the Zone 4 population, or approximately 270 acres of nesting habitat for each pair. This figure overestimates average density, because not all murrelets in the population are breeding age, and only a portion of the breeding age birds attempt to nest in any given year (McShane et al. 2004), indicating low densities of murrelets are present relative to the total available nesting habitat in Zone 4.

Considering the average density of murrelets in the Zone 4 (>270 acres of nesting habitat per pair), and the small area of nesting habitat likely to be exposed to direct retardant impacts (49.4 acres over 10 years), the likelihood of direct injury to murrelets from retardant is low. Although there is a potential for direct injury from retardant impacts to occur, the mere potential for injury is not sufficient to anticipate that such effects are reasonably certain to occur. Due to the small area of habitat likely to be exposed to direct retardant impacts, the effects to murrelets from nesting habitat degradation associated with direct retardant impacts are considered to be insignificant.

Considering aircraft noise disturbance, a total of 145 retardant drops within the range of the murrelet on the Forest over 10 years is expected to expose 7,452 acres of potential murrelet nesting habitat to noise disturbance. This represents approximately 3 percent of the total murrelet nesting habitat on the Forest. Considering the average density of murrelets in the Zone 4 (>270 acres of nesting habitat per pair), the total area exposed to aircraft noise, and the occurrence of wildfires during the murrelet nesting season, we assume that exposure of nesting murrelets to aircraft noise disturbance is reasonably certain to occur.

If we apply the average density of murrelets relative to nesting habitat (>270 acres of nesting habitat per pair), the total number of murrelet nests exposed to noise disturbance would be < 27 nests (7,452 acres divided by 270 equals 27.6). However, we know this average overestimates the actual density of breeding murrelets in Zone 4, and murrelets are not evenly distributed in nesting habitat across the landscape. Therefore, the total number of murrelets likely to be exposed to aircraft noise disturbance is unknown. As described above, aircraft noise disturbance is anticipated to create a likelihood of injury to murrelet chicks or eggs by increasing the risk of premature fledging, reduced fitness of juveniles, or increased risk of nest predation (USFWS 2006). Under a worst-case scenario, the disturbance would result in a failed nesting attempt. However, the behavioral responses to noise disturbance are generally considered to be non-lethal, and do not automatically lead to failed reproduction or injury.

### Klamath National Forest

The Klamath National Forest encompasses over 1.5 million acres of land straddling the California and Oregon border. A relatively small portion of the Forest (approx. 12.9 percent) is located within the Siskiyou Coast Range (Zone 4) murrelet conservation zone. There are approximately 67,860 acres of murrelet nesting habitat located on the Forest (33.4% of the murrelet range on the Forest) (Table 9). There were 1,159 fires documented on the Forest from 2000 – 2010, and fire retardant was dropped on the Forest 271 times (USFS 2011). Monitoring for the Northwest Forest Plan from 1994 to 2007 indicated only minor losses of murrelet habitat had occurred in California (Raphael et al. 2011). However, in 2008 the Klamath Theater Complex burned over 180,000 acres on the Klamath National Forest and adjacent lands (GeoMAC 2011). The loss of murrelet habitat from this fire has not been quantified in published reports. Over 9,000 acres of murrelet habitat on the Klamath National Forest are located within the fire perimeter area, indicating there may have been significant losses of murrelet habitat depending on fire severity (GeoMAC 2011).

Based on the past history of fire retardant use, we assume there will be a total of 246 retardant drops on the Forest over the next 10 years. Only 12.91 percent of the Forest is located within the range of the murrelet, so we assume up to 32 retardant drops are likely to occur with the range of the murrelet. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance, so 32 retardant drops will expose a total of 6,656 acres to aircraft noise disturbance within the range of the murrelet. Applying the percentage of suitable murrelet habitat within the range of the murrelet on the Forest (33.40 %), we estimate that approximately 2,223 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each



retardant drop impacts 1.38 acres, so 32 retardant drops within the range of the murrelet will expose a total of 44.2 acres to direct retardant impacts, but based on the percentage of suitable habitat within the murrelet range on the Forest (33.40%) we expect only 14.7 acres of nesting habitat will likely be exposed to direct retardant impacts.

In some areas, radar studies have been used to estimate the average density of nesting murrelets (Raphael et al. 2002), but most areas across the range are lacking this type of information. To estimate an average density on the Forest, we used the total murrelet population estimate for Murrelet Conservation Zone 4 (Siskiyou Coast Range) (3,668 murrelets) (Falxa et al. 2011) and the total potential nesting habitat in Conservation Zone 4 (494,000 acres) (Raphael et al. 2011). These figures indicate an average of density of 135 acres of potential nesting habitat for each murrelet in the Zone 4 population, or approximately 270 acres of nesting habitat for each pair. This figure overestimates average density, because not all murrelets in the population are breeding age, and only a portion of the breeding age birds attempt to nest in any given year (McShane et al. 2004), indicating low densities of murrelets are present relative to the total available nesting habitat in Zone 4.

Considering the average density of murrelets in the Zone 4 (>270 acres of nesting habitat per pair), and the small area of nesting habitat likely to be exposed to direct retardant impacts (14.7 acres over 10 years), the likelihood of direct injury to murrelets from retardant is extremely low, and therefore considered to be discountable. Due to the small area of habitat likely to be exposed to direct retardant impacts, the effects to murrelets from nesting habitat degradation associated with direct retardant impacts are considered to be insignificant.

Considering aircraft noise disturbance, a total of 32 retardant drops within the range of the murrelet on the Forest over 10 years is expected to expose 2,223 acres of potential murrelet nesting habitat to noise disturbance. This represents approximately 3.2 percent of the total murrelet nesting habitat on the Forest. Considering the average density of murrelets in the Zone 4 (>270 acres of nesting habitat per pair), the total area exposed to aircraft noise, and the occurrence of wildfires during the murrelet nesting season, we assume that exposure of nesting murrelets to aircraft noise disturbance is reasonably certain to occur.

If we apply the average density of murrelets relative to nesting habitat (>270 acres of nesting habitat per pair), the total number of murrelet nests exposed to noise disturbance would be < 8 nests (2,223 acres divided by 270 equals 8.2). However, we know this average overestimates the actual density of breeding murrelets in Zone 4, and murrelets are not evenly distributed in nesting habitat across the landscape. Therefore, the total number of murrelets likely to be exposed to aircraft noise disturbance is unknown. As described above, aircraft noise disturbance is anticipated to create a likelihood of injury to murrelet chicks or eggs by increasing the risk of premature fledging, reduced fitness of juveniles, or increased risk of nest predation (USFWS 2006). Under a worst-case scenario, the disturbance would result in a failed nesting attempt. However, the behavioral responses to noise disturbance are generally considered to be non-lethal, and do not automatically lead to failed reproduction or injury.

#### Six Rivers National Forest

The Six Rivers National Forest lies east of Redwood State and National Parks in northwestern California, and stretches southward from the Oregon border for about 140 miles. It encompasses over 964,000 acres. Approximately 56 percent of the Forest is located within the Siskiyou Coast Range (Zone 4) murrelet conservation zone. There are approximately 155,940 acres of murrelet nesting habitat located within the range of the murrelet on the Forest (28.81%) (Table 9). There were 786 fires documented on the Forest from 2000 – 2010, and fire retardant was dropped on the Forest 234 times (USFS 2011). Monitoring for the Northwest Forest Plan from 1994 to 2007 indicated only minor losses of murrelet habitat had occurred in California (Raphael et al. 2011). However, in 2008 the Klamath Theater Complex burned over several thousand acres on the Six Rivers National Forest and adjacent lands (GeoMAC 2011). The loss of murrelet habitat from this fire has not been quantified in published reports. Over 1,600 acres of murrelet habitat on the Six Rivers National Forest are located within the fire perimeter, indicating there may have been significant losses of murrelet habitat depending on fire severity (GeoMAC 2011).

Based on the past history of fire retardant use, we assume there will be a total of 213 retardant drops on the Forest over the next 10 years. Only 56.1 percent of the Forest is located within the range of the murrelet, so we assume up to 119 retardant drops are likely to occur within the range of the murrelet. Using the assumptions described above, each retardant drop exposes 208 acres to aircraft noise disturbance, so 119 retardant drops will expose a total of 24,752 acres to aircraft noise disturbance within the range of the murrelet. Applying the percentage of suitable murrelet habitat within the range of the murrelet on the Forest (28.81%), we estimate that approximately 7,131 acres of murrelet nesting habitat is likely to be exposed to aircraft noise disturbance. Applying the same principles for direct retardant impacts, we assume each retardant drop impacts 1.38 acres, so 119 retardant drops within the range of the murrelet will expose a total of 164.2 acres to direct retardant impacts, but based on the percentage of suitable habitat within the murrelet range on the Forest (28.81%) we expect only 47.3 acres of nesting habitat will likely be exposed to direct retardant impacts.

In some areas, radar studies have been used to estimate the average density of nesting murrelets (Raphael et al. 2002), but most areas across the range are lacking this type of information. To estimate an average density on the Forest, we used the total murrelet population estimate for Murrelet Conservation Zone 4 (Siskiyou Coast Range) (3,668 murrelets) (Falxa et al. 2011) and the total potential nesting habitat in Conservation Zone 4 (494,000 acres) (Raphael et al. 2011). These figures indicate an average density of 135 acres of potential nesting habitat for each murrelet in the Zone 4 population, or approximately 270 acres of nesting habitat for each pair. This figure overestimates average density, because not all murrelets in the population are breeding age, and only a portion of the breeding age birds attempt to nest in any given year (McShane et al. 2004), indicating low densities of murrelets are present relative to the total available nesting habitat in Zone 4.

Considering the average density of murrelets in the Zone 4 (>270 acres of nesting habitat per pair), and the small area of nesting habitat likely to be exposed to direct retardant impacts (47.3 acres over 10 years), the likelihood of direct injury to murrelets from direct retardant impacts is low. Although there is a potential for direct injury from retardant impacts to occur,

the mere potential for adverse effects to occur is not sufficient to anticipate that such effects are reasonably certain to occur. Due to the small area of habitat likely to be exposed to direct retardant impacts, the effects to murrelets from nesting habitat degradation associated with direct retardant impacts are considered to be insignificant.

Considering aircraft noise disturbance, a total of 119 retardant drops within the range of the murrelet on the Forest over 10 years is expected to expose 7,131 acres of potential murrelet nesting habitat to noise disturbance. This represents approximately 4.5 percent of the total murrelet nesting habitat on the Forest. Considering the average density of murrelets in the Zone 4 (>270 acres of nesting habitat per pair), the total area exposed to aircraft noise, and the occurrence of wildfires during the murrelet nesting season, we assume that exposure of nesting murrelets to aircraft noise disturbance is reasonably certain to occur.

If we apply the average density of murrelets relative to nesting habitat (>270 acres of nesting habitat per pair), the total number of murrelet nests exposed to noise disturbance would be < 26 nests (7,131 acres divided by 270 equals 26.4). However, we know this average overestimates the actual density of breeding murrelets in Zone 4, and murrelets are not evenly distributed in nesting habitat across the landscape. Therefore, the total number of murrelets likely to be exposed to aircraft noise disturbance is unknown. As described above, aircraft noise disturbance is anticipated to create a likelihood of injury to murrelet chicks or eggs by increasing the risk of premature fledging, reduced fitness of juveniles, or increased risk of nest predation (USFWS 2006). Under a worst-case scenario, the disturbance would result in a failed nesting attempt. However, the behavioral responses to noise disturbance are generally considered to be non-lethal, and do not automatically lead to failed reproduction or injury.

### **Summary of Effects to Murrelets on National Forests**

Using the above assumptions, we calculated the total area of murrelet habitat potentially exposed to aircraft noise disturbance and direct retardant impacts for each National Forest within the listed range of the murrelet (Table 9). The amount of murrelet habitat exposed to noise disturbance on each Forest varies greatly depending on the average number of retardant drops, and the area of the Forest located within the range of the murrelet. Over a ten year period, we anticipate an average of 521 retardant drops will occur on National Forest lands within the range of the murrelet. Based on the percentage of murrelet habitat on each National Forest, we anticipate that approximately 27,835 acres of murrelet nesting habitat will likely be exposed to aircraft noise disturbance, and 184.5 acres of murrelet nesting habitat will likely be exposed to direct retardant impacts associated with the aerial application of fire retardant (Table 9).

**Table 9. Summary of murrelet nesting habitat acres likely to be exposed to aircraft noise disturbance and direct fire retardant impacts for each National Forest.**

Administrative Unit	Total National Forest acres (and % of Forest within murrelet range)	Total murrelet habitat on Forest (acres)	Percent of murrelet zone that is suitable murrelet habitat	10-year average number of retardant drops on National Forest	Estimated number of retardant drops in murrelet range (over 10 years)	Estimated direct retardant impact to murrelet habitat (acres)	Estimated acres of murrelet habitat exposed to aircraft noise disturbance
Olympic National Forest	630,830 (100.00%)	194,880	30.89%	4	4	1.7	257
Mt. Baker-Snoqualmie National Forest	1,746,290 (96.81%)	434,880	25.72%	3	3	1.1	161
Okanogan-Wenatchee National Forest	4,260,000 (6.66%)	6,680	2.35%	1,325	88	2.8	431
Gifford Pinchot National Forest	1,370,210 (12.42%)	30,550	17.96%	59	7	1.7	261
Siuslaw National Forest	626,400 (100.00%)	242,860	38.77%	123	123	65.8	9,919
Rogue River-Siskiyou National Forest	1,719,500 (56.33%)	239,310	24.71%	258	145	49.4	7,452
Klamath National		67,860	33.40%	246	32	14.7	2,223

Forest	1,573,950 (12.91%)						
Six Rivers National Forest	964,620 (56.10%)	155,940	28.81%	213	119	47.3	7,131
Totals	12,891,800 (39.67%)	1,372,960	26.84%	2,231	521	184.5	27,835

Notes: Values for total acres of murrelet nesting habitat on each National Forest have been rounded to the nearest 10th. All acreage figures are estimates derived from GIS data. National Forest acres are from spatial data for Federal lands developed for the Northwest Forest Plan 10-year monitoring report ([www.reo.gov](http://www.reo.gov)), non-federal lands within the administrative boundaries of National Forests are not included in these totals. Murrelet habitat estimates are derived from the Expert Judgment Model, Class 3 (moderately high suitability) and Class 4 (highest suitability) developed by Raphael et al. (2006).

**Potential Beneficial Effects Associated with Aerial Application of Fire Retardant**

The use of fire retardant has proven to be an effective tool in the control and management of wildland fire (USFS 2011). Effective use of fire retardant can significantly reduce the amount of late-successional and old-growth forest lost to uncontrolled wildfires. Long-term monitoring for the Northwest Forest Plan indicates that wildfire has been the single largest cause of murrelet nesting habitat loss on Federal lands since 1994. From 1994 to 2007, approximately 56,900 acres of murrelet nesting habitat were lost due to wildfires, with the greatest losses occurring on Federal lands in Oregon (Raphael et al. 2011). Although we assume that the application of fire retardant can result in adverse effects to murrelets and their habitat, we believe that the relative risk to murrelets from aircraft disturbance and fire retardant impacts is significantly less than the potential loss of nesting habitat (and eggs/chicks) from uncontrolled wildfire.

**Effects to Murrelet Numbers, Reproduction, and Distribution**

Overview of Murrelet Population Demography and Habitat Relationships

Murrelets are long-lived birds, with high adult survival, low annual fecundity, and delayed maturity (McShane et al. 2004). It may take a breeding pair several successive years of

nesting attempts to replace themselves in the population. Murrelet demography studies and population viability modeling indicate that murrelet populations are most sensitive to changes in adult survival and fecundity (reproductive success) (McShane et al. 2004). Although adult annual survival rates are relatively high in murrelets (83-92 percent), recruitment rates throughout the species listed range are currently too low to reverse the population decline.

Juvenile ratios, as an index of nest success, indicate that fecundity is well below the level needed to maintain current murrelet abundance. In California (Zones 4, 5, and 6), the leading causes of low fecundity are nest predation and poor food abundance or quality in the marine environment (Peery et al. 2004). We expect these factors, along with the continued loss of murrelet nesting habitat from wildfire and timber harvest, may be the leading causes of low fecundity in Oregon and Washington as well (Zones 1, 2, and 3).

Recent monitoring efforts in Washington indicated only 20 percent of murrelet nesting attempts were successful, and only a small portion (13 percent) of the 158 tagged adult birds actually attempted to nest (Raphael and Bloxton 2009). The authors note that the apparent low nesting rate coupled with low nesting success suggests the murrelet population in Conservation Zone 1 does not produce enough young to support a stable population (Raphael and Bloxton 2009). The low number of adults attempting to nest is not unique to Washington. Some researchers suspect that the portion of non-breeding adults in murrelet populations can range from about 5 percent to 70 percent depending on the year, but most population modeling studies suggest a range of 5 to 20 percent (McShane et al. 2004).

The population estimate for the Northwest Forest Plan area in 2010 was 16,691 murrelets (95 percent confidence interval: 13,075 – 20,307) (Falxa et al. 2011). The largest populations occur in Conservation Zone 3 (Coastal Oregon, ~ 7,200 murrelets) and in Conservation Zone 1 (Puget Sound/Strait of Juan de Fuca, ~ 4,400 murrelets). Raphael et al. (2011) showed a strong positive association between regional murrelet populations and total suitable habitat at the scale of the five Conservation Zones within the Northwest Forest Plan area. At the scale of the entire Northwest Forest Plan (including non-Federal lands), murrelet nesting habitat has declined from 3.81 million acres (1994) to 3.54 million acres (2007), a loss of over 7 percent (Raphael et al. 2011).

Surveys from 2001 to present have documented that murrelet populations throughout the listed range have declined at a rate of 3.7 percent per year. This represents an overall population decline of about 29 percent since 2001 (Falxa et al. 2011). The population decline is most severe in the northern part of the listed-range, particularly in Conservation Zone 1 (Puget Sound/Strait of Juan de Fuca). Rates of habitat loss (primarily from timber harvest on non-Federal lands) were also highest in Washington, which suggests that the loss of nesting habitat continues to be an important limiting factor for the recovery of murrelets (Raphael et al. 2011).

Although there are strong correlations between the amount and distribution of nesting habitat and the total numbers of murrelets at a regional scale (Raphael et al. 2011), there are no corresponding data that allow us to accurately enumerate the number or density of murrelets at the scale of individual stands of murrelet nesting habitat. Raphael et al. (2002) used radar survey data to estimate an average density of >370 acres of nesting habitat per murrelet detected in their study on the Olympic Peninsula, indicating very low densities of murrelets at a regional scale. At the watershed scale, murrelet nest densities estimated from radar range from 0.005 to 0.083 nests per acre (1 nest per 12 acres to 200 acres of nesting habitat), while nest densities at the nest patch scale estimated from tree climbing efforts have ranged from 0.05 to 1.7 per acre (1 nest per 1.7 acres to 20 acres of nesting habitat) (McShane et al. 2004). Given the tremendous variability in the density of murrelets at inland nest sites, we are limited in our ability to accurately correlate direct habitat effects to the actual number of murrelets that may be affected by a given action. However, we are able to reliably quantify habitat effects, and we can infer how these effects may influence murrelet population dynamics at both local and regional scales.

Given all of the above information, there are several key facts that we draw upon in our analysis of effects to murrelet populations:

- Adult murrelets are long-lived, have high annual survival rates, and have very low reproductive rates. In any given year, a significant portion of the adult population does not nest or attempt to nest.
- Nesting success (fecundity) is very low, and is currently insufficient to sustain a stable population. Nest predation and poor marine foraging conditions are implicated as primary causes.
- Murrelet density at inland nesting sites is highly variable. At a regional scale, murrelets occupy nesting habitat at very low densities (100s of acres of nesting habitat per murrelet). Loss of nesting habitat continues to be an important factor limiting murrelet recovery at a regional scale.

In summary, the species' inherently low annual reproductive potential, coupled with the suite of mortality factors, leads us to conclude that the species will continue to experience local and rangewide population declines in the foreseeable future. Therefore, the survival and recovery of this species depends upon maintaining adult survival and improving fecundity.

#### Effects to the Murrelet Populations in Conservation Zones 1-4

As described above, we elected to use acres of nesting habitat affected by the action as a surrogate for the number of murrelets likely to be exposed to the effects of the aerial



application of fire retardant. There are currently over 3.54 million acres of suitable murrelet nesting habitat on all lands (including non-Federal) within the Northwest Forest Plan area (Raphael et al. 2011), which supports a total estimated population of 16,691 murrelets (Falxa et al. 2011). Almost the entire listed murrelet population occurs in Conservation Zones 1-4; relatively few murrelets are present in Conservation Zones 5 and 6 (USFWS 2009).

Approximately 1.37 million acres (58 percent) of murrelet nesting habitat are located on National Forest lands, and we expect National Forest lands provide nesting habitat for a significant portion of the total murrelet population. Habitat on National Forest lands is considered essential for the long-term recovery of murrelets (USFWS 1997), and we expect the use of fire retardant will be valuable in limiting the loss of murrelet habitat from wildfires.

There are several factors, addressed below, that limit the magnitude of project effects to the murrelet populations in Conservation Zones 1-4.

#### *Murrelet Numbers*

In the above analysis, we estimated a cumulative total of 521 retardant drops on National Forests within the murrelet range will directly impact approximately 184.5 acres of murrelet nesting habitat, and expose murrelets associated with approximately 27,835 acres of murrelet nesting habitat to aircraft noise disturbance. Direct habitat impacts at the scale of individual National Forests range from 1 acre to 66 acres. Given the low densities of nesting murrelets relative to the total available nesting habitat on National Forest lands, the likelihood of a direct injury or mortality of murrelet chicks or eggs is considered to be very low. Although there is a potential for direct injury to occur, at the scale of individual National Forests, the amount of habitat exposed to direct retardant impacts is low enough that direct mortality impacts are not reasonably certain to occur.

The area exposed to noise disturbance at the scale of individual National Forests ranges from 161 acres to over 9,000 acres over a period of 10 years. Not all acres are likely to be exposed in a given year, and the effects of noise disturbance are considered to be non-lethal. Considering the small size of the area affected and the variable response of murrelets (i.e., not all nests exposed to the disturbance are expected to fail), the proposed action is not anticipated to appreciably reduce the likelihood of survival and recovery through a reduction in murrelet numbers. This conclusion is based largely upon our finding that no direct mortality or injury to adult breeding murrelets is anticipated; therefore, there would be no reduction in the existing potential breeding population at the scale of the action area, Conservation Zones 1-4, or rangewide.

#### *Murrelet Reproduction*

We expect that over the course of a decade, murrelet nest sites are likely to be exposed to noise disturbance from the aerial application of fire retardant on National Forests, particularly in Oregon and California. As described above, the total number of adult murrelets that attempt to nest in any given year is highly variable, and the overall nest success rates are highly variable and generally very low. Although we expect there will be some reduced nesting success, the level of lost reproduction is expected to be so low as to not have a discernable effect on the likelihood of persistence at the scale of local or regional murrelet populations.

### *Murrelet Distribution*

We do not expect that the proposed action would affect the distribution of murrelets within either the action area or Conservation Zones 1-4 for the following reasons: 1) although the project will result in some limited, local degradation of murrelet nesting habitat, the project would not result in the loss of murrelet nesting habitat stands, and in fact, is expected to contribute to maintaining existing murrelet habitat on National Forest lands; 2) over 98 percent of the nesting habitat in the on National Forest lands would not be exposed to effects from aerial application of fire retardant; and 3) we do not expect murrelet occupancy at the scale of individual stands to be reduced over time as a result of the proposed action. The essential conservation role of National Forest lands to provide for murrelet survival and recovery would not be reduced or diminished by this action. Therefore, the proposed action is not expected to affect the distribution of murrelets in the action area, Conservation Zones 1-4, or within the listed range of the species.

### Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. National Forests within the action area encompass large areas of non-Federal lands within the administrative boundaries of individual National Forests. Therefore, cumulative effects from future non-Federal actions are likely to occur within the action area.

Due to the large scale of the action area (all National Forest lands within the listed range of the murrelet), we are only able to address general cumulative effects that are affecting murrelets at a regional scale. We lack specific information regarding the location or management of non-Federal lands within the action area.

In our review of cumulative effects, we identified three factors that are likely to cause significant effects to murrelets: timber harvest on non-Federal lands; nest predation associated with habitat fragmentation and proximity to human activities; and climate change.

### Timber Harvest

Timber harvest on non-Federal lands continues to be significant factor influencing murrelet populations throughout the listed range of the species. Raphael et al. (2011) reported that a substantial amount of suitable murrelet nesting habitat (36 percent) is located on non-Federal lands within the Northwest Forest Plan area. Currently, over 1.18 million acres of murrelet habitat are estimated to occur on non-Federal lands, and as much as 394,300 acres of nesting habitat were lost due to timber harvest on non-Federal lands from 1994 to 2007 (Raphael et al. 2011). This represents a cumulative loss of approximately 2 percent of habitat on non-Federal lands per year. Although most of this habitat loss occurs outside the action area, it is indicative of habitat loss that is likely to occur due to non-Federal timber harvest within the geographic boundaries of National Forest lands (and therefore within the action area). This further emphasizes the essential role that National Forest lands provide for the long-term survival and recovery of murrelets.

### Nest Predation

One of the most significant indirect effects of timber harvest is the fragmentation of habitat and exposure of murrelets to increased risk of predation associated with clear-cut edges and proximity to human developments (McShane et al. 2004). Nest site predation is suspected to be the principal factor limiting murrelet reproductive success. Losses of eggs and chicks to avian predators have been determined to be the most important cause of nest failure (McShane et al. 2004). Nest failure rates of 68 to 81 percent have been reported in some areas (Peery et al. 2004). The risk of predation by avian predators appears to be highest in close proximity to forest edges and human activity, where many corvid species (e.g., jays, crows, ravens) are in highest abundance (McShane et al. 2004). We expect that non-Federal actions within the action area will continue to cause habitat loss and fragmentation, resulting in increased predation risk to murrelets.

### Climate Change

During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathe et al. 2009). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littell et al. 2009). Additionally, the changing climate will likely alter forest ecosystems as a result of the frequency, intensity, duration and timing of disturbance factors such as fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, landslides, and flooding (Littell et al. 2009).

One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. In general, wet western forests have short dry summers and high fuel moisture levels that result in very low fire frequencies. However, high fuel accumulations and forest densities create the potential for fires of very high intensity and severity when fuels are dry (Mote 2008). Westerling et al. (2006) looked at a much larger area in the western US including the Pacific Northwest, and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period 1970-1986. The total area burned is more than six and a half times the previous level and the average length of the fire season during 1987-2003 was 78 days longer compared to 1978-1986 (Westerling et al. 2006). Littell et al. (2009) project that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s.

Climate change is likely to further exacerbate some existing threats such as the projected potential for increased habitat loss from drought related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that the murrelet will be adversely affected by these fires, we lack adequate information to quantify the magnitude of effects to the species from climate change (USFWS 2009).

### Summary of Cumulative Effects

The ongoing effects of past non-Federal actions within the action area are reflected in the declining trends of murrelet populations and nesting habitat on all lands within the Northwest Forest Plan area. The anticipated cumulative effects clearly indicate the important conservation role of the National Forests to provide high-quality nesting habitats for murrelets. The expected increased magnitude and severity of wildfire events in the Pacific Northwest suggests that fire management, and the aerial application of fire retardant will be necessary to minimize losses of murrelet nesting habitat on the National Forests.

### Conclusion

After reviewing the current status of the murrelet, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the aerial application of fire retardant on National Forests, as proposed, is not likely to jeopardize the continued existence of the murrelet. We reached this conclusion based on the following rationale:

- Effects to individual murrelets are expected to be limited to few individuals over the course of a 10 year period. There would be no appreciable reduction in the likelihood of survival and recovery at the scale of Conservation Zones 1-4, or within the listed range of the species.
- The proposed action would not result in the loss of stands of murrelet nesting habitat.
- The proposed action is likely to protect and maintain occupied nesting habitat that

would otherwise be lost or degraded by wildfires.

- The essential conservation role of the National Forest lands to provide for murrelet survival and recovery would not be reduced or diminished by this action.

Although we assume that the application of fire retardant can result in adverse effects to murrelets and their habitat, we believe that the relative risk to murrelets from aircraft disturbance and fire retardant impacts are significantly less than the potential loss of nesting habitat from uncontrolled wildfire.

## **Marbled Murrelet Critical Habitat**

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### Environmental Baseline

Over 2.64 million acres of National Forest lands are designated as murrelet critical habitat. This represents over 68 percent of entire murrelet critical habitat designation. Murrelet critical habitat is designated in 32 critical habitat units (CHUs). There are 16 CHUs on National Forests, which encompass many critical habitat subunits. The majority of CHUs designated on National Forest lands are located in Late-Successional Reserves or other reserved land-use allocations established by the Northwest Forest Plan (USDA and USDI 1994). Nearly 90 percent of the suitable murrelet nesting habitat on Federal lands is located in reserved areas managed under the Northwest Forest Plan (Raphael et al. 2011). The Northwest Forest Plan provides a substantial contribution towards protecting murrelet critical habitat on Federal lands, especially habitat that is currently occupied by murrelets, and represents the backbone of the recovery strategy for the species (USFWS 1997).

The Northwest Forest Plan identified two murrelet management zones: Zone 1, which encompasses areas closest to the coast (e.g. 0-40 miles inland in Washington), and Zone 2, which encompasses further inland areas at the edge of murrelets nesting range (e.g. from 40 to 55 miles inland in Washington). Murrelet critical habitat is designated in both Northwest Forest Plan Zones. Subsequent surveys for murrelets in southern Oregon and California have demonstrated that murrelets are not present in Zone 2 in those states. In the 2006 proposed rule to revise murrelet critical habitat, the Service excluded these areas from the proposed designation (71 FR 53847 [Sept. 12, 2006]). The 2006 proposed rule was not finalized, and the critical habitat designation in these areas remains. Recent murrelet monitoring and habitat mapping efforts have excluded these areas because they are now considered to be outside the range of the murrelet (Raphael et al. 2006; 2011).

Designated critical habitat areas that are outside the range of the murrelet include over 329,000 acres on portions of the Rogue-Siskiyou, Klamath, Six Rivers, and Shasta-Trinity National Forests within Northwest Forest Plan Zone 2. The Service has previously

established via interagency memorandums that consultation requirements for murrelet critical habitat in these areas are limited. Because these areas are now outside the recognized range of the murrelet, they are excluded from further discussion in this analysis, and are not calculated as part of the environmental baseline (Table 10). Although the Okanogan-Wenatchee National Forest is within the listed range of the murrelet, no critical habitat is designated on that Forest, so it is excluded from this analysis as well.

All National Forests with designated murrelet critical habitat have documented aerial application of fire retardant during 2000 -2011 (USFS 2011). Regional interagency monitoring and mapping of wildfire perimeters in the Pacific Northwest document significant wildfires have occurred on all National Forests within the range of the murrelet, with the exception of the Siuslaw National Forest in coastal Oregon (GeoMAC 2011).

Murrelet critical habitat is generally located within close proximity to coastal areas with a relatively low risk of catastrophic wildfire. However, long-term monitoring for the Northwest Forest Plan indicates that wildfire has been the single largest cause of murrelet nesting habitat loss on Federal lands since 1994. From 1994 to 2007, approximately 56,900 acres of murrelet nesting habitat were lost due to wildfires, with the greatest losses occurring on Federal lands in Oregon (Raphael et al. 2011).

**Table 10. Summary of designated murrelet critical habitat on National Forests (NF).**

Administrative Unit	National Forest acres and percent of NF within range of murrelet (%)	Designated murrelet critical habitat on NF (acres)	Murrelet CHUs	Percent of NF acres in murrelet critical habitat	Total murrelet nesting habitat on NF lands (acres)	Percent of murrelet range on NF that is suitable nesting habitat
Olympic National Forest	630,830 (100%)	412,020	WA-01 WA-02 WA-03 WA-06	65.31%	194,880	30.75%
Mt. Baker-Snoqualmie National Forest	1,746,290 (98%)	694,250	WA-07 WA-08 WA-09 WA-10	39.76%	434,880	25.72%

			WA-11			
Gifford Pinchot National Forest	1,370,210 (12.43%)	88,420	WA-11	6.45%	30,550	17.96%
Siuslaw National Forest	626,400 (100%)	461,630	OR-02 OR-03 OR-04	73.70%	242,860	38.77%
Rogue River- Siskiyou National Forest	1,719,500 (56.33%)	394,670	OR-07 CA-01	22.95%	239,310	24.71%
Klamath National Forest	1,573,950 (12.91%)	33,310	CA-01	2.12%	67,860	33.40%
Six Rivers National Forest	964,620 (56.1%)	234,000	CA-01 CA-02 CA-11	24.26%	155,940	28.81%
Totals	8,631,800 (46.60%)	2,318,300	16 CHUs	26.86%	1,366,280	26.03%

Notes: Acres for all values have been rounded to the nearest 10th. All acreage figures are estimates derived from GIS data. National Forest acres are from spatial data for Federal lands developed for the Northwest Forest Plan 10-year monitoring report ([www.reo.gov](http://www.reo.gov)). Murrelet critical habitat acres in Northwest Forest Plan Zone 2 are excluded from these estimates in Oregon and California. Murrelet habitat estimates are derived from the Expert Judgment Model, Class 3 (moderately high suitability) and Class 4 (highest suitability) developed by Raphael et al. (2006).

Effects of the Action

**Assumption Used for the Effects Analysis**

Effects to murrelet critical habitat are based on the expected exposure of murrelet nesting habitat (Primary Constituent Element (PCE) 1 and 2) to direct retardant impacts.

The average area directly affected by each retardant drop is 800 ft long by 75 ft wide = 60,000 sq. ft. or 1.38 acres. This is based on information provided in the BA, p. 13.

To calculate the area of murrelet critical habitat exposed to retardant, we applied simple percentages and calculated the total area exposed to retardant drops divided by the percentage



of National Forest acres located within the range of the murrelet, and the percentage of suitable murrelet habitat present on the Forest.

### **Effects Common to all National Forests with Designated Murrelet Critical Habitat**

Based on the documented use of fire retardant on National Forests within the range of the murrelet, and the recent history of large wildfires that have resulted in the direct loss of thousands of acres of murrelet nesting habitat, we expect that murrelet critical habitat will be exposed to direct effects from the aerial application of fire retardant on each National Forest with designated murrelet critical habitat.

In the May, 2011, *Draft Environmental Impact Statement for Aerial Application of Fire Retardant* (USFS 2011, pp. 130-131), the Forest Service identified the following effects for terrestrial wildlife species that are applicable to this analysis of effects to murrelet critical habitat:

—Another possible direct effect to habitat is the breaking off of tree tops/vegetation by a low, fast drop of a large load (2,500 gallons). It is possible that retardant drops could adversely affect components of critical habitat (or required breeding and rearing habitat) either with a direct hit, thus covering vegetation, or by breaking vegetation for nesting, foraging, or perching.”

The two PCEs of murrelet critical habitat are: (1) individual trees with potential nesting platforms, and (2) forested areas within 0.8 km (0.5 mile) of individual trees with potential nesting platforms, and a canopy height of at least one-half the site-potential tree height (61 FR 26264). These PCEs are essential to provide and support suitable nesting habitat for the successful reproduction of murrelets. An important component of murrelet critical habitat PCEs is canopy cover over potential nest platforms for protection from predators and weather, which may be provided by overhanging branches, limbs above the nest area, or branches from neighboring trees (61 FR 26264).

Based on our review of the proposed action, we expect that the aerial application of fire retardant will remove, damage, or degrade murrelet critical habitat PCEs.

### **Effects of Direct Impact of Fire Retardant on Murrelet Critical Habitat**

As described by the Forest Service, the direct impact of a large load of fire retardant can cause tree tops and tree branches to break (USFS 2011). Fire retardant drops that damage tree crowns, break branches, and reduce canopy cover will reduce the quality of murrelet critical habitat PCEs at the scale of individual nest trees (PCE 1) and adjacent trees that provide canopy cover for nest trees (PCE 1 and PCE 2). Murrelets nest in live conifer trees with large branches that provide suitable nest platforms and live crowns that provide vertical and horizontal canopy cover to provide shade, protection from the elements, and hiding cover from avian predators. Murrelet nest sites generally have a high level of overstory canopy cover (>70 percent) and a high density of suitable nest platforms (Nelson et al. 2006).

If crown damage from the application of fire retardant is severe enough to break platform branches or reduce canopy cover to less than 70 percent, the habitat quality for murrelet nesting will be degraded. The likelihood of murrelet occupancy at the stand scale increases with high platform densities (Nelson et al. 2006). Murrelets returning to nest in subsequent years may be displaced from degraded areas if platform density and live canopy cover have been significantly reduced from damage caused by fire retardant impacts.

Research in Oregon (Meyer et al. 2002) and in British Columbia (Zharikov et al. 2006) indicates that murrelets do not immediately abandon fragmented or degraded habitats. Murrelets are likely to maintain fidelity to their nesting sites as long as the habitat stands retain some suitable nesting structures and the birds are able to successfully nest at the site (Divoky and Horton 1995). Murrelets in some areas are known to reuse the same nest trees from year to year, but this appears to be most common in landscapes that have limited nesting habitat, and less common in landscapes with large tracts of available nesting habitat (Burger et al. 2009). Because there are large stands of suitable nesting habitat (PCE 1) within designated critical habitat on National Forest lands, we expect that the scattered loss of individual tree tops or platform branches would not result in a significant disruption of murrelet breeding behavior in subsequent years.

Based on the above information, we consider the degradation of murrelet critical habitat PCEs associated with fire retardant impacts to be a direct adverse effect to murrelet critical habitat due to the loss and/or degradation of PCEs. However, we do not expect the scattered loss of individual tree tops or platform branches will result in a long-term abandonment of nesting stands, and that any local displacement of murrelets from fire retardant impacts in a given year would not result in a loss of reproduction within the National Forests in subsequent years.

Not all fire retardant applications are likely to result in canopy damage or be of sufficient force to break platform branches and damage trees, but it is reasonably certain that some retardant drops will result in physical damage to tree canopies, and direct impacts to murrelet critical habitat PCEs. We do not expect these effects to result in the loss of entire stands of suitable murrelet habitat. The effects are limited to individual trees or small groups of trees within a retardant impact zone. Although we have no data on specific levels of canopy damage associated with fire retardant impacts, it is reasonable to assume, for this analysis, that the areas exposed to direct retardant impacts will have degraded habitat conditions.

#### Exposure of Murrelet Critical Habitat to Direct Impacts from Fire Retardant

In the May, 2011, *Draft Environmental Impact Statement for Aerial Application of Fire Retardant* (USFS 2011, p. 116), the Forest Service provides the following description of aerial application of fire retardant:

–Retardant coverage level is a unit of measure used to describe the thickness of retardant on the ground and is expressed in gallons per 100 square feet (gpc). Application rates range between 1 and 8 gpc with the majority of applications between 4 and 8 gpc... Usually, the width and length of a retardant drop swath varies based on the type of aircraft used for delivery, drop height, and surface wind speeds and direction. An average drop is 50 to 75 ft wide by up to 800 ft long. Depending on

firefighting tactics, retardant drop width and length might be strung together, creating a continuous path of retardant on the ground or used to create a barrier in combination with other naturally occurring barriers to the advancement of fires (i.e., ridgetops, roads, waterways, old burn scars).”

Based on this description, we assume for this analysis that the average area of direct retardant impact is 800 ft long by 75 ft wide = 60,000 sq. ft. or 1.38 acres.

To be consistent with the analysis of effects to murrelets, we applied simple percentages and calculated the total area exposed to retardant impacts divided by the percentage of National Forest within the range of the murrelet, and the percentage of suitable murrelet nesting habitat present on the Forest:

*Example:*

Gifford Pinchot National Forest = 1,368,300 acres (100 percent).

National Forest lands located within the range of the murrelet = 170,140 acres (12.43 percent)

Total murrelet nesting habitat on the Forest = 30,550 acres, or 17.96 percent of the murrelet range.

Number of retardant drops on the Forest (2000-2010) = (65 drops) ÷ (11 years) = (5.9 drops per year) x (10 years) = 59 drops over a 10 year period for the entire National Forest.

(59 retardant drops) x (12.43 percent of the Forest within murrelet range) = 7 retardant drops within the murrelet range and/or designated critical habitat on the Forest.

(7 retardant drops) x (1.38 acres of retardant impact per drop) = 9.66 total acres exposed to retardant impacts.

(9.66 acres) x (17.96 percent suitable murrelet habitat on Forest) = 1.7 acres of murrelet nesting habitat exposed to direct retardant impacts.

Using the above assumptions, we estimated the total area of murrelet critical habitat anticipated to be exposed to direct fire retardant impacts for each National Forest within the listed range of the murrelet (Table 11). Although this analysis method is based on the percentage of total murrelet nesting habitat on each Forest, we have chosen to adopt these estimates for the analysis of effects to critical habitat to be consistent with the murrelet effects analysis, and because murrelet nesting habitat best represents murrelet critical habitat PCE 1.

**Table 11. Summary of murrelet critical habitat acres exposed to direct fire retardant impacts for each National Forest.**

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Administrative Unit	Designated murrelet critical habitat on NF (acres)	Total murrelet nesting habitat on NF lands (acres)	Percent of murrelet range on NF that is suitable murrelet habitat	10-year average number of retardant drops on National Forest	Estimated number of retardant drops in murrelet range (over 10 years)	Estimated direct retardant impact to murrelet nesting habitat (PCE 1) (acres)
Olympic National Forest	412,020	194,880	30.89%	4	4	1.7
Mt. Baker-Snoqualmie National Forest	694,250	434,880	25.72%	3	3	1.1
Gifford Pinchot National Forest	88,420	30,550	17.96%	59	7	1.7
Siuslaw National Forest	461,630	242,860	38.77%	123	123	65.8
Rogue River-Siskiyou National Forest	394,670	239,310	24.71%	258	145	49.4
Klamath National Forest	33,310	67,860	33.40%	246	32	14.7
Six Rivers National Forest	234,000	155,940	28.81%	213	119	47.3
Totals	2,318,300	1,372,960	26.03%	2,231	433	181.7

Notes: Values for total acres of murrelet nesting habitat on each National Forest have been rounded to the nearest 10th. All acreage figures are estimates derived from GIS data. National Forest acres are from spatial data for Federal lands developed for the Northwest Forest Plan 10-year monitoring report ([www.reo.gov](http://www.reo.gov)). Murrelet critical habitat acres in Northwest Forest Plan Zone 2 are excluded from these estimates in Oregon and California. Murrelet habitat estimates are derived from the Expert Judgment Model, Class 3 (moderately high suitability) and Class 4 (highest suitability) developed by Raphael et al. (2006).

The amount of murrelet habitat exposed to direct retardant impacts on each Forest varies greatly depending on the average number of retardant drops, and the area of the Forest located within the range of the murrelet. Over a ten year period, we anticipate an average of 433

retardant drops will occur on National Forest lands within the range of the murrelet. It is reasonable to assume that some of these retardant drops will occur in designated murrelet critical habitat. Based on the percentage of murrelet nesting habitat on each National Forest, we anticipate that approximately 181.7 acres of murrelet nesting habitat (PCE 1) will be exposed to direct retardant impacts and habitat degradation (Table 11).

Our estimates of murrelet critical habitat exposed to direct retardant impact are in fact rough estimates based on several simplifying assumptions. We have no accurate way to predict the actual number of acres of murrelet critical habitat that will be exposed due to the random and stochastic nature of wildfire events. However, given the scope and scale of this Nation-wide programmatic consultation, we believe these are reasonable assumptions for the purpose of evaluating the effects of the proposed action to murrelet critical habitat.

Several factors limit the scale and magnitude of the effects of the proposed action to murrelet critical habitat. We do not expect fire retardant impacts to result in the loss of entire stands of suitable murrelet habitat. The effects are limited to individual trees or small groups of trees within a retardant impact zone. At the scale of each National Forest, the area exposed to direct fire retardant impacts represents a very minor portion of the total available critical habitat that is present on these Forests. On Forests with few fires, (e.g., Olympic and Mt. Baker-Snoqualmie), the rate of retardant application is very low, and the corresponding exposure of murrelet critical habitat to the effects are limited to small areas, likely to be associated with a single fire event over the course of a decade.

The Forest with the greatest level of expected critical habitat effects is the Siuslaw National Forest in Oregon (Table 11). Over 73 percent of the Forest is designated as murrelet critical habitat. For this analysis, we make the reasonable worst-case assumption that all retardant drops on the Forest will occur within murrelet critical habitat. Using the assumptions described above, we estimate that a total of 123 drops over 10 years would directly impact 65.8 acres of murrelet nesting habitat (PCE 1). This represents a very small percentage of the critical habitat present on the Forest, and not all effects are expected to occur in a single year or be concentrated in a single area.

### **Effects to the Essential Conservation Role of CHUs for Recovery of Murrelets**

The proposed action also would adversely affect murrelet critical habitat PCEs by degrading a total of approximately 182 acres of suitable nesting habitat (PCE 1) across all National Forests over a 10-year period. These effects will be distributed across seven National Forests, and 16 CHUs. The effects will incrementally degrade the quality of the critical habitat at the scale of individual trees but the amount of habitat degraded is very small relative to the amount of critical habitat or adjacent cover trees in CHUs on National Forests.

Given the current condition of critical habitat in the action area and the minor amounts of critical habitat that would be degraded, the Service determined that the proposed action would:

- Not result in the loss of stands of suitable murrelet habitat
- Not affect the functional ability of CHUs on National Forests to provide for murrelet nesting
- Not reduce or impair the ability of the CHUs to provide for the conservation of the murrelet
- Not diminish the ability to attain the critical habitat goals in the CHUs at the Conservation Zone scale or the rangewide scale.

### **Beneficial Effects Associated with Aerial Application of Fire Retardant**

The use of fire retardant has proven to be an effective tool in the control and management of wildland fire (USFS 2011). Effective use of fire retardant can significantly reduce the amount of late-successional and old-growth forest lost to uncontrolled wildfires. Long-term monitoring for the Northwest Forest Plan indicates that wildfire has been the single largest cause of murrelet nesting habitat loss on Federal lands since 1994. From 1994 to 2007, approximately 56,900 acres of murrelet nesting habitat were lost due to wildfires, with the greatest losses occurring on Federal lands in Oregon (Raphael et al. 2011). Although we assume that the application of fire retardant can result in adverse effects to murrelets and their habitat, we believe that the relative risk to murrelets from fire retardant impacts is significantly less than the potential loss of nesting habitat from uncontrolled wildfire.

### Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. National Forests within the action area encompass large areas of non-Federal lands within the administrative boundaries of individual National Forests. Therefore, cumulative effects from future non-Federal actions are likely to occur within the action area.

Due to the large scale of the action area (all National Forest lands within the listed range of the murrelet), we are only able to address general cumulative effects that are affecting murrelet critical habitat at a regional scale. We lack specific information regarding the location or management of non-Federal lands within the action area.

In our review of cumulative effects, we identified two factors that are likely to cause significant effects to murrelet critical habitat in the action area: timber harvest on non-Federal

lands within the boundaries of, or directly adjacent to, the National Forests, and climate change.

### Timber Harvest

Timber harvest on non-Federal lands continues to be significant factor influencing murrelet populations throughout the listed range of the species. Raphael et al. (2011) reported that a substantial amount of suitable murrelet nesting habitat (36 percent) is located on non-Federal lands within the Northwest Forest Plan area. Currently, over 1.18 million acres of murrelet habitat are estimated to occur on non-Federal lands, and as much as 394,300 acres of nesting habitat were lost due to timber harvest on non-Federal lands from 1994 to 2007 (Raphael et al. 2011). This represents a cumulative loss of approximately 2 percent of habitat on non-Federal lands per year. Although most of this habitat loss occurs outside the action area, it is indicative of habitat loss that is likely to occur due to non-Federal timber harvest within the geographic boundaries of National Forest lands (and therefore within the action area). The primary effect to murrelet critical habitat from timber harvest on adjacent non-Federal lands would be edge effects such as windthrow, that are likely to degrade critical habitat along clear-cut boundaries. This further emphasizes the essential role that National Forest lands provide for the long-term survival and recovery of murrelets.

### Climate Change

During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathe et al. 2009). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littell et al. 2009). Additionally, the changing climate will likely alter forest ecosystems as a result of the frequency, intensity, duration and timing of disturbance factors such as fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, landslides, and flooding (Littell et al. 2009).

One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. In general, wet western forests have short dry summers and high fuel moisture levels that result in very low fire frequencies. However, high fuel accumulations and forest densities create the potential for fires of very high intensity and severity when fuels are dry (Mote 2008). Westerling et al. (2006) looked at a much larger area in the western US including the Pacific Northwest, and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period 1970-1986. The total area burned is more than six and a half times the previous level



and the average length of the fire season during 1987-2003 was 78 days longer compared to 1978-1986 (Westerling et al. 2006). Littell et al. (2009) project that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s.

Climate change is likely to further exacerbate some existing threats such as the projected potential for increased habitat loss from drought related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that the murrelet will be adversely affected by these fires, we lack adequate information to quantify the magnitude of effects to the species from climate change (USFWS 2009).

### Summary of Cumulative Effects

The ongoing effects of past non-Federal actions within the action area are reflected in the declining trends of murrelet populations and nesting habitat on all lands within the Northwest Forest Plan area. The anticipated cumulative effects clearly indicate the important conservation role of the National Forests to provide high-quality nesting habitats for murrelets. The expected increased magnitude and severity of wildfire events in the Pacific Northwest suggests that fire management, and the aerial application of fire retardant will be necessary to minimize losses of murrelet nesting habitat on the National Forests.

### Conclusion

After reviewing the current status of the murrelet critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the aerial application of fire retardant on National Forests, as proposed, is not likely to destroy or adversely modify designated critical habitat. We reached this conclusion based on the following rationale:

- The proposed action would not result in the loss of stands of murrelet critical habitat.
- The proposed action is likely to protect and maintain occupied critical habitat within designated CHUs that would otherwise be lost or degraded by wildfires.
- The essential conservation role of the National Forest lands to provide for murrelet survival and recovery would not be reduced or diminished by this action.

### **Northern Spotted Owl (*Strix occidentalis caurina*)**

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### Environmental Baseline

The population size of northern spotted owl pairs occurring in the action area is unavailable because surveys are not done on virtually all of the National Forests to determine the number of spotted owl nest sites, pair occupancy rates, and reproduction rates. Population declines continue and barred owl competition has resulted in a decrease in the number of spotted owl nesting pairs in many parts of its range (Forsman et al. 2011a), yet we do not have this information by individual Forest.

Nest site data (Table 12) are based on either field survey results (known sites) or derived using a USFWS methodology for estimating owl occupancy based on habitat (predicted sites) (USFWS et al. 2008). This methodology, known as the owl estimation methodology (OEM), is intended to facilitate a reasonable basis for estimating occupied spotted owl habitat on a given landscape along with estimating the number of northern spotted owl pairs that can occur within the area affected by a proposed Federal action. The template relies on known spotted owl locations derived from spotted owl surveys as the foundation for the template. To estimate likely occupied habitat outside of known home ranges, spotted owl density estimates and spotted owl habitat usage from survey and demography studies within a Physiographic Province were utilized to identify areas that could support a nesting pair. Physiographic Provinces are designated as Recovery Units in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011). Known and estimated sites serve as the foundation for evaluating the effects of a proposed Federal action on the spotted owl.

As part of a reasonable worst case analysis, our estimation of the number of nest sites by National Forest and Physiographic Province (Table 12) assumes that spotted owl nest sites are capable of being occupied by reproducing spotted owls.

The exact level of pair occupancy by spotted owls using habitat that will be impacted by the proposed action is unknown because some sites may contain resident singles or no spotted owls. Occupancy of nest sites by northern spotted owls varies among years, and only a subset of the exposed nest sites may be occupied by pairs of owls in any given year. For this analysis, we used occupancy data found in reports from the Demography Study Areas (DSAs) located throughout the range of the northern spotted owl (see references listed in Table 16). Data are available from these study areas for at least 15 years, and over 25 years in other areas. We also used data from other study areas where spotted owl populations are being monitored (e.g., Gerhardt 2003). Because of the variation that occurs in nesting site occupancy from year to year, we wanted to analyze occupancy data from more than a single year. However, given the effects of barred owl range expansion on spotted owl nest site occupancy rates, we did not want to sample too far in the past. Thus, for all reports, we used the data from the most recent 5 years and used the average to determine a mean occupancy rate for the province. For some study areas, we did not have 5 years worth of data available, so we used all the years presented. We were interested in the proportion of the nesting sites surveyed that were occupied by pairs of spotted owls. Some of the reports only presented occupancy data for pairs combined with resident single owls (Forsman et al 2010c, Herter et al 2008). By counting sites occupied by resident singles in addition to pairs, the occupancy rate will be higher, which leads to a conservative occupancy estimate for these provinces (Eastern Washington Cascades and Western Washington Cascades Provinces).

For this analysis, we used reproduction data found in reports from the Demographic Study Areas (DSAs) and additional spotted owl monitoring data gathered throughout the range of the northern spotted owl (see references listed in Table 16).

The action area for this consultation is located within 10 of the 12 designated Physiographic Provinces/Recovery Units for the spotted owl (Table 12). The only Physiographic Provinces that are not covered by the action area are the Western Washington Lowlands and the Willamette Valley. Available habitat on National Forests ranges from 83,743 acres in the California Cascades Province to over 1.7 million acres in the Oregon Western Cascades Province (Table 12). Available habitat on National Forest lands comprises 84 percent of northern spotted owl habitat on Federal lands throughout the species' range (Tables 1 and 2, bottom of this species' section). Among the provinces, removal of habitat by National Forests since 1994 has ranged from 0.02 percent of the Olympic Province to 6.6 percent of the Oregon Eastern Cascades Province. Almost 70 percent of spotted owl habitat removal on National Forests since 1994 has occurred in three provinces: (1) the Oregon Western Cascades Province; (2) the Oregon Eastern Cascades Province; and (3) the California Klamath Province (Table 12). Habitat removal is caused by Federal actions that are subject to Section 7 consultation, as well as natural disturbance events such as fire.

There are no estimates of the spotted owl's population size prior to settlement by Europeans. Spotted owls are believed to have inhabited most old-growth forests or stands throughout the Pacific Northwest, including northwestern California, prior to the beginning of modern settlement in the mid-1800s (USFWS 1989). According to the final rule listing the spotted owl as threatened (USFWS 1990), approximately 90 percent of the current population (roughly 2,000 known spotted owl breeding pairs) is located on Federally managed lands.

Eleven, long-term demographic study areas are located throughout the range of the northern spotted owl. Demographic data such as fecundity, apparent survival, recruitment, and annual finite rate of population change have been collected on these areas from as early as 1985. A recent analysis has been done of study area data collected from 1985 -2008 (Forsman et al. 2011a). The results show that fecundity is increasing on 3 study areas, declining on 5 study areas, and stable on the remaining 3 areas (Table 14). Apparent survival estimates were declining on all study areas except for the study area located in the Oregon Klamath Province, where survival was stable. Declines were most dramatic in Washington. In addition, survival was negatively associated with the presence of barred owls in 6 of the 11 study areas (Table 14). The estimated annual rate of population change was less than 1.0, indicating a declining population for all study areas. However, on 4 of the study areas (Table 14), the 95% confidence intervals on population estimates overlapped 1.0, indicating that the populations in these study areas may be stable. Additional population data in the form of mean annual occupancy rate and mean annual fledgling rate by province is displayed later in this document in Table 16.

Spotted owls are widely distributed throughout most of the 17 National Forests within their range. There are 6 National Forests in which spotted owl distribution is limited to that portion of the Forest within the range of the spotted owl; these forests and the portion of the forest within the spotted owl range are the Lassen (1 percent), Modoc (3 percent), Fremont-Winema (14 percent), Deschutes (43 percent), Okanogan-Wenatchee (67 percent), and Klamath (96 percent) National Forests.

The action area is located within the area managed under the direction of the Northwest Forest Plan (NWFP), which established a conservation strategy for the northern spotted owl on Federal lands (USDA and USDI 1994a, b). The NWFP is designed around the conservation needs of the spotted owl and is based on the designation of a variety of land-use allocations whose objectives are either to provide for spotted owl population clusters (i.e., demographic support) or to maintain connectivity between population clusters. Several land-use allocations are intended to contribute primarily to supporting spotted owl population clusters: Late-Successional Reserves (LSRs), Managed Late-Successional Areas (MLSAs), Congressionally Reserved Areas (CRAs), Managed Pair Areas, and Reserve Pair Areas. The remaining NWFP land-use allocations (Matrix, Adaptive Management Areas (AMAs), Riparian Reserves (RRs), Connectivity Blocks, and Administratively Withdrawn Areas (AWAs)) provide connectivity between habitat blocks intended for demographic support.

The range-wide system of LSRs set up under the NWFP captures the variety of ecological conditions within the 12 different physiographic provinces to which spotted owls are adapted. This design reduces the potential for extinction of the spotted owl due to large catastrophic events in a single province. Multiple, large LSRs in each province reduce the potential that spotted owls will be extirpated in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within a LSR. In addition, LSRs are generally arranged and spaced so that spotted owls may disperse to two or more adjacent LSRs and/or Wilderness complexes. This network of reserves reduces the likelihood that catastrophic events will impact habitat connectivity and population dynamics within and between provinces.

It has been 17 years since the adoption of the NWFP in 1994. Thomas et al. (1990) argued that the spotted owl's population trend should stabilize at a lower equilibrium sometime within the next 100 years. During the interim, there was an expectation that the rate of decline would slowly decrease as habitat loss was arrested and new habitat regenerated in the habitat conservation areas. The NWFP predicted a continuing decline of spotted owls until such time as new habitat developed (over the course of decades) (Appendix J of USDA and USDI 1994a, Courtney et al. 2004). Lint (2005) concluded that during the first ten years of the NWFP, the prognosis for spotted owl habitat seemed to be correct. Anthony et al. (2006) stated that spotted owl populations appeared to be stationary in several study areas, although more recent analyses indicate population declines throughout the northern spotted owl range (Forsman et al. 2011a). While the habitat provision of the NWFP is a necessary condition for spotted owls, it may not be a wholly sufficient provision (Courtney et al. 2004), given the observed spotted owl population declines (Forsman et al. 2011a). Information collected during the first decade of the NWFP affirms that protecting habitat is very important to the

survival and recovery of the spotted owl, and that the reserve network prescribed under the NWFP has been effective in maintaining and restoring spotted owl habitat (Lint 2005).

The 2011 *Revised Recovery Plan for the Northern Spotted Owl* (USFWS 2011) describes the most important range-wide threats to the northern spotted owl as: competition with barred owls; ongoing loss of habitat as a result of timber harvest; loss or modification of habitat from uncharacteristic wildfire; and the loss of habitat and distribution as a result of past activities and disturbances. The Recovery Plan proposes to address the barred owl threat through a scientific evaluation of potential management options to reduce the impact of barred owls on spotted owls. To address habitat threats, the Recovery Plan does not recommend a new habitat conservation network, but rather to continue application of the reserve network of the NWFP until either the 2008 designated spotted owl critical habitat is revised or land management agencies amend their land management plans taking into account the guidance in the Revised Recovery Plan. The Recovery Plan provides a modeling framework to assist in the development of this network. In addition, the Revised Recovery Plan notes the necessity of conserving the highest value spotted owl habitat to address key threats. In addition, given the continued decline of the species, the apparent increase in severity of the threat from barred owls, and information indicating a recent loss of genetic diversity for the species, the Revised Recovery Plan recommends retaining more occupied spotted owl sites and unoccupied, high-value spotted owl habitat on all lands within the range of the spotted owl.

## EFFECTS OF THE ACTION

Effects of the action for purposes of a section 7(a)(2) analysis refer to the permanent or temporary direct and indirect effects caused by a proposed Federal action on a listed species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action, occur later in time, but are still reasonably certain to occur.

In this section, a general discussion of how the proposed use of fire retardant affects spotted owls as a result of noise disturbance, habitat modification, and retardant contact with the spotted owl or its prey is presented, followed by a discussion of specific effects. A separate discussion of effects to spotted owl critical habitat is presented in Appendix B.

### *Disturbance Effects (background)*

Noise in the canopy can result in a significant disruption of breeding, feeding, or sheltering behavior of the spotted owl such that it creates the likelihood of injury to individuals (i.e., excessive noise can cause incidental take in the form of harass). For a significant disruption of spotted owl behavior to occur as a result of disturbance caused by the proposed action, the disturbance and the spotted owl(s) must be in close proximity to one another (USFWS 2003, 2005).

Spotted owl reactions to excessive noise levels are expected to include the following: flushing from the nest site that would leave eggs or young exposed to predation; premature fledging of a juvenile that would increase its risk of predation; interruption of foraging activities that would result in the reduced fitness or even mortality of the affected individual(s); or disruption of roosting activities that would cause a spotted owl to relocate. A spotted owl that may be disturbed at a roost site is presumably capable of moving away from disturbance without a significant disruption of its behavior. Spotted owls forage primarily at night. Therefore, projects that occur during the day are not likely to disrupt its foraging behavior. During the day, the potential for effects is mainly associated with disruption of spotted owl breeding behavior at an active nest site.

Adult spotted owls are expected to survive excessive noise disturbances. The potential impact to the affected populations is the loss of owl production at the nest site as a result of disturbance from noise. Loss of production could occur in multiple ways throughout the nesting season through: (1) disrupting courtship and breeding such that nesting is not attempted or egg laying fails; (2) flushing an adult that is incubating, exposing the eggs to predators or to temperature extremes that results in death of the embryo; (3) disturbing an incubating adult to the degree that it flushes with enough force to accidentally kick an egg out of the nest; and (4) flushing an adult that is caring for fledglings and exposing the fledglings to an increased risk of predation or exposing them to temperature or precipitation extremes that increases their chance of injury or death.

After owls fledge, which typically occurs between early July and early August, depending on their location, potential effects from disturbance decline because juvenile spotted owls are increasingly more capable of moving as the nesting season progresses. Once capable of sustained flight, young owls are presumably able to distance themselves from disturbance and minimize their risk of predation. However, disturbances associated with Type 1 helicopters are considered to have a greater impact than other activities, due to the intensity of the noise. Thus, these activities would require fledglings to move over greater distances, potentially increasing their risk of predation or harm. Therefore, disturbance from Type 1 helicopters may still adversely affect spotted owls during the entire nesting period.

Although the Service has assumed disruption distances based on interpretation of the best available information, the exact distances where different disturbances disrupt breeding are difficult to predict and can be influenced by a multitude of factors. Site-specific information (e.g., topographic features, project length/duration or frequency of disturbance to an area) would also influence the degree of the effects to spotted owls. The potential for noise producing activities creating the likelihood of injury to spotted owls is also dependent on the background or baseline levels in the environment. In areas that are continually exposed to higher ambient noise levels (e.g., areas near well-traveled roads, campground), spotted owls are probably less susceptible to small increases in disturbances because they are accustomed to such activities. Some spotted owls occur in areas near human activities and may habituate to certain levels of noise.



*Specific Disturbance Effects to Spotted Owls Likely to be Caused by the Use of Fire Retardants*

The proposed use of fire retardants entails the use of multiple aircraft types. Fixed wing airtankers ranging in size and retardant capability from Type 1 (largest aircraft with 3,000 gallon retardant capability) to Type 4 (smallest fixed wing aircraft with 799 gallon retardant capability) may be used. In addition, Type 1 (2,000 gallon capability) and Type 2 (buckets up to 1,000 gallon capability) helicopters may be used in areas where the use of airtankers is not possible. Above ambient noise levels caused by this activity will adversely affect and potentially significantly disrupt the breeding behavior of spotted owls during their critical breeding period if the activity is implemented at or in close proximity to an active nest site.

Because the activity of dropping fire retardant is predicated on the imminent occurrence of fire, the timing and location of which are not known at this time, it is not possible to identify specific spotted owl nest sites that may be affected by this activity. Instead, an assessment of past retardant drops combined with nest site densities on individual forests was used as a surrogate for determining exposure of owl nest sites to excessive noise disturbance from aircraft (Table 15). Several assumptions on project effects to the species were made as part of this analysis:

1. All retardant drops will be done by Type 1 helicopters, which have the greatest disturbance potential among all aircraft available for retardant drops.
  - Multiple aircraft are available for retardant drops, and different disturbance distances are associated with individual aircraft. The disturbance footprint per retardant drop expressed below was based on the largest disturbance distance, which is associated with Type 1 helicopters (440 yards). This is the distance within which noise from the aircraft will adversely affect and significantly disrupt spotted owl breeding and nesting behavior. The disturbance distance for other helicopters, as well as fixed wing aircraft, is 120 yards; drops from these aircraft will have a disturbance footprint that is just over 10 percent of that associated with Type 1 helicopters (25 acres compared with 208 acres, as described in the assessment calculations below). There are 18 fixed wing aircraft and an unquantified number of helicopters under contract to the Forest Service. Given the variety of air resources available, Type I helicopters will only be a portion of aircraft types used for retardant drops. However, we did not have data to estimate what proportion of future drops would be done with Type 1 helicopters compared with other aircraft, and have thus used the largest disturbance distance among all retardant aircraft available to develop a reasonable worst case assessment.



2. The calculated disturbance footprint assumes the aircraft is at canopy height when the retardant is dropped.
  - The disturbance footprint is calculated using a horizontal distance from the retardant swath and thus presumes the aircraft will be flying at tree-top level when the load is dropped. In reality, the aircraft will be above the canopy and for fixed wing airtankers there are minimum above-ground altitudes that must be met during the drop; these drop heights range from 60 to 200 feet above ground level, with the greater heights associated with larger aircraft. The higher the aircraft is above the ground, the smaller the disturbance footprint on the ground becomes because maintaining a straight-line distance of 440 yards from the ground to the aircraft will result in a decrease in distance to the retardant swath as the aircraft distance to the ground increases. This assumption results in maximizing the disturbance footprint for a reasonable worst case scenario.
  
3. All retardant drops will reach the maximum length as noted in the BA (USDA 2011).
  - The disturbance footprint calculated below is based on the maximum drop length of 800 feet described in the BA (USDA 2011). Not all drops will reach this distance. This assumption results in maximizing the disturbance footprint for a reasonable worst case scenario.
  
4. All drops will occur within the spotted owl's nesting season.
  - Outside of the critical nesting season for the spotted owl, the use of non-Type 1 helicopters and fixed-wing aircraft to deliver fire retardant is not likely to adversely affect the spotted owl because spotted owls have fledged and the juveniles are increasingly more capable of moving away from disturbances as the nesting season progresses. However, disturbances associated with the use of Type 1 helicopters are considered to have an adverse effect during the entire nesting season due to the intensity of the noise, requiring fledglings to move greater distances and potentially increasing their risk of predation or harm. The project description provided by the Forest Service indicates that peak fire season within the Oregon and Washington forests occurs from June through October, while it is August through October for California forests. However, this is "peak" fire season, and it is not uncommon for fires to begin in May, or even earlier (CDF 2011, ODF 2011). The beginning of the fire season varies throughout the range of the spotted owl and fire start dates vary annually based on local climate, making it difficult to select a specific starting date. Thus, we did not have data to reasonably determine what proportion of all retardant drops occurred outside of the spotted owl nesting season, or what proportion of drops done by aircraft other than Type 1 helicopters occurred outside of the

critical nesting season. Thus, as part of a reasonable worst case scenario, all drops were assumed to have the potential to adversely affect a spotted owl nest site during the nesting season.

5. All retardant drops occur in spotted owl habitat in proportion to its availability on a Forest.

- Although retardant drops can be done in denser forest areas such as spotted owl habitat, retardant drops tend to occur in areas not typically associated with spotted owl nesting areas (ridge tops and human-caused or natural fire breaks such as roads, meadows, and rock outcrops). However, we did not have data to determine the proportion of drops that may occur in spotted owl habitat. Hence, we assumed all drops occurred in habitat in proportion to the amount of habitat occurring on an individual Forest as part of a reasonable worst case scenario.

6. All aircraft will fly at at distances of 440 yards or more above northern spotted owl habitat on their way to and from the retardant drop site.

- We did not have data for cruising heights of retardant aircraft. Nor can we determine flight paths between drop points and tanker bases or other remote bases without knowing where the fires will occur. Frequent, repeated aircraft activity will occur at tanker bases and remote, mobile bases. Tanker bases are located at airports, which are not expected to be near spotted owl habitat. Remote, mobile bases, however, are typically activated for helicopter support near the fire and may be located adjacent to northern spotted owl habitat. Location of remote bases can be planned during the incident to avoid location near nesting sites and reduce disturbance effects on owl pairs.

All of the above assumptions combined provide for a reasonable worst case scenario in determining the effects of the proposed project.

Based on the above assumptions, we analyzed the number of expected retardant drops, combined with nest site densities on individual forests, to calculate exposure of owl nest sites to excessive noise disturbance from aircraft (Table 15). The specific steps in this assessment include:

- A disturbance footprint was calculated for each retardant drop, presuming Type I helicopters were used (disturbance distance of 440 yards). The maximum length of the retardant swath described in the BA (800 ft) was used in this calculation. A 440 yard disturbance distance was added on each end of the swath and on either side to derive a disturbance footprint of 208 acres.

- The disturbance footprint was multiplied by the mean annual number of retardant drops for each Forest (based on data from 2000-2010 in Table B-3 of the BA) to determine the annual area of disturbance. That value was then multiplied by the proposed term of the action (10 years) to determine the total disturbed area expected over the life of the project.
- Finally, an owl nest site density was determined for each Forest by dividing the number of nesting sites (Maximum number of owl sites available for exposure in Table 15) by the total acreage of the Forest. That density was then multiplied by the total disturbance acreage over the life of the project to derive the number of owl nest sites that will be subject to effects that conform to the regulatory definition of harassment over the proposed term of the project.

A reasonable worst case assessment indicates that as many as 223 spotted owl sites containing spotted owl nesting pairs will be adversely affected during the breeding season in the form of harassment by disturbance from retardant-applying aircraft over the 10-year term of the proposed action (Table 15).

#### *Disturbance Effects to the Spotted Owl Population Likely to be Caused by the Use of Fire Retardants*

A total of 223 spotted owl nesting sites is likely to be subject to excessive noise levels caused by low-flying aircraft dropping retardant that are sufficient to significantly disrupt the breeding behavior of adult owls. The pairs associated with these sites will experience adverse effects due to excessive noise disturbance sufficient to disrupt breeding and nesting behavior to the degree that young are not produced. However, the actual effect on the population will be reduced because not all spotted owl nest sites are occupied every year, and not all occupied sites produce young; annual occupancy and production are assumptions made because we have no current data available for pair status and reproduction for the 223 nesting sites affected (see Environmental Baseline).

Of the 223 nesting sites affected by the action, only 96 of those are predicted to be occupied, based on local demography data (Table 16), and thus exposed to disruption by low-flying aircraft. The greatest number of sites disturbed, 41, occurs in the California Klamath Province, followed by 23 in the Oregon Western Cascades Province. Because these are total numbers of exposed occupied sites disturbed over the 10-year span of the proposed action, they equate to 4.1 and 2.3 sites per year for the California Klamath and Oregon Western Cascades Provinces, respectively. Remaining provinces have substantially reduced levels of exposure to disturbance to occupied nest sites, with less than 1 site per year being disturbed to this extent (Table 16).

Adult spotted owls are expected to survive the above disturbance. The impact to the population is the loss of owl production at these 96 nest sites as a result of excessive disturbance from noise during the breeding season. We have further attempted to quantify the number of young owls that will not be produced as a result of disturbance to nest sites using data from the DSAs. The estimated loss of young due to the disturbance effects of aircraft applying retardant over the life of the proposed action is estimated at 70 (Table 16). Most of the young (22) would be lost in the California Klamath Province, with 13 and 12 coming from the Oregon Western Cascades and Washington Eastern Cascades Provinces, respectively. A total estimated loss of 70 spotted owl young over a 10-year period translates into an annual loss of 2.2, 1.3 and 1.2 young owls for these three provinces, respectively. The remaining provinces would experience the loss of less than 1 spotted owl young per year. When proportioned by National Forest, the total estimated loss of spotted owl young is 72 due to rounding errors in summing loss by Forest because many National Forests occur in multiple provinces.

The worst case scenario loss of 70 spotted owl young, averaging 7 young per year rangewide, is not likely to be a significant adverse effect to the spotted owl at the provincial or range-wide scales. These effects are temporary in nature and the associated adult owls are likely to continue to reproduce in future years. This loss would be distributed across almost 5.9 million acres of habitat on 17 National Forests. The use of retardant is likely to contribute to keeping fires from becoming “catastrophic” (i.e., stand-replacing), thus, the use of retardant is likely to contribute to maintaining and enhancing the amount and distribution of spotted owl habitat by promoting, in part, smaller and cooler fires that remove understory but not canopy trees.

#### *Habitat Effects (Background Information)*

The decline of the spotted owl throughout its range is in part linked to the removal and degradation of suitable habitat (USFWS 2001, Courtney et al. 2004). Specific vegetative composition and structural components are associated with spotted owl suitable habitat (USFWS 2001, Courtney et al. 2004). The removal of any of those components can cause adverse effects to affected spotted owls by:

- Displacing spotted owls from nesting, roosting, or foraging areas;
- Concentrating displaced spotted owls into smaller, fragmented patches of suitable habitat that may already be occupied;
- Increasing intra-specific competition of suitable nest sites;
- Decreasing survival of displaced spotted owls and their offspring by increasing their exposure to predators and/or limiting the availability of food resources;
- Diminishing the future reproductive productivity of displaced nesting pairs that may forgo nesting temporarily following their displacement; and

- Diminishing spotted owl population size due to declines in productivity and recruitment.

According to the BA, little is known about the effects of fire retardant as a modifier of forest vegetation. Widespread short-term effects (leaf death in tree, shrub, and ground cover species) have been reported in an Australian eucalyptus forest (Bradstock et al. 1987). In that study, the retardant mixture contained ammonium sulfate and an organic polysaccharide. 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 1 year post application. The results of the associated greenhouse experiments reported in this study indicate that the ammonium sulfate component was the retardant ingredient responsible for foliar damage and that foliar washing did not minimize the adverse effects. Retardant PC-D75 is the only retardant that currently has ammonium sulfate within the formulation, and this retardant is being phased out and will not be used by the Forest Service in the future (Johnson 2010).

In addition, there is a potential for increased vegetative growth and change in vegetative community composition through the addition of nitrogen and phosphorous, principle components of fire retardants. However, the direction and magnitude of these changes are strongly site-specific, and much of the research on this topic was not done in plant communities other than forests (USDA 2011). The actual fire event may cause changes in availability of nitrogen and phosphorus in the soil and mask effects of retardant application. In addition, the persistence of nitrogen and phosphorus from fire retardant applications and its availability to plants varies depending on retardant concentration and soil quality.

Finally, retardant drops have the potential to damage tree crowns if the slurry does not have the time to spread out and disperse in the air before it reaches the vegetation. This can result in both creating and removing some of the structural features that are valuable components of northern spotted owl habitat. For example, retardant drops may result in crown breakage and loss of potential nesting platforms, but the woody material would be available on the ground as coarse woody debris.

Retardant drops are not likely to adversely affect habitat functionality at the stand scale due to the very small areas directly impacted by retardant drops. There may be occasional damage to the canopy, and small openings may occur. However, these are expected to increase diversity within and among stands. There may be some change in the vegetative composition, but the small scale at which this occurs is expected to maintain habitat functionality. All blocks of suitable habitat will remain essentially intact, and continue to support spotted owl nesting, roosting and foraging. Dispersal habitat will continue to function to allow spotted owl movement across the landscape. For these reasons, aerial drops of fire retardant may affect, but are not likely to adversely affect spotted owls through habitat modification.

*Retardant Contact with Spotted Owls or Its Prey*

A primary assumption in the Forest Service's analysis of the proposed action is that spotted owls and most birds in general are highly mobile and thus are likely to escape from areas with fire activities and avoid direct drops of retardant upon them (USDA 2011). This assumption presumes that a drop will occur after owlets have fledged and are mobile enough to readily leave the area as well. If not, there is a risk that retardant may directly fall on nestlings or fledglings. Potential effects on individuals include physical injury or knocking nestlings out of the nest if the retardant load is particularly dense or concentrated. Injury or knocking nestlings out of the nest would expose them to increased risk of predation, as well as exposure to weather that may increase their chance of mortality, if they are not killed outright. Because retardant is a sticky substance, it is expected to stick to an owls feathers, potentially reducing the bird's thermoregulatory abilities and reducing it's chance for surviving extreme weather events.

It is also possible that spotted owls may ingest retardant, either through preening feathers if they are exposed to a direct drop, obtaining water from a contaminated source, or capturing prey that were either exposed to a direct drop or traveled through a drop zone and picked up the retardant on its pelage. Finally, they may also increase their body burden of retardant by foraging on prey that may not have any retardant on their surface, but also have a body burden after having also ingested retardant.

As noted in the BA, retardant must meet stringent requirements in order to ensure safety for equipment, people, and the environment. Retardant formulations in use today are primarily inorganic fertilizers, the active compound being ammonia polyphosphates (USDA Forest Service Specification 5100-304c Retardant, Wildland Firefighting, June 1, 2007 (amendments inserted into text May 17, 2010)). Currently approved retardant used by the Forest Service includes: P100F, D75-R, LC-95A, PC 259F (for a complete description of constituents of these retardants see <http://www.fs.fed.us/rm/fire/wfcs/lt-ret.htm>). Although retardant is approximately 85 percent water, the ammonia 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, as cited in USDA 2011). The ammonia salt causes the solution to adhere to vegetation and other surfaces; this stickiness makes the solution effective in retarding the advance of fire (Johansen and Dieterich 1971, as cited in USDA 2011). Corrosion inhibitors are needed to minimize the deterioration of retardant tank structures and aircraft, which contributes to flight safety (Raybould and others 1995, as cited in USDA 2011).

The toxicity of the fire retardant chemicals used by the Forest Service has been assessed for a small set of terrestrial wildlife species selected to represent a broad array of species (LABAT 2007). Acute toxicity effects of fire retardant on all bird species studied in this analysis (American Kestrel, red-wing blackbird, bobwhite quail) indicated slight toxicity. When specific retardant ingredients were evaluated for their toxicity, only one ingredient, a retardant salt, was associated with risks to terrestrial species. The American Kestrel, the only raptor



evaluated in this study, was at risk to this ingredient only when two retardant products (Fire-Trol 300-F, Fire-Trol TTS-R) were applied at concentrations above 4 gallons/100 ft<sup>2</sup>(gpc). Kestrels were also at risk from the same salts in the above two products, as well as four additional products (Phos-Chek D75-F, Phos-Chek D75-R, Phos-Chek G75-F, Phos-Chek G75-W) when they were applied at higher concentrations of 6 gpc. Application rates on wildfires range between 1 and 8 gpc, with most occurring between 4 and 8 gpc (USDA 2011).

Although there are no available data on the toxicity of fire retardants on spotted owls, available data for another raptor species, the American Kestrel, indicates there is a low level of toxicity, though it appears limited to specific retardant formulas applied at moderate to high concentrations. There is also a risk of injury to birds if they are hit by large loads of a retardant, or if the retardant soils their feathers and degrades their ability to thermoregulate. However, given the small footprint of retardant drop areas (50 to 75 ft wide and up to 800 ft long) (USDA 2011), the likelihood of any given drop landing on a nest is very low. Therefore, we conclude that aerial drops of fire retardant may affect, but are not likely to adversely affect spotted owls through direct contact with the species or ingestion by the species.

#### CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur within the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. We are not aware of any cumulative effects that would affect this species.

#### CONCLUSION

After reviewing the current status of the spotted owl, the environmental baseline for the action area, the effects of the proposed action on the spotted owl and the cumulative effects, it is the Service's biological opinion that the activities, as proposed, are not likely to jeopardize the continued existence of the spotted owl.

The Service reached this conclusion because the proposed action: (1) is not likely to adversely affect the quantity and quality of northern spotted owl habitat at the stand and provincial scales; and (2) only short-term adverse effects to the spotted owl in the form of an estimated worst case scenario loss of 72 young-of-the-year owls over the 10-year term of the proposed action is expected as a result of excessive disturbance to nest sites caused by low-flying aircraft dropping retardant. The adult spotted owls associated with these nests are not expected to be injured or killed and are expected to continue normal breeding behavior during the term of the action. The probability of the same adults and their nests being affected more than once by low-flying aircraft is considered negligible.



**Table 12. Aggregate results of all adjusted, suitable habitat (NRF1) acres addressed by section 7 consultation on Forest Service lands for the northern spotted owl. Baseline and summary effects are displayed by state, physiographic province, and National Forest.**

State	Physiographic Province <sup>2</sup>	National Forest	1994 Baseline Habitat <sup>3</sup>	Habitat Removed/ Downgraded <sup>4</sup>	Available Habitat	Percent of Provincial Baseline Habitat Affected	Percent of Range-wide Available Habitat Affected	Total Estimated Owl Nest Sites <sup>5</sup>
WA	Olympic Peninsula	Olympic	251,189	-93	251,096	0.04	0.08	125
	<b>Olympic Peninsula Province Total</b>		<b>251,189</b>	<b>-93</b>	<b>251,096</b>	<b>0.04</b>	<b>0.08</b>	<b>125</b>
	Western Cascades	Gifford Pinchot	449,400	-6,519	442,881	0.63	5.71	226
		Mt. Baker - Snoqualmie	581,187	-1,176	580,011	0.11	1.03	305
		Okanogan - Wenatchee	863	-6	857	0.00	0.01	0
	<b>Washington Western Cascades Province Total</b>		<b>1,031,450</b>	<b>-7,701</b>	<b>1,023,749</b>	<b>0.75</b>	<b>6.75</b>	<b>531</b>
	Eastern Cascades	Gifford Pinchot	68,355	-100	68,255	0.01	0.09	35
		Mt. Baker - Snoqualmie	210	0	210	0.00	0.00	0
		Okanogan - Wenatchee	627,064	-13,033	614,031	1.87	11.42	277
	<b>Washington Eastern Cascades Province Total</b>		<b>695,629</b>	<b>-13,133</b>	<b>682,496</b>	<b>1.89</b>	<b>11.51</b>	<b>312</b>
OR	Western Cascades	Deschutes	695	-2,096	-1,401 <sup>b</sup>	0.12	1.84	0
		Klamath	32	0	32	0.00	0.00	0

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		Mt. Hood	379,488	-4,125	375,363	0.23	3.62	253
		Rogue River - Siskiyou	141,600	-354	141,246	0.02	0.31	127
		Umpqua	479,000	-163	478,837	0.01	0.14	466
		Willamette	766,734	-20,836	745,898	1.18	18.26	733
		<b>Oregon Western Cascades Province Total</b>	<b>1,767,549</b>	<b>-27,574</b>	<b>1,739,975</b>	<b>1.56</b>	<b>24.17</b>	<b>1578</b>
	Eastern Cascades	Deschutes	144,214	-25,491	118,723	6.04	22.34	28
		Fremont-Winema	86,490	-2,301	84,189	0.55	2.02	116
		Mt. Hood	189,088	-28	189,060	0.01	0.02	128
		Rogue River - Siskiyou	1,728	0	1,728	0.00	0.00	2
		Umpqua	24	0	24	0.00	0.00	0
		Willamette	270	0	270	0.00	0.00	0
		<b>Oregon Eastern Cascades Province Total</b>	<b>421,814</b>	<b>-27,820</b>	<b>393,994</b>	<b>6.60</b>	<b>24.38</b>	<b>273</b>

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Table 12 (cont). Aggregate results of all adjusted, suitable habitat (NRF<sup>1</sup>) acres addressed by section 7 consultation on Forest Service lands for the northern spotted owl. Baseline and summary effects are displayed by state, Physiographic province, and National Forest. Estimated owl sites are also included.

State	Physiographic Province <sup>2</sup>	National Forest	1994 Baseline Habitat <sup>3</sup>	Habitat Removed/ Downgraded <sup>4</sup>	Available Habitat	Percent Provincial Baseline Affected	Percent Range-wide Affected	Total Estimated Owl Nest Sites <sup>5</sup>
OR	Coast Range	Siuslaw	234,258	-471	233,787	0.20	0.41	270
	<b>Oregon Coast Range Province Total</b>		<b>234,258</b>	<b>-471</b>	<b>233,787</b>	<b>0.20</b>	<b>0.41</b>	<b>270</b>
	Klamath	Klamath	2,831	-4	2,827	0.00	0.00	3
		Rogue River - Siskiyou	397,146	-3,983	393,163	0.94	3.49	352
		Six Rivers	139	0	139	0.00	0.00	0
		Umpqua	22,369	-5,711	16,658	1.35	5.01	16
	<b>Oregon Klamath Province Total</b>		<b>422,485</b>	<b>-9,698</b>	<b>412,787</b>	<b>2.30</b>	<b>8.50</b>	<b>372</b>
CA	Klamath	Klamath	394,802	-12,927	381,875	1.21	11.33	399
		Mendocino	99,823	-8,205	91,618	0.77	7.19	199
		Rogue River - Siskiyou	23,090	0	23,090	0.00	0.00	21
		Shasta-Trinity	209,416	-1,090	208,326	0.10	0.96	368
		Six Rivers	339,402	-1,482	337,920	0.14	1.30	432

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	<b>California Klamath Province Total</b>		<b>1,066,533</b>	<b>-23,704</b>	<b>1,042,829</b>	<b>2.22</b>	<b>20.77</b>	<b>1420</b>
	Coast Range	Mendocino	1,762	0	1,762	0.00	0.00	4
		Six Rivers	5,248	-278	4,970	3.97	0.24	6
	<b>California Coast Range Province Total</b>		<b>7,010</b>	<b>-278</b>	<b>6,732</b>	<b>3.97</b>	<b>0.24</b>	<b>10</b>
	Cascades	Klamath	11,917	-2,361	9,556	2.70	2.07	10
		Lassen	14,400	0	14,400	0.00	0.00	0
		Modoc	1,700	0	1,700	0.00	0.00	3
		Shasta-Trinity	59,354	-1,267	58,087	1.45	1.11	103
	<b>California Cascades Province Total</b>		<b>87,371</b>	<b>-3,628</b>	<b>83,743</b>	<b>4.15</b>	<b>3.18</b>	<b>116</b>
	Rangewide total		5,985,288	-114,100	5,871,188	1.91	100	5007

<sup>1</sup>Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components, nesting-roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) from 1994 to June 26, 2001. After June 26, 2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

<sup>2</sup>Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS (USDA and USDI 1994a). The Washington Western Lowlands and Oregon Willamette Valley provinces are not listed as they are not expected to contribute to recovery.

<sup>3</sup>1994 FSEIS baseline (USDA and USDI 1994a).

<sup>4</sup>Includes both effects reported in USFWS (2001) and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database). Also includes some, though not necessarily all, removal or downgrading of habitat by fire.

<sup>5</sup>Owls were estimated on individual forests by the USFWS owl estimation methodology (USFWS 2008) based on habitat availability, known owl locations, and demographic studies. This is not a population estimate.

<sup>6</sup>Negative habitat availability due to an error in either initial classification of baseline habitat for the Deschutes NF in the western Cascades Province, or a mapping error in either the baseline habitat or habitat removed/downgraded.

**Table 13. Aggregate results of all adjusted, suitable habitat (NRF1) acres addressed by section 7 consultation on Northwest Forest Plan lands for the northern spotted owl. Baseline and summary effects are displayed by state, Physiographic province, and National.**

State	Physiographic Province <sup>2</sup>	1994 Baseline Habitat <sup>3</sup>	Habitat Removed / Downgraded			Percent of Provincial Baseline Habitat Affected	Percent of Range-wide Available Habitat Affected
			Habitat Change From Section 7 Actions	Habitat Change From Natural Events	Total Habitat Change <sup>4</sup>		
Washington	Eastern Cascades	706,849	10,914	14,307	25,221	3.57	6.29
	Olympic Peninsula	560,217	2,580	299	2,879	0.51	0.72
	Western Cascades	1,112,480	12,551	3	12,554	1.13	3.13
Oregon	Eastern Cascades	443,659	16,749	40,884	57,633	12.99	14.38
	Western Cascades	2,046,472	69,808	24,583	94,391	4.61	23.55
	Coast Range	516,577	4,291	66	4,357	0.84	1.09
	Klamath	785,589	58,061	101,676	159,737	20.23	39.86
California	Cascades	88,237	4,830	329	5,159	5.85	1.29

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	Coast	51,494	543	100	643	1.25	0.16
	Klamath	1,079,866	10,974	27,212	38,186	3.54	9.53
Total		7,397,098	191,301	209,459	400,760	5.42	100

<sup>1</sup>Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components, nesting-roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) from 1994 to June 26, 2001. After June 26, 2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

<sup>2</sup>Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS (USDA and USDI 1994a). The Washington Western Lowlands and Oregon Willamette Valley provinces are not listed as they are not expected to contribute to recovery.

<sup>3</sup>1994 FSEIS baseline (USDA and USDI 1994a).

<sup>4</sup>Includes both effects reported in USFWS (2001) and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database). Also includes some, though not necessarily all, removal or downgrading of habitat by fire.



**Table 14. Summary of northern spotted owl demographic parameters from demographic study areas (from Forsman et al. 2011a).**

Demographic Study Area	Principle Province Location	Fecundity Trend	Apparent Survival Estimates	Effects of Barred Owl on Apparent Survival	Population Change
Cle Elum	WA E. Cascades	Declining	Declining	Weak/negligible	Declined
Rainier	WA W. Cascades	Increasing	Declining	Negative	Declined
Olympic	WA Olympic	Stable	Declining	Negative	Declined
Coast Range	OR Coast Range	Increasing	Declining since 1998	Negative	Declined
H.J. Andrews	OR Western Cascades	Increasing	Declining since 1997	Negative	Declined
Tyee	OR Coast Range	Stable	Declining since 2000	Weak/negligible	Insufficient precision to detect decline <sup>1</sup>
Klamath	OR Klamath	Declining	Stable	Weak/negligible	Insufficient precision to detect decline <sup>1</sup>
South Cascades	OR E Cascades and OR W. Cascades	Declining	Declining sine 2000	Weak/negligible	Insufficient precision to detect decline <sup>1</sup>
NW California	CA Klamath	Declining	Declining	Negative	Declined
Hoopa	CA Klamath	Stable	Declining since 2004	Weak/negligible	Insufficient precision to detect decline <sup>1</sup>
Green Diamond	CA Coast Range	Declining	Declining	Negative	Declined

<sup>1</sup>Estimate of annual rate of population change was less than 1.0 (declining population), but 95% confidence intervals on the estimate overlapped 1.0, so could not reject hypothesis that the populations were stable.

**Table 15. Estimation of number of northern spotted owl nesting sites affected by noise disturbance from retardant drops over the course of the action (10 years). Data is displayed by forest.**

NAME	STATE	Forest area <sup>1</sup> (ac)	mean annual retardant drop <sup>2</sup> (n)	Total area disturbed by retardant drop <sup>3</sup> (ac)	Maximum number of owl sites available for exposure <sup>4</sup> (n)	Estimated number of owl sites exposed <sup>5</sup> (n)
Deschutes NF	OR	1,596,899	70	145,600	28	3
Fremont-Winema NF	OR	2,252,587	111	230,880	116	12
Gifford Pinchot NF	WA	1,321,506	8	16,640	261	3
Klamath NF	CA	1,737,774	25	52,000	412	12
Lassen NF	CA	1,070,992	20	41,600	0	0
Mendocino NF	CA	911,733	41	85,280	203	19
Modoc NF	CA	1,663,401	20	41,600	3	0
Mt. Baker-Snoqualmie NF	WA	2,560,903	0.3	567	305	0
Mt Hood NF	OR	1,071,442	15	31,200	381	11
Okanogan-Wenatchee NF	WA	3,237,440	133	276,640	277	24
Olympic NF	WA	628,117	0.4	832	125	0
Rogue River Siskiyou NF	OR	1,723,179	26	54,080	501	16
Shasta-Trinity NF	CA	2,210,368	121	251,680	471	54
Siuslaw NF	OR	634,210	12	24,960	270	11
Six Rivers NF	CA	998,540	21	43,680	439	19
Umpqua NF	OR	983,129	12	24,960	482	12
Willamette NF	OR	1,678,037	30	62,778	733	27
Total		26,280,257		1,384,977	5,007	223

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<sup>1</sup>Forest acreage data obtained from USDA Forest Service Lands Area report, [http://www.fs.fed.us/land/staff/lar/LAR2010/LAR\\_Table\\_03.pdf](http://www.fs.fed.us/land/staff/lar/LAR2010/LAR_Table_03.pdf)

<sup>2</sup>Data obtained from table B-3 of BA.

<sup>3</sup>Calculated based on disturbance footprint per retardant drop (208 acres, see text for derivation of this number) multiplied by mean annual retardant drop, multiplied by 10 year life of action.

<sup>4</sup>Number of owl sites based on data supplied by National Forests with owl estimation methodology (OEM) (USFWS 2008) applied to identify additional areas on the landscape that may also support owls based on available habitat. OEM was not applied to the Deschutes NF because they do annual surveys and know all owl locations.

<sup>5</sup>Estimated exposure calculated by multiplying owl density (Maximum number of owl sites available for exposure<sup>4</sup> divided by forest area) by Total area disturbed by retardant drop.

<sup>6</sup>Estimated number of owl sites exposed, adjusted for occupancy rates among individual provinces. See Table 16 for occupancy rates. Several forests have ownership in multiple provinces, so occupancy rates were pro-rated by proportion of the forest in individual provinces.

**Table 16. Estimate of the distribution of spotted owl nest sites by Physiographic Province that are likely to be subject to excessive noise levels caused by low-flying aircraft dropping retardant that will likely harass nesting pairs and harm young spotted owls.**

Physiographic Province	Estimated Number of Owl Sites Affected by Disturbance Within Province <sup>1</sup>	Mean Occupancy Rate for Province (percent)	Estimated Sites Affected Over the Life of the Action, Adjusted for Occupancy	Mean Annual Reproduction Rate	Estimated Loss of Reproduction Over the Life of the Action <sup>2</sup>	Occupancy Data Source	Reproduction Data Source
Washington Olympic Peninsula Province	0.2	14	0	0.37	0	Forsman et al. 2011b	Forsman et al. 2009, 2010a, 2011b <sup>3</sup>
Washington Western Cascades Province	2.9	44	1	0.38	0	Herter et al. 2008 <sup>4</sup>	Herter et al. 2008 <sup>5</sup>
Washington Eastern Cascades Province	24.1	28	7	1.8	12	Forsman et al. 2010c <sup>6</sup>	Forsman et al. 2010c <sup>7</sup>
Oregon Western Cascades Province	50.6	46	23	0.59	14	Dugger et al. 2011	Dugger et al. 2011 <sup>3</sup>
Oregon Eastern Cascades Province	18.2	38	7		4	Gerhardt 2003, 2004, 2006, 2007	Gerhardt 2003, 2004, 2006, 2007 <sup>3</sup>
Oregon Coast Range Province	10.6	30	3	1.62	5	Forsman et al. 2010b	Forsman et al. 2010b <sup>7</sup>
Oregon Klamath Province	11.6	50	6	1.57	9	Davis et al. 2011	Davis et al. 2011 <sup>8</sup>

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California Klamath Province	92.1	45	41	0.54	22	Franklin et al. 2008, 2010, 2011;Higley and Carlson 2007	Franklin et al. 2008, 2010, 2011 <sup>3</sup>
California Coast Range Province	0.6	45	0	0.54	0	Franklin et al. 2008, 2010, 2011;Higley and Carlson 2007	Franklin et al. 2008, 2010, 2011 <sup>3</sup>
California Cascades Province	12.1	38	5	0.61	3	Dugger et al. 2010	Dugger et al. 2010 <sup>9</sup>
Range-wide total			94 <sup>10</sup>		70 <sup>10</sup>		

<sup>1</sup>Spotted owl sites from Table 15 are displayed by province. For those forests located in more than 1 province, the owl sites were proportioned based on the available habitat within each province as displayed in Table 12.

<sup>2</sup>Estimated loss of reproduction calculated by multiplying mean annual reproduction rate by estimated sites affected adjusted for occupancy.

<sup>3</sup>Reproduction data reported as number of young fledged per pair.

<sup>4</sup>Herter et al. (2008) included resident singles in their occupancy estimate, resulting in an unquantifiable increase in occupancy rate than that determined for pairs alone.

<sup>5</sup>Reproduction data from Herter et al. (2008) was number of fledglings per active site (active sites included resident singles).

<sup>6</sup>Forsman et al. (2010c) included resident singles in their occupancy estimate, resulting in an unquantifiable increase in occupancy rate than that determined for pairs alone.

<sup>7</sup>Reproduction data reported as number of young produced per female that successfully fledged young.

<sup>8</sup>Reproduction data reported as mean brood size.

<sup>9</sup>Reproduction data reported as number of fledglings per pairs fledgling young.

<sup>10</sup>Estimated sites affected and estimated loss of reproduction differ slightly from that presented in Table 17 due to rounding errors introduced into the values for the number of nest sites by National Forest, which may overlies multiple provinces.

**Table 17. The number of spotted owl nest sites per National Forest where excessive noise disturbance caused by low-flying aircraft dropping retardant is likely to harass adult owls and affect production of young spotted owls (see also Table 16). Numbers presented are for the 10-year term of the action.**

National Forest	Number of Nest Sites Subject to Excessive Noise Levels Likely to Harass Northern Spotted Owls	Number of Disturbed Nest Sites that are Expected to be Occupied by Spotted Owls <sup>1</sup>	Loss of reproduction (number of young harmed) from Disturbed and Occupied Sites <sup>1</sup>
Deschutes	3	1	1
Fremont-Winema	12	5	3
Gifford Pinchot	3	1	1
Klamath	12	6	3
Lassen	0	0	0
Mendocino	19	9	5
Modoc	0	0	0
Mt. Baker-Snoqualmie	0	0	0
Mt Hood	11	5	3
Okanogan-Wenatchee	24	7	12
Olympic	0	0	0
Rogue River Siskiyou	16	8	10
Shasta-Trinity	54	23	13
Siuslaw	11	3	5
Six Rivers	19	9	5
Umpqua	12	6	4
Willamette	27	13	7
Total	223	96 <sup>2</sup>	72 <sup>2</sup>

<sup>1</sup>Occupancy and reproduction rates based on demography data in Table 16.



<sup>2</sup>Total sites affected and loss of reproduction differs slightly from that presented in Table 16 due to rounding errors introduced into the values for the number of nest sites by National Forest, which may overlie multiple provinces.

## **Spalding's Catchfly (*Silene spaldingii*)**

*Species Lead:* Pam Druliner, Idaho Fish and Wildlife Office; ph: (208) 378-5348

### Environmental Baseline

Spalding's catchfly was listed as threatened in 2001 and a final recovery plan for this plant was released October 15, 2007. The goal of the recovery plan is to recover the plant by protecting and maintaining reproducing, self-sustaining populations so that the species no longer needs protection under the Endangered Species Act.

Spalding's catchfly (*Silene spaldingii*) is an herbaceous perennial in the pink family (*Caryophyllacea*). The species is endemic to the Palouse region of south-east Washington and adjacent Oregon and Idaho. Disjunct populations also occur in northwestern Montana and British Columbia, Canada. This species is found predominantly in the Pacific Northwest bunchgrass grasslands and sagebrush-steppe, and occasionally in open-canopy pine stands. Occupied habitat includes five physiographic (physical geographic) regions: 1) the Palouse Grasslands in west-central Idaho and southeastern Washington; 2) the Channeled Scablands in east-central Washington; 3) the Blue Mountain Basins in northeastern Oregon; 4) the Canyon Grasslands along major river systems in Idaho, Oregon, and Washington; and 5) the Intermontane Valleys of northwestern Montana and British Columbia, Canada.

In general, *Silene spaldingii* is found in open, mesic grassland communities or sagebrush-steppe communities, and occasionally within open pine forests. *Silene spaldingii* continues to be impacted by habitat loss due to human development, habitat degradation associated with adverse grazing and trampling by domestic livestock and wildlife, and invasions of aggressive nonnative plants, which can occur after wildland fires. In addition, a loss of genetic fitness (the loss of genetic variability and effects of inbreeding) is a problem for many small, fragmented populations where genetic exchange is limited. Other impacts include changes in fire frequency and seasonality, off-road vehicle use, and herbicide spraying and drift. Although fire does not appear to affect recruits or adults in some years (Lessica 1999), it can be indirectly affected by increasing introduced weed species (Hill and Gray 2005). While fire does not appear to pose an immediate threat to plants or reproduction, the resulting increase in non-native invasive plants is a threat to *Silene spaldingii*.

The objective of the *Silene spaldingii* recovery plan is to protect and maintain reproducing, self-sustaining populations in each of the five distinct physiographic regions where it resides by addressing relevant threats at each population location. Within each of these regions we have identified key conservation areas to focus conservation efforts at larger populations. At this time, no element occurrences on USFS land have burned, but over 200 acres have burned off USFS land. According to the LANDFIRE database (<http://www.landfire.gov>), approximately

215 acres have burned within 1 mile of *Silene spaldingii* on USFS land in the last 10 yrs (of 17,886 acres within 1 mile of SS on USFS). The nearest fire has occurred within 0.2 miles of occupied habitat.

More information on the species can be found at:

<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q1P9>

For more information on the recovery efforts for Spalding's can be found at:

<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q1P9#recovery>

### ***Nez Perce National Forest (2.2 million acres)***

Two populations (Element Occurrences) of *Silene spaldingii* are found on the Nez Perce National Forest. One population encompasses approximately four acres and contains 500 plants and the other encompasses approximately one acre and contains 100 plants. Habitat modeling completed as part of the Island Ecosystem Analysis at the Watershed Scale (EAWS) (Forest Service 2006) indicate that there are approximately 2,064 acres of potential habitat on Forest Service lands between the Salmon River and the Salmon/Snake divide. One small population of 12 plants also occurs on the Forest within the boundary of the Hells Canyon National Recreation Area (managed by the Wallawa Whitman National Forest). During the period 2000-2011, there have been 1,305 reported fires on the Forest with 194 retardant drops. Less than 0.002% of the Forest lands have been treated with fire retardant.

### ***Factors Affecting the Species on the Nez Perce National Forest***

Factors threatening Spalding's catchfly include invasive non-native plants, small geographically isolated populations or occurrences, changes in fire regime and fire effects, including the increase in non-native vegetation and the resultant changes in plant communities, land conversion associated with urban and agricultural development, grazing and trampling by livestock and wildlife species, herbicide and insecticide spraying, off-road vehicle use, insect damage and disease, impacts from drought and global warming, and inadequacy of existing regulatory mechanisms (Fish and Wildlife Service 2007). Based on information provided in the Assessment, it is unknown at this time if populations have been subject to fires or retardant and the associated effects. Less than .002% of the Forest has been treated with fire retardant from 2000-2011 and there have been 194 drops during that time. The two known populations of *Silene spaldingii* on the Forest and 2,064 acres of modeled potential habitat in Canyon grassland habitat (where the plant occurs). Although the Forest does not treat a high percentage of its total land-base annually with retardants, Canyon grassland habitat is prone to fire (BA pg. 73). Therefore, all else equal, the area surrounding or near the populations is likely to receive a disproportionate amount of retardant applications.

***Umatilla National Forest (1.4 million acres)***

*Silene spaldingii* occurs on the Umatilla National Forest. Extensive range-wide loss of habitat for *Silene spaldingii* has resulted from a combination of substantial habitat conversion to agriculture and degradation of the remaining habitat, primarily by weed invasion. The fragmentation of habitat has resulted in small, genetically isolated populations scattered across four states and five physiographic provinces (Fish and Wildlife Service 2007). More than half of the remaining populations are on private land, with the majority of these unprotected (Fish and Wildlife Service 2007). Over the period of 2000-2011 there have been 992 reported fires on the Forest with 392 retardant drops. During this time, approximately .005% of the Forest has been treated with retardant.

*Silene spaldingii* is located on the Umatilla National Forest in T9N, R43E, Sections 13, 14, 15, 23, 24, and 32, within the Peola and Mackee Allotments. Both allotments have been surveyed, as listed in Table 18, by Forest botanists, including specific searches for *Silene spaldingii* in 1997 and 2000. Total forest acres of known habitat are 60.4.

**Table 18. Site locations of Spalding's catchfly (*Silene spaldingii*) in the Sourdough area.**

FS GIS Site	EOR Number	Section	Allotment Pasture Name	Number of Plants Reported
20	149	13	Lower Sourdough	45
21	49	13	Lower Sourdough	130
831	49	13	Lower Sourdough	150
14	49	14	Upper Sourdough	490
15	49	15	Upper Sourdough	83
61	49	23	Upper Sourdough	113
832	49	23	Mackee & Upper Sourdough	10
57	49	23	Mackee	6
76 & 77	58	24	Lower Sourdough	21
2Not available	2Not available	2Not available	Smoothing Iron Ridge	>500

1. Element Occurrence Record (EOR) Numbers 50 and 56 were combined into EOR 49 in 2006
2. These data are not available yet as this is a new population, reported July 2008, and documentation has not been completed yet.

The Sourdough area where *Silene spaldingii* occurs includes at least portions of four open ridges on the south side of Lick Creek (Cabin, Sheep, Sourdough, and Bracken ridges) and their intervening draws that support plant communities typical of the Canyon Grasslands (Fish and Wildlife Service 2007; Johnson and Simon 1987; Tisdale 1986). Elevations range approximately from a low of 2800 feet to a high of 4000 feet on the upper ridges. South aspects favor bluebunch wheatgrass/Sandberg’s bluegrass communities, while north aspects support Idaho Fescue communities, snowberry/rose communities of shrubs in swales and draws, and occasional stringers of ponderosa pine and Douglas-fir. As elevation increases to 4500 feet and above, especially to the southwest and west of the Sourdough area, mixed conifer forest predominates. The entire area of suitable habitat on the Umatilla National Forest has been surveyed.

Based on information provided in the BA, it is unknown at this time if populations have been subject to fire or retardant drops and the subsequent effects of either. Although the Forest does not treat a high percentage of its total land-base annually with retardants, habitat surrounding the populations is particularly prone to fire (BA pg. 73). Therefore, the area surrounding or near the populations may receive a disproportionate amount of retardant applications.

***Wallowa-Whitman National Forest (2.3 million acres)***

Within the Wallowa-Whitman National Forest, *Silene spaldingii* is found on the Wallowa Plateau and Canyon Grasslands. The three populations (made up of eleven element occurrence records) have shared ownership between the Forest Service and private landowners; therefore the area size and plant numbers for each ownership can only be approximated. Roughly 38 percent of the plants are found on Forest Service land (1,357 out of 3,502 plants). Those element occurrences on Forest Service land total 43.1 acres. While no populations have been found, habitat modeling predicts over 24,000 acres of high probability habitat for Spalding’s catchfly in the Hells Canyon National Recreation Area. About 42 percent of these acreages are located in active grazing allotments or administrative horse pastures (USDA Forest Service 2003). Over the period of 2000-2011 there have been 1,134 reported fires on the Forest with 730 retardant drops. Approximately .006% of the forest has been treated with retardant during that time.

Table 19 lists the currently identified Spalding’s catchfly element of occurrences within the action area.

**Table 19. Spalding’s catchfly (*Silene spaldingii*) on the Forest are located in the Wallowa Valley District area.**

State	WW GIS #	# Plants	Invasive Plant	Allotment
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Element of Occurrence		Reported	Proximity (based on GIS mapping data)	
EOR - 016	1266, 1267	99-203	> ½ mile away	Crow creek
EOR - 014	0519,1337, 1338, 0518/new sites in 2004, 0600-0608	126-295/414	> ½ mile away	Crow creek
EOR - 013	0516, 0517	41-94	> ½ mile away	Crow Creek
EOR - 017	1268, 1269	58-79	Diffuse knapweed within 1/4 mile along Crow Creek	Swamp Creek
EOR - 019	1280	14-20	> ½ mile away	Swamp Creek
EOR - 020	1275-1279	659-1860	Diffuse knapweed within 1/4 mile along Crow Creek	Swamp Creek
EOR - 018	1265	91-300	> 1/2 mile away	Private
EOR -	61602-1274		Not within ½ mile on USFS lands, however, population is also adjacent to private and roads	Bear-Gulch/Private
None yet	061604-2326 new population in Imnaha	25-30	within ½ mile from Yellow Star thistle and Scotch Thistle	Lone Pine T4N, R49E Sec.19, 20
None yet	061604-2328 new population in Imnaha	45-50	> than a mile away from known weed sites	Toomey T4N, R49E Sec.31
None yet	061604-2327 new population in Imnaha	5-10	within ½ mile from Yellow Star thistle and Scotch Thistle	Lone Pine T4N, R49E Sec.19

On Forest Service land, populations (Element Occurrences or EOs) appear stable or increasing where multiple years (15-20 years) of inventory work has been completed (see Table 19 for

locations). Populations range from 20 to over 500 plants per population. The populations on Forest Service land in Oregon are located within grazing allotments. The Mud Duck allotment is presently closed. All remaining EO records of *Silene spaldingii* listed in Table 19 are within active grazing allotments.

#### *Factors Affecting Species Environment within the Wallowa-Whitman and Umatilla National Forests*

Even though grazing allotment pastures where Spalding's catchfly occur are either closed or actively managed to protect *Silene spaldingii* populations (USDA Joseph Creek Range Allotment 2005), grazing animals can cause areas of disturbance where invasive weeds can establish. The area where *Silene spaldingii* occurs is considered primarily winter range for elk, although many animals are also present in summer. Elk create obvious pockets of soil disturbance at natural salt licks, watering holes, and on steep slopes and chutes. They also maintain existing trails and create new ones up and down draws and across upper slopes and along ridges. They graze and browse along the trails and also fan out across the slopes and ridges where the native bunchgrasses and forbs are most abundant and healthy.

Elk, and/or deer, sporadically browse the flowering stalks of *Silene spaldingii*, probably to the greatest extent in the late season of drier years when other plants have senesced and become unpalatable. In the process of grazing the intact native plant communities, both elk and cattle can spread the propagules of numerous weedy species into even the most pristine of the upper slopes and ridges, and they likely continue to do so at an unknown rate. There are also roads/trails near two of the subpopulations located in the Swamp Creek allotment and along Forest Road 129 located in the Bear Gulch allotment that continues onto private lands. Although at this time no invasive species are identified near these areas it is a well known fact that roads and trails serve as primary sources for dispersal of invasive plant species.

Much of the area where *Silene spaldingii* is found falls within terrain where fire is actively suppressed. Fire fighting activities such as fire-line construction and mop-up operations could uproot and kill plants and disrupt habitat. Fire-lines can provide pathways into otherwise intact plant communities, facilitating weed invasion and displacement of desirable species. Firefighting equipment is often driven off-road to support suppression efforts, and these vehicles could dislodge or crush plants, as well as disturb soils. It is not known how *Silene spaldingii* would respond to retardant application. However, most exotic weedy species respond much more quickly to pulses of available nutrients than do native species, so the fertilizing effect of retardant would likely increase the advantage of invasive non-native plants over the natives.

Based on information provided in the BA, it is unknown at this time if known populations have been subject to retardant drops and the subsequent effects. Less than 0.002% of the Forest has been treated with fire retardant from 2000-2011 and there have been 194 drops during that time. As stated above, there are two known populations of *Silene spaldingii* on the Forest and 2,064



acres of modeled potential habitat. Although the Forest does not treat a high percentage of its total land-base annually with retardants, and the Forest Service's admittedly patchy retardant misapplication data does not shed any light on misapplication rate (none indicated), the Canyon grassland habitat (where the plant occurs) is relatively prone to fire (BA pg. 73) and use of retardants rather than ground crews due to the high rate of fuel consumption characteristic of a grassland fire. Therefore, the area surrounding or near the populations is likely to receive a disproportionate amount of retardant applications.

## EFFECTS ANALYSIS

Our working assumptions for the proposed action are defined as follows:

- The potential for retardant misapplications on known *Silene spaldingii* populations is the pathway for the LAA determination. The mechanism for adverse effects to this species is the fertilizer component of fire retardant and the potential for increased abundance of invasive species within occupied habitat.
- Mapped avoidance areas around known populations will be finalized prior to implementation of the proposed action by the Forests. Forests will take precautions to prevent application of fire retardant in those mapped avoidance areas. These precautions are expected to reduce the potential for retardant misapplications within the core avoidance areas. Although the forests where *Silene spaldingii* occur have a relatively low retardant use (less than 0.01% of landbase annually), wildfire response in the grasslands and lower montane grassland openings with Ponderosa pine/Douglas-fir forest are more likely to result in retardant use (BA p. 73). Therefore, the Forest Service determined that the proposed action is likely to adversely affect *Silene spaldingii*.

Changes in plant communities can occur after retardant applications. Although the BA cites few examples from in the literature, decreases in species richness, increase in forage that attracts herbivores, alterations of the structure of the vegetation community, and enhancement of noxious weeds have been reported in areas subjected to retardant. Retardants serve as a source of plant nutrients when not phytotoxic. This may have both positive and negative effects to *Silene spaldingii*; stimulating its own growth but also that of competing species. Fertilizer effects are variable among plant species, with some more responsive than others, leading to a wide range of outcomes based on the existing plant community.

Invasive non-native plants alter various attributes of ecosystems including geomorphology, fire regime, hydrology, microclimate, nutrient cycle, and productivity (Pyke and Novak 1994). Additionally, invasive non-native plants can negatively affect native plants through competitive exclusion, niche displacement, competition for pollinators, and changes in insect predation (Monsen 1994).

***Nez Perce National Forest (2.2 million acres)***

As stated above, there are two known populations of *Silene spaldingii* on the Forest and 2,064 acres of modeled potential habitat. The Forest treats less than 0.01 percent (25 acres) of its land-base annually with retardants, but because the Canyon Grassland habitat (where the plant occurs) is prone to fire, according to the BA, *Silene spaldingii* habitat is expected to receive a disproportionate amount of retardant applications while the species is flowering and setting seed.

Given that (1) there are two populations of the plant on the Forest, (2) there is a 2,064 acres of modeled potential habitat, (3) the species is flowering and setting seed during the fire season, and (4) there is a high probability of fire and retardant drops in the Canyon Grasslands where the plant occurs, it is likely that some *Silene spaldingii* plants and their habitat will be exposed to effects of retardants. According to the BA, p 73, ~~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 placing undetected or undocumented populations at risk due to competition with non-native invasive plants..

#### ***Umatilla National Forest (2.3 million acres)***

One population of *Silene spaldingii* (12 site locations) is located on the Umatilla National Forest in T9N, R43E, Sections 13, 14, 15, 23, 24, and 32, within the Peola and Mackee Allotments. There are greater than 1,548 plants in this population on 60.4 acres. All suitable habitat has been surveyed. Fires will impact *Silene spaldingii* the most during the flowering and seeding period (late July to September) and during seedling and shoot emergence in early spring.

Given that (1) there is one population and 12 site locations of the plant on the Forest, (2) the species is flowering and setting seed during the fire season, and (3) the relatively high likelihood of fire and retardant drops (including intentional misapplications when it is unsafe to put responders on the ground) in the grasslands where the plant occurs than in other areas of the Forest, it is likely that some *Silene spaldingii* plants and their habitat will be exposed to effects of retardants resulting from a misapplication into the core of the mapped avoidance area.

#### ***Wallowa-Whitman National Forest (2.3 million acres)***

Within the Forest, *Silene spaldingii* is found on the Wallowa Plateau and Canyon Grasslands. The three populations (made up of eleven EO records) have shared ownership between the Forest Service and private landowners; therefore the area size and plant numbers associated with each ownership can only be approximated. Roughly 38 percent of the plants are found on Forest Service land (1,357 out of 3,502 plants). The EOs on Forest Service land total approximately 43.1 acres. While no populations have been found, habitat modeling predicts over 24,000 acres

of high probability habitat for *Silene spaldingii* in the Hells Canyon National Recreation Area. Fires will impact *Silene spaldingii* the most during the flowering and seeding period (late July to September) and during seedling and shoot emergence in early spring.

Given that (1) there are three populations and eleven occurrence site locations of the plant on the Forest for 43.1 total acres, (2) the species is flowering and setting seed during the fire season, and (3) there is a high probability of fire and retardant drops (including intentional misapplications when it is unsafe to put responders on the ground) in the grasslands where the plant occurs, it is likely that some *Silene spaldingii* plants and their habitat will be exposed to effects of retardants resulting from a misapplication into the core of the mapped avoidance area.

### ***Summary of Effects***

Invasive non-native plant species are an identified threat to populations of *Silene spaldingii* and increases in the abundance of non-native plants due to the fertilizer effect of retardant could exacerbate this threat. Some non-native plants (e.g., *Bromus diandrus*) have been shown to respond favorably to retardant applications due to the associated fertilizer effect. One population (12 site locations) and 60.4 acres of known habitat occur in the Canyon Grasslands on the Umatilla National Forest. Three populations (eleven site locations) and 43.1 acres of known habitat occur in the Wallowa Plateau and Canyon Grasslands on the Wallowa-Whitman National Forest. The Nez Perce National Forest has two populations and 2,064 acres of modeled habitat. Canyon Grasslands, where most of these populations occur, are susceptible to fire and are likely to be impacted by associated retardant drops resulting from a misapplication into the core of the mapped avoidance area.

Although a misapplication(s) may minimize the extent of fire within *Silene spaldingii* habitat as well as cause some other beneficial effects to the species due to the fertilizer in the retardant, adverse effects are likely to occur to *Silene spaldingii* due to the fertilizer effect of enhancing populations of invasive plant species within affected areas of habitat. When these factors are considered, the proposed action is likely to cause significant localized adverse effects to *Silene spaldingii* in terms of habitat loss and degradation due to increases in the abundance on non-native plant species that are not compatible with its local conservation needs, but also not expected to appreciably reduce the worldwide population.

## **CUMULATIVE EFFECTS**

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. We are not aware of any cumulative effects that would affect this species.

## CONCLUSION

After reviewing the current status of *Silene spaldingii*, the environmental baseline, the direct and indirect effects of fire retardant, and cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of *Silene spaldingii*. No critical habitat has been designated for *Silene spaldingii*; therefore, none will be affected.

The Service reached the no-jeopardy determination because, as proposed, occupied habitat will be mapped for avoidance and the effects of the action on the plant stem from the likelihood of misapplication of fire retardant onto the occupied habitat. As discussed in the *Silene spaldingii* (Spalding's Catchfly) 5-Year Review Summary and Evaluation (Fish and Wildlife Service 2007, [http://ecos.fws.gov/docs/recovery\\_plan/071012.pdf](http://ecos.fws.gov/docs/recovery_plan/071012.pdf)), the invasion of non-native species continues to be a major threat, which is exacerbated by wildfires and wildfire response. Retardant application, or misapplication, may act as a fertilizer and benefit the non-native invasive species. The effects of wildfires often result in adverse changes in the ecological conditions of the species habitat that can lead to the subsequent invasion of non-native plant species, or reduction of suitable habitat due to changes in the soil chemistry and disturbance.

Although we expect adverse effects, we do not anticipate the effects of the proposed action will appreciably reduce the likelihood of survival and recovery *Silene spaldingii*. The proposed project may result in localized adverse effects to *Silene spaldingii* by compounding changes in ecological conditions of occupied habitat; however, it is not anticipated to result in large changes in populations or element occurrences, because species occurrences will be mapped for avoidance of fire retardant use to protect the habitat and individual plants. In addition, although the habitat where the plant is found has a high potential for fire and the likelihood of fire retardant being used near plant occurrences is great, all three of the forests generally treat a small percentage of their total land base. It is unlikely that misapplication would occur across all occurrences of the plant, therefore the effects from the use of fire retardants will be localized, and so it is likely that only a small proportion of the extant occurrences will be impacted in terms of habitat loss and degradation over the next 10 years due to increases in the abundance on non-native plant species occurrences in the action area.

### **Warner sucker (*Catostomous warnerensis*)**

*Species Team Lead:* Alan Mauer, Bend Field Office; Ph. (541) 383-7146

#### Environmental Baseline

Occupied Warner sucker (*Catostomous warnerensis*) habitat is entirely downstream of the Fremont National Forest administrative boundary. Occupied habitat is located approximately five miles downstream of the Forest Service boundary on Honey Creek; 16 miles downstream on Deep Creek; nine miles downstream on Twentymile Creek, most of which is intermittent and not running water during the fire suppression times of year; and seven miles downstream on

Twelvemile Creek. Critical habitat is designated for Honey Creek, Twentymile Creek, and Twelvemile Creek which originate on National Forest Service lands, but is not designated within the Forest Service boundary. Designated critical habitat is located approximately two miles downstream of the Forest Service boundary on Honey Creek, one mile downstream on Twentymile Creek, seven miles of which is intermittent, and eight miles downstream on Twelvemile Creek. There is no designated critical habitat on Deep Creek. See Table 20.

**Table 20. Approximate distances from Forest Service boundary to occupied Warner sucker habitat and designated critical habitat.**

Distance from Forest Service administrative boundary	Honey Creek	Deep Creek	Twentymile Creek	Twelvemile Creek
to occupied Warner sucker habitat	5 miles	16 miles	9 miles	7 miles
to designated critical habitat	2 miles	NA	1 mile	8 miles

Forest Service activities have previously been identified as affecting Warner sucker. Prior to management changes and reduction of cattle grazing utilization in the watersheds affecting Warner sucker, the Forest Service had identified cattle grazing as a potential affect to Warner sucker due to indirect downstream affects. After 10 years of management changes and enforcement of compliance standards on the grazing allotments, the Forest Service determined in 2007 that the allotments were no longer likely to adversely affect Warner sucker occupying downstream habitats. The Service concurred with the Forest Service determination that the allotments may affect and are not likely to adversely affect Warner sucker with a letter on May 10, 2007.

During an emergency fire response to wildfire in 2004, a retardant drop occurred in Honey Creek. The retardant entered directly into the stream and is estimated to have killed approximately 160 fish. The effects from the retardant were noted to have impacted the fish for approximately 0.5 mile downstream from the retardant drop location. At the 0.5 mile point live and apparently healthy fish were observed. None of the dead fish observed were Warner suckers, as all habitat for Warner sucker is further downstream of the Forest Service boundary.

## **EFFECTS OF THE ACTION**

## ASSUMPTIONS AND SPECIES CONSERVATION MEASURES

The following assumptions and findings were included as part of the project description related to the Warner sucker and its designated critical habitat in the biological assessment:

- Determinations are made range wide for the species and designated critical habitat.
- The probability for fire retardant misapplications is 0.42% if there is only a single application on any Forest.
- The current frequency of misapplications is rare and at the extreme ends of their respective curves.
- Based on the data available, the assumption is that all drops within the 300-foot buffer will enter waterways and affect aquatic species.
- Any species where any retardant has been used within the past 10 years would have a “Likely to Adversely Affect” determination for those species.
- Any misapplications that result in the introduction of retardants to occupied habitat of any listed species is likely to result in a “take” of that listed species.
- If the species or designated critical habitat has a very low likelihood of occurring on any national forest/grassland, then the determination is Not Likely to Adversely Affect (NLAA).
- The current data for misapplications does not support the assumption that a larger buffer will be more protective than the current 300-foot buffer on waterways. In the same way that if we wait 100 years, we are not guaranteed to encounter a 100 year flood event, if the buffer size were expanded from 300 feet to 600 feet, we would not be able to anticipate a linear reduction in the intrusion rate.
- When fire retardant enters waterways and aquatic populations are present, there will be adverse effects to those populations.
- Many of our listed species have small isolated populations and if a retardant misapplication occurs it could have significant effects on the species and habitat.
- Because the effects to the species would also affect the habitat, the determinations where a species has designated critical habitat mirror the determinations made for the species.

No conservation measures specific to the Warner sucker are identified in the Forest Service’s biological assessment.

## FREMONT NATIONAL FOREST

### **Location: Spatial extent of retardant compared to species distribution in the Forest**

Retardant may be applied on any portion of the Forest during a fire suppression effort. All Warner sucker occupied habitat is located outside the Forest Service boundary. The closest occupied habitat is on Honey Creek approximately five miles downstream of the Forest Service administrative boundary. The occupied habitat in Deep Creek, Twentymile Creek, and Twelvemile Creek is far enough downstream (16, nine, and seven miles respectively) that no effect to Warner sucker would be likely from application of fire retardant on National Forest Service lands within those watersheds.

### **Timing: Species life-cycle activity during fire season and times of retardant drops**

Warner sucker are present in reaches of streams downstream of the Forest Service administrative boundary. During the summer months when fire retardant application is most likely, larval, juvenile, and adult stages of life history are present. Warner sucker spawning occurs in the early spring with eggs maturing to larval stage prior to approximately mid-June, depending on factors affecting egg development. It is unlikely there would be retardant drops before mid-June and therefore impacts to egg or early larval stage suckers are not likely to occur as a result of fire retardant application. Additionally, approximately eight miles of Twentymile Creek closest to the Forest Service boundary are intermittent and expected to be dry by mid-June.

### **Likelihood of exposure to retardant**

#### *Typical application*

Exposure of Warner sucker to retardant is not likely when retardant is applied as planned using a 300 foot protective buffer on streams. Tests using 1,000 gallons of fire retardant were applied across four streams in Idaho, Oregon and California. Results indicated no immediate increase in  $\text{NH}_3$  concentrations where retardant was applied parallel to a stream (Norris et al 1978 in Forest Service 2011). Retardant that was applied to the ground on either side of the streams was effectively mitigated by untreated strips of ground as narrow as three meters wide from the stream banks and contributed little or not at all to the streams (Norris et.al. 1978 in Forest Service 2011).

Assuming the results from the experiment discussed above, a maximum concentration of 0.32 mg/L reduced to three percent concentration, 2,600 feet downstream, the concentration of  $\text{NH}_3$  would be less than 0.01 mg/L with a three meter buffer. A full mile or more downstream the concentration would also be unlikely. The Forest Service determined that little affect can be observed with as little as three meter buffer based on several studies by Norris (Forest Service 2011). Application as proposed would require a 300 foot buffer which further decreases the likelihood of exposure of Warner sucker to affects from retardant application. There is likely to



be no effect to occupied habitat or designated critical habitat downstream of the Forest Service boundary and the application point.

Surface run-off occurring after the fire retardant is applied to the ground outside the 300-foot waterway buffer may be carried into a waterway by stormwater runoff. Retardant applied outside the 300-foot waterway buffer may have adverse effects to aquatic organisms; however, the level of toxicity depends on the surface or soil type (rock, sand, soils with high or low organic matter, etc.); persistence in the environment; timing of a rainfall event; and the amount of retardant on the ground (Norris et al 1978; 1991). Affects from fire retardant applied outside the 300 foot buffer are not likely.

### **Misapplication effects**

The Forest Service estimates that based on three years of misapplication data in aquatic habitats there is a 0.42 percent chance of application to water or within a 300 foot stream side buffer. The Forest Service analysis assumes that if a Forest has more than one retardant application per year then the chance of misapplication is greater than 0.1 percent and does not meet the threshold for a Not Likely to Adversely Affect determination and therefore determined the proposed action is likely to adversely affect Warner sucker (Forest Service 2011).

The LC50 levels for rainbow trout (likely to be similar for Warner sucker based on fish body size and similar respiratory system) for retardants being considered in this consultation ranges from a low of 94 mg/L to 280 mg/L depending on the product and the water chemistry (Forest Service 2011). Concentrations of retardant one mile or greater from the point of application is likely to be far lower than the effects described above and below the LC 50 level. It is difficult to predict actual effects much less mortality of fish exposed to low levels of fire retardant especially under such unlikely probability of exposure downstream of the Forest Service boundary. Therefore, the likelihood of adverse effects to Warner sucker from retardant would depend on the amount of retardant applied directly to the stream and are likely to be very low.

Additional results of tests using 1,000 gallons of fire retardant to streams (see discussion above) applied directly into water showed maximum concentrations of un-ionized ammonia ranging from 0.02 to 0.32 mg/L, approximately 150 feet downstream from the application point at time intervals between two and 22 minutes after application (Norris et.al. 1978 in Forest Service 2011). Time to dilution to one percent of maximum concentration, at 150 feet downstream, ranged between 10 minutes to almost four hours. Sampling over all the sites at various time intervals from 10 minutes to four hours after application showed a reduction in concentration from four to 29 percent at 650 feet downstream of the application points, and one to three percent at 2,600 feet downstream. The differences in concentrations were due to factors of velocity and mixing turbulence of the stream flows.

In addition to the test results discussed above, simulations run by Norris and Webb (1989 in Forest Service 2011) showed ammonia concentrations could remain at lethal levels between 0 and 6.2 miles downstream, depending on stream characteristics and the size of the retardant load. Van Meter and Hardy (1975 in Forest Service 2011) also found that concentrations of retardant high enough to kill 10 percent of the fish population were measurable more than four miles downstream. Such high concentrations are not likely to occur when retardant is applied with a 300 foot buffer to waterways, but may occur in the case of misapplication.

–Buhl and Hamilton (1998 in Forest Service 2011) showed that when 267 gallons of fire retardant, a relatively small amount, enters a stream, the ammonia concentration reaches 5,026 mg/l. At such extreme levels, mortality would be nearly immediate, but downstream as the plume is diluted, longer exposure to LC50 levels described above can be lethal. Buhl and Hamilton (1998) cited in Forest Service (2011) provide a case study of a 1995 Fire-Trol LCG-F misapplication in which 23,000 fish were killed, and although the retardant contained sodium ferrocyanide, the cause of mortality was determined to be ammonia concentrations. Their research concluded that fire retardant misapplications have biologically significant effects to aquatic communities” (Forest Service 2011).

Forest Service biological assessment (2011) states that the potential for affects extends downstream up to 6.2 miles of downstream effect of retardant applied to streams and described by Norris and Webb (1989 in Forest Service 2011) as a “worst case scenario” in the case of misapplication to streams. The effects to occupied Warner sucker habitat may extend downstream of the Forest Service boundary within Honey Creek. Warner sucker occupied habitat is five miles downstream of the Forest Service boundary, so we expect 1.2 miles of occupied habitat to be adversely affected if a misapplication to Honey creek occurs. All other occupied stream habitat is greater than 6.2 miles from the Forest Service boundary, so adverse effects to Warner sucker on Deep Creek, Twentymile Creek, and Twelvemile Creek are not likely.

The primary factor which would determine whether Warner sucker would be exposed to toxic fire retardant is the Warner sucker’s exposure to contaminated water. Direct application of fire retardant onto the stream surface would be expected to be the primary source of contamination in streams occupied by Warner sucker. If fire retardant were applied on National Forest System lands upstream of occupied habitat, the resulting toxic chemical dissolved in water would need to be in high enough concentration to persist in the water long enough to reach the occupied habitat. The buffer prescribed by the guidelines in the biological assessment would prevent, under normal circumstances, the introduction of fire retardant into streams on Forest Service lands.

Fire retardant is toxic to aquatic organisms including Warner sucker. Fire retardant is soluble in water and therefore may be transported downstream of the fire retardant application location, causing the flowing contaminated water to be toxic to fish including Warner sucker. With the 300 foot buffer prescribed by the guidelines, the probability of a fire retardant drop application actually being applied to a waterbody is reasonably lessened. If the Guidelines are implemented

as intended, the 300 foot buffer would prevent toxic material from entering the streams on Forest Service lands and therefore would not result in retardant reaching occupied Warner sucker habitat.

In addition, Little and Calfee (2002) found that rainbow trout avoided fire retardant at concentrations from one to 10 percent of the LC50. The salinity of the solution appears to have been the sensory cue fish responded to when exposed to fire chemicals. The results indicate that if fish have an avenue of escape, they can limit exposure by avoiding areas of the water column where fire chemicals are present. Therefore we may expect volitional avoidance of fire retardant by Warner suckers to further reduce the potential for exposure to toxic effects from misapplication of fire retardant.

The main cause of impact to the reproduction, numbers, and distribution of Warner sucker from fire retardant would be due to toxic effects of direct application to streams with occupied habitat downstream. Ammonia concentrations as low as 0.3 mg/L were lethal to trout and 75 mg/L were extremely lethal to mature trout (Norris et al. 1991). Concentrations predicted to result from misapplication of fire retardant ranges from 94 mg/L to 280 mg/L (see discussion above). Translation of application of fire retardant related to downstream concentrations and resulting affects to Warner sucker is difficult to predict. It is possible for lethal and sub-lethal concentrations to reach occupied Warner sucker habitat downstream of the Forest Service boundary on Honey Creek based on the effects discussed by the Forest Service (2011). The reach of habitat likely to be affected (Forest Service 2011) is estimated to have a density of 1 to 50 Warner suckers per kilometer (Scheerer et al. 2011). Based on that density, 2 to 96 Warner suckers occupying 1.2 miles of habitat along Honey Creek downstream of the Forest Service boundary are likely to be killed or injured by one misapplication of fire retardant on Honey Creek. The Forest Service predicts that one such misapplication is likely to occur during the term of the proposed action.

The estimated population size of the Warner sucker in Honey Creek in 2009 was 4,612 (95% CI: 3,820-5,567) Warner suckers greater than or equal to 60 milometers in length (Scheerer 2011). The death or injury as many as 96 individuals (two percent of the estimated population) in the 1.2 miles of stream affected by a misapplication would adversely affect the upper limit of the Warner sucker's distribution in Honey Creek, but given the known information about Warner sucker fecundity and reproduction, such an impact to the population is likely to result in minor impacts to reproduction in the overall species' population.

### Critical Habitat

All Warner sucker designated critical habitat is located one to eight miles downstream of the Forest Service boundary. Affects to designated critical habitat within 6.2 miles of the Forest Service boundary are likely to be minimal. The designated critical habitat on Honey Creek is approximately two miles downstream of the Forest Service boundary. Misapplication of fire

retardant may affect the critical habitat and constituent elements of a predicted 4.2 miles (three miles of which is un-occupied) of designated critical habitat on Honey Creek.

Twentymile Creek contains nine miles of designated critical habitat. The designated critical habitat within the 6.2 miles of the Forest Service boundary on Twentymile Creek is an intermittent stream and is not likely to be flowing during the fire suppression time of the year. Misapplication of fire retardant is not likely to adversely affect the designated critical habitat and constituent elements of a predicted 5.2 miles of designated critical habitat on Twentymile Creek. It is also likely that since the stream would be intermittent and would not likely flow significant water until the following spring runoff, the impacts from the retardant would have abated over time and not result in measurable impacts to Warner sucker designated critical habitat.

The designated critical habitat on Twelvemile Creek is approximately eight miles downstream of the Forest boundary. Misapplication of fire retardant to Twelvemile Creek is not likely to adversely affect the critical habitat and constituent elements greater than 6.2 miles from the Forest Service boundary. No critical habitat has been designated for Deep Creek.

### **Toxicity of fire retardant to various life stages**

Toxicity of fire retardant to various life stages is not likely to be variable between life history stages. Since no eggs, embryos, or early larval stages are likely to be present during the fire suppression period, exposure is most likely to only affect the juvenile and adult life stages. Additional affects are discussed in the above section.

### **For critical habitat effects, percentage affected compared to overall CH**

Designated critical habitat extends to within approximately one mile of the Forest boundary so there are likely to be effects to a total of 9.4 miles of designated critical habitat located outside the Forest Service boundary. A total of 43 miles of critical habitat has been designated for the Warner sucker (Fish and Wildlife Service 1985). Although unlikely, a total of 21.9 percent of designated Warner sucker critical habitat may be affected by the proposed action.

### **Loss or degradation of habitat (CH) from invasive non-native plants due of retardant fertilizer effect**

Fertilizer affect is expected to be minimal due to the low concentrations of retardant transmitted to occupied and designated critical habitat downstream of the Forest Service administrative boundary.

## CONCLUSION

### WARNER SUCKER

After reviewing the current status of the Warner sucker, the environmental baseline, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed aerial application of fire retardant on National Forest Service System land is not likely to jeopardize the continued existence of the Warner sucker. Warner sucker-occupied habitat is located entirely off of and downstream from Forest Service-administered lands. The likelihood of sucker exposure to retardant from application on Forest Service lands is low and the likelihood of adverse effects from retardant being transported downstream within occupied habitat is even less. No significant effects to the Warner sucker from interrelated or interdependent actions are expected to occur. No cumulative effects to the Warner sucker are anticipated to occur during the term of the proposed Project.

### WARNER SUCKER CRITICAL HABITAT

After reviewing the current status of Warner sucker critical habitat, the environmental baseline, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed aerial application of fire retardant on National Forest Service System land is not likely to destroy or adversely modify Warner sucker critical habitat.

Only one (mis)application of retardant is expected to occur within a small portion of Warner sucker critical habitat during the term of the proposed action. During the period when fire retardant application is likely to occur, intermittent stream flow conditions are usually present within two of the three creeks in the action area containing Warner sucker critical habitat. Any toxic concentrations of ammonia caused by a misapplication of retardant would be localized and temporarily degrade water quality, but such concentrations are likely to dissipate under flowing water conditions. On that basis, only a one-time temporary effect to PCEs is anticipated to occur within a small portion of Warner sucker critical habitat. No significant effects to critical habitat are anticipated from interrelated or interdependent actions, and no cumulative effects to critical habitat are anticipated to occur during the term of the proposed Project. For these reasons, Warner sucker critical habitat is likely to provide its intended conservation role for the Warner sucker with implementation of the proposed action.

### *Species Recovery*

Although we expect adverse effects, we do not anticipate the effects of the proposed action will appreciably reduce the likelihood of survival and implementation of the recovery plan for Warner sucker from application of fire retardant. Since the listing of Warner sucker as threatened in 1985 several activities contributing to the recovery of Warner sucker have occurred:

*Cattle grazing consultations.* The BLM Lakeview Resource Area has completed numerous consultations on BLM actions affecting Warner sucker. In 1994, Lakeview Resource Area determined that ongoing site-specific livestock grazing actions were likely to adversely affect Warner sucker in the Warner Valley Watersheds and has, to date, consulted under recurring biological opinions with the Service. Present grazing prescriptions and monitoring protocols are in accordance with biological opinions issued by the Service, and results of grazing monitoring appear annually in reports to the Service. Consultation for Lakeview Resource Area's grazing activities has been reinitiated due to changes in the action, changes due to new information, and to comply with terms and conditions of the biological opinions.

*Fish passage improvements.* In 1991, BLM installed a modified steep-pass Denial fish passage facility on the Dyke diversion on lower Twentymile Creek. The fishway is intended to re-establish a migration corridor, and allow access to high quality spawning and rearing habitats. The Dyke diversion structure is a four foot high irrigation diversion that was impassable to Warner sucker and redband trout before the fishway was installed. It blocked all migration of fishes from the lower Twentymile Creek, Twentymile Slough and Greaser Reservoir populations from moving upstream to spawning or other habitats above the structure. To date, no suckers have been observed or captured passing the structure, but redband trout have been observed and captured in upstream migrant traps.

An evaluation of fish passage alternatives has been done for diversions on Honey Creek which identifies the eight dams and diversions on the lower part of the creek that are barriers to fish migration (Campbell-Craven Environmental Consultants 1994). In May 1994, a fish passage structure was tested on Honey Creek. It consisted of a removable fishway and screen. The ladder immediately provided passage for a small redband trout. The structure was removed by ODFW shortly after their installation due to design flaws that did not pass allocated water.

*Warner sucker research.* Research through 1989 summarized in Williams et al. (1990) consisted of small scale surveys of known populations. Williams et al. (1990) primarily tried to document spawning and recruitment of the Hart Lake population, define the distributional limits of the Warner sucker in the streams, and lay the groundwork for further studies.

White et al. (1990) conducted trap net surveys of the Anderson Lake, Hart Lake, Crump Lake, Pelican Lake, Greaser Reservoir, and Twentymile Slough populations. Lake spawning activity was observed in Hart Lake, though no evidence of successful recruitment was found. White et al. (1991) documented the presence of suckers in the Nevada reach of Twelvemile Creek. This area had been described as apparently suitable habitat by Williams et al. (1990), but suckers had not previously been recorded there.

Kennedy and North (1993) and Kennedy and Olsen (1994) studied sucker larvae drift behavior and distribution in streams in an attempt to understand why recruitment had been low or nonexistent for the lake morphs in previous years. They found that larvae did not show a



tendency to drift downstream and theorized that rearing habitat in the creeks may be vital to later recruitment.

Tait and Mulkey (1993a,b) investigated factors limiting the distribution and abundance of Warner sucker in streams above the man-made stream barriers. The detrimental effects of these barriers are well-known, but there may be other less obvious factors that are also affecting the suckers in streams. These studies found that general summertime stream conditions, particularly water temperature and flows, were poor for most fish species. Subsequent studies concentrated on population estimates, marking fish from Hart Lake and monitoring the recolonization of the lakes by native and non-native fishes (Allen et al. 1995a,b, Allen et al. 1996).

ODFW has conducted investigations of Warner sucker life history 2006 through 2011 (Scheerer et al. 2006; Scheerer et al. 2007; Scheerer et al. 2008; Richardson et al. 2010; and Scheerer et al. 2011). Additional observations on distribution, population estimates and life history information have been gathered and summarized in annual reports.

## **Region 2 Desert Southwest: Arizona, New Mexico, Oklahoma, and Texas**

*Lead for twenty (20) Species Total*

### **Apache trout (*Oncorhynchus apache*)**

#### Environmental Baseline

Apache trout are located on two National Forests' (NF) identified as Apache-Sitgreaves (ASNF) and Kaibab (KNF). Table 21 below identifies the number of Apache trout populations known to occur on Forest Service lands. Apache trout are also found on the Fort Apache Indian Reservation (FAIR) but this consultation will only focus on proposed actions identified on Forest Service lands. An estimated, 32 pure Apache trout populations exist within historical range in Gila, Apache, and Greenlee counties of Arizona, on lands of the FAIR and ASNF. A total of 19 populations occur in two National Forest; Coleman Creek on the ASNF and North Canyon Creek on the KNF are outside of the historical range of Apache trout but are still occupied. The 16 populations (within historical range) on ASNF are in various stages of recovery. The on-going maintenance of artificial barriers, chemical and mechanical removal of non-native trout's, and restocking of pure Apache trout in some of the existing recovery populations continue to occur on the ASNF. Recently the 2011 Wallow Fire impacted several Apache trout populations on the ASNF and at least one population of Apache trout may have been lost as a result of the 2011 fire season (Service field notes). Before the onset of the Wallow Fire, Apache trout were well on their way to achieving recovery goals of at least 30 self-sustaining populations in approximately 275 kilometers (km) (171 miles) of secured stream habitat. All Apache trout populations on the ASNF are located within the Wallow Fire perimeter. The full level of impacts is unknown and have not been evaluated at this time; however, we do know that 13 of the 14 natural populations were unaffected by the fire.



### Effects of the Action

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for a ten year period. The BA includes measures that are incorporated in the proposed action that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed threatened, endangered or proposed terrestrial plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and/or populations.

The BA includes in the proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to Apache trout. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 in the BA includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, and/or surface run-off and leaching. The BA states that ~~any~~ forest with more than one retardant drop over the last 10 years would have a ~~Likely to Adversely Affect~~ "determination for those species and designated critical habitat that occur there." And the Forest Service ~~assumes~~ that all drops within the 300 foot buffer will enter waterways and affect aquatic species."

The BA identifies the average number of retardant drops by National Forests' in Table B-4. This table shows that all National Forests' where Apache trout occur have at least one retardant drop over the last 10-years; therefore, we consider the effects of fire retardant application to Apache trout occupied habitat.

### Effects Discussion

Adverse effects of fire retardant products to aquatic species (fish and invertebrates) are discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels. Other components of the fire retardant product may also have toxic effects.

The programmatic nature of this consultation includes predictions on human error rates (misapplication), estimates of variables such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped (between 799 and 3,000 gallons/drop), and then estimate a set of operational and environmental factors such as the height and speed of the aircraft, terrain, habitat type, and width of the stream at the time of the

retardant drop. Because of the unknown variables associated with future fire retardant drops, we use the best available information provided in the BA to support our discussion and effects determination for Apache trout.

We used the information provided in Table ABA-5 and B-4 (from the BA) to support our conclusions for misapplications on Forest Service land over the next 10-years (Table 21). We applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands (i.e.  $390 \div 11 \times 10 = 354.5$ , and  $354.5 \times .0042 = 1.48$  drops or 2 when rounded up) and then calculated the extent of stream miles where adverse effects to Apache trout are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years.

**Table 21. Number of Anticipated Drops on Forest Service land over the next 10-years.**

<b>National Forest</b>	<b>Total Number of Drops 2000-2010</b>	<b>Apache trout Populations By Forest</b>	<b>Number of Anticipated Drops</b>	<b>Extent of Stream Miles (6.2miles/drop)</b>
ASNF	355	18	2	12.4
KNF	163	1	1	6.2

Based on the calculations in Table 21, we anticipate three retardant drops will occur over the next 10 years affecting Apache trout in approximately 18.6 stream miles. Because all drops that occur within the 300 foot buffer are assumed to enter waterways; Apache trout are likely to be adversely affected by introduced retardants. We believe adverse effects to individuals and/or populations will occur from the application of retardants on USFS lands.

Considering the toxicity studies of Phos-Chek to algae and benthic macroinvertebrates were shown to have adverse effects to primary producers and aquatic invertebrates (MacDonald et al. 1995), and the toxicity of field applications are higher than the lab studies (for accidental retardant delivery); the application of retardants to Apache trout habitat will likely alter the biodiversity and trophic dynamics in the stream and will result in short term adverse effects to the food source for Apache trout.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the Apache trout, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service’s biological

opinion that the proposed action is not likely to jeopardize the continued existence of the Apache trout, and is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

1. There are approximately 19 Apache trout populations that exist beyond USFS lands; therefore, adverse effects to the species on USFS lands will not preclude recovery and survival of the species.
2. The environmental persistence of the chemicals identified in the BA will cause short-term adverse effects to the aquatic food source for Apache trout; however, the effects will dissipate over time and will not render the affected area unsuitable for Apache trout establishment in the future.

### **Canelo Hills ladies' tresses (*Spiranthes delitescens*)**

#### Environmental Baseline

Canelo Hills ladies' tresses (CHLT) occurs on finely grained, highly organic, saturated soils of cienegas and are intermixed with tall grasses and sedges at an elevation of approximately 1,524 m (5,000 ft) on the Coronado National Forest (Cor. NF) where 1,429 retardant drops were applied between 2000 and 2010 (Table B-4, BA).

CHLT is a species sensitive to interspecific competition, requiring both ample light penetration and little competition for nutrients (Newman 1991, p. 7). Fire retardant may act as a fertilizer (USFS 2011, p. 30, 32), thus increasing the size or vigor of existing competing vegetation within CHLT habitat. Any increase in competing plant species could result in a negative impact to CHLT. Researchers at the Canelo Hills CHLT populations report competition with native (horsetail and spikerush at Canelo Hills Cienega [Newman 1991, p. 7]) and non-native (Johnsongrass at Canelo Hills Cienega [Newman 1991, p. 7]) plants. In addition, Fishbein and Gori (1992, p. 4) report the dominance of spikerush, Kentucky bluegrass, and sedge at Canelo Hills Cienega, all of which could easily compete with CHLT. These species very likely also co-occur with CHLT on Forest Service administered land near the Canelo Hills Cienega.

CHLT requires some level of disturbance to reduce competition periodically. Many species of *Spiranthes* are found in habitats that are grazed, mowed, or are otherwise disturbed (McClaran and Sundt 1992, p. 302). In addition to periodic flooding, soil churning from moderate levels of grazing may have played an important role in southwestern cienegas over the past 10,000 years, initially from grazing by mammoth, ground sloth, bison, camelid species, deer, and antelope (Gori 1994, p. 3, Stromberg 1993, p. 21), followed by cattle and horses in the last 500 years (Gori 1994, p. 4).

Fire itself may play a role in reducing interspecific competition in cienega habitat (Newman 1991, p. 7). In recent centuries, disturbance from fire in southwestern cienegas is thought to have occurred about every 38 years, being highly correlated with El Nino winter precipitation followed by La Nina drying periods (Brunelle et al. 2010, p. 479). The El Nino events

encourage fine fuel growth and connectivity, while the La Nina events enable surface fires from surrounding grasslands to burn lightly through cienegas and remove fine fuels (A. Brunelle, pers. comm., August 16, 2011). Early in the season, fires benefit CHLT by removing competing vegetation prior to CHLT emergence, while fires in July or August, the period when the plant is aboveground, may negatively impact CHLT (Gori and Backer 1999, p. 1). Fires occur naturally in many wetlands only during drought years (Schmalzer and Hinkle 1992, p. 8), as is the case in the cienegas containing CHLT (Mima Falk, Service, pers. comm., August 5, 2011).

#### Effects of the Action

The National Fire Retardant Biological Assessment (BA) states that “any forest with more than one retardant drop over the last 10 years would have a “Likely to Adversely Affect” determination for those species and designated critical habitat that occur there.” We recognize the benefits from preventing the spread of catastrophic fire are greater than the negative impacts of fire retardant application for CHLT. Catastrophic fire in the landscapes surrounding CHLT cienega habitat may lead to scouring floods and loss of habitat, plant populations, and seed banks in the event of heavy post-fire rainfall on barren landscapes.

Actions described within the BA refer to effects from aerial delivery of fire retardant for a ten year period. The BA includes measures intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed threatened, endangered or proposed terrestrial plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and/or populations.

The proposed action includes guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to CHLT. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, and/or surface run-off and leaching.

Fire retardant may increase herbaceous vegetation growth which could out-compete CHLT. CHLT is a poor competitor; low to moderate levels of disturbance are required to remove competing native or non-native vegetation. USFWS (2008, p. 28) states, “there are no invasive plants in the area that are likely to increase with retardant use”, but this has been found to not be an accurate assessment of the situation. Researchers at other CHLT populations report competition with native and non-native plants. It is unlikely that none of these plants co-occur with CHLT on Cor. NF lands or that none of these species would be enhanced with the addition of fertilizer from fire retardant application.

Because CHLT requires saturated soils associated with cienegas all occupied sites on USFS land will require a 300 foot waterway buffer. Because the CLHT is limited in distribution, USFS Region 3 documented the need to highlight areas occupied by CLHT through additional avoidance mapping buffers identified in the BA. Email records between USFWS Region 2 and USFS Region 3 (May 9 and 12, 2011) provide documentation and concurrence from USFWS with the Fire Retardant Avoidance Mapping justifications. We understand these avoidance mapping requirements are specific to USFS Region 3's listed threatened and endangered species (including designated critical habitat) and will be incorporated in the in the final BA. We also understand these maps are not available at this time for our review; however, local coordination between USFWS and USFS is required annually to ensure that "any updates that are needed for retardant avoidance areas on National Forest System lands are mapped using the most up-to-date information" (page 4, August 2011 BA).

Direct effects of fire retardant on plant species and their habitats are not well understood, but can include foliar damage or death, alterations in species composition, and either reductions or increases in plant size and vigor (USFS 2011, p. 29-30, 32). It is unknown how fire retardant will directly impact CHLT individuals should retardant with high salt content contact plants directly. In general, it is thought that impacts are transitory (USFS 2011, p. 30); however, should rhizomatous perennial native or non-native plants increase in abundance from nutrient pulses, CHLT may be out-competed.

#### Cumulative Effects

There are just five known populations of CHLT, all within a 24 x 5 mile area of the San Pedro River watershed and within wetlands totaling less than 200 acres in size (USFWS 1997, p. 666). The Canelo Hills Preserve and Forest Service populations are in very close proximity to one another along O'Donnell Creek, therefore an aerial retardant drop on the Coronado could impact both populations. Of the five known populations of CHLT, these two are the smallest. Possible land management activities on non-Forest lands near the remaining three CHLT populations are many, though impacts will not likely be enhanced by an inadvertent fire retardant drop on nearby National Forest lands, as retardant concentration is expected to dilute downstream.

#### Conclusion

After reviewing the current status of CHLT, the environmental baseline for the action area, the effects of the proposed fire retardant use, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the CHLT. No critical habitat has been designated for this species; therefore, none will be affected. We base this no jeopardy conclusion on the following:

- The species will be avoidance mapped and only inadvertent drops or application from an exception to the proposed action would occur.
- Three of the five populations of this species, all of which occur on non-Forest lands, will not likely be impacted by inadvertent drops or application from an exception to the proposed action.
- The overall benefit of preventing the complete loss of populations and their seed banks from scouring post-fire floods outweighs competition impacts to populations with in-tact seed banks that could respond if competition is later reduced.

## **Chihuahua Chub (*Gila nigrescens*)**

### Environmental Baseline

Currently the Chihuahua chub is found in the U.S. only in the Mimbres River, Grant County, New Mexico. The Mimbres River has its origins on the Gila National Forest. Most of the extant Chihuahua chub populations occur on private lands downstream from Forest Service lands. Chub were stocked into McKnight Creek on Forest Service lands in 1992 and 1998 however, there was no evidence of reproduction, and the habitat was considered marginal because of very low flows. Subsequent surveys in McKnight Creek have not found Chihuahua chub (Forest Service 2011). In 2008 and 2009, Chihuahua chub were discovered near Cooney's Place on the Mimbres River in the Gila National Forest (Monzingo 2009). The Mimbres River is typically intermittent between Cooney's Place and the National Forest boundary. No critical habitat is designated for the Chihuahua chub.

### Effects of the Action

Fire retardant applications in the Gila National Forest are likely to affect the Mimbres River watershed especially the Cooney's Place area population of Chihuahua chub. Chihuahua chub populations on private lands below the Gila National Forest may be affected by fire retardant runoff; though the intermittent nature of the Mimbres River, and distance from Forest Service lands make the risk low.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the Chihuahua chub, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is may affect and is likely to adversely affect the continued existence of the Chihuahua chub. No critical habitat has been designated for the species, thus, none would be affected. We base these conclusions on the following:

1. Only a small number of Chihuahua chub occur on Forest Service lands.
2. Distance from Forest Service lands and the intermittent nature of the Mimbres River limits impacts to the remaining downstream Chihuahua chub populations.

No critical habitat is designated for the Chihuahua chub; therefore, none will be affected.

## **Chiricahua Leopard Frog (*Lithobates chiricahuensis*)**



The following discussion includes baseline information and effects analysis for Chiricahua leopard frog and its proposed critical habitat in Arizona and New Mexico.

#### Environmental Baseline

The Chiricahua leopard frog inhabits cienegas, springs, pools, livestock tanks, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet in central/southeastern Arizona and west-central/southwestern New Mexico, a region where wildfires are common and fire suppression activity is expected to occur. The Chiricahua leopard frog has proposed critical habitat designated on Federal lands (48% of all proposed) and 29 percent of all proposed critical habitat occurs on five Forests in Region 3: Coronado, Gila, Tonto, Coconino, and Apache-Sitgreaves (A-S) national forests. Fifty-two percent of all proposed critical habitat on Forest Service lands occurs on the Coronado National Forest (13 units, 1687.6 acres). Twenty-six percent of all proposed critical habitat on Forest Service lands occurs on the Gila National Forest (eight units, 839 acres). Thirteen percent of all proposed critical habitat on Forest Service lands occurs on the Tonto National Forest (eight units, 417 acres). Seven percent of all proposed critical habitat on Forest Service lands occurs on the Coconino National Forest (one unit, 232 acres). Three percent of all proposed critical habitat on Forest Service lands occurs on the A-S National Forest (five units, 96 acres). In total, 3271.6 acres of proposed critical habitat occurs on these five National Forests and the majority of these units are represented by populations occupying stock tanks.

In this discussion, we address the effects of anticipated climate change on the size, frequency, and behavior of wildfire in the future of the southwest. These factors affect the degree and need for wildfire suppression activities and therefore the use of fire retardant on the landscape. Several climate-related trends have been detected since the 1970s in the southwestern United States including increases in surface temperatures, rainfall intensity, drought, heat waves, extreme high temperatures, average low temperatures (Overpeck 2008). Annual precipitation amounts in the southwestern United States may decrease by 10 percent by the year 2100 (Overpeck 2008). Seager et al. (2007, pp. 1181-1184) analyzed 19 different computer models of differing variables to estimate the future climatology of the southwestern United States and northern Mexico in response to predictions of changing climatic patterns. All but 1 of the 19 models predicted a drying trend within the southwest; one predicted a trend toward a wetter climate (Seager et al. 2007, p. 1181). A total of 49 projections were created using the 19 models and all but 3 predicted a shift to increasing aridity (dryness) in the Southwest as early as 2021-2040 (Seager, et al. 2007, p. 1181). The Chiricahua leopard frog depends on permanent or nearly permanent water for survival.

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



Drought stress and a subsequent high degree of tree mortality from bark beetles make high-elevation forests more susceptible to unnaturally intense wildfires. Climate is a top-down factor which synchronizes with fuel loads which is a bottom-up factor; combined, these factors correlate to supporting larger, more frequent, and more severe wildfires in the southwestern United States, influenced by a predicted reduction in snowpack and an earlier snowmelt (Fulé 2010). Wildfires are expected to reduce vegetative cover and result in greater soil erosion from increased droplet splash-erosion and reduced infiltration capacity, subsequently resulting in increased sediment flows in streams (Fulé 2010). Increases in the number and severity of wildfires on the landscape is likely to translate into more suppression activities and therefore more use of retardants, and potentially a greater area affected by misapplication.

### Critical Habitat

There are 35 units proposed as critical habitat for the Chiricahua leopard frog on Forest Service lands. Primary constituent elements for Chiricahua leopard frog proposed critical habitat are:

(1) Aquatic breeding habitat and immediately adjacent uplands exhibiting the following characteristics:

(a) Perennial (water present during all seasons of the year) or nearly perennial pools or ponds at least 6.0 ft (1.8 m) in diameter and 20 in (0.5 m) in depth;

(b) Wet in most years, and do not or only very rarely dry for more than a month;

(c) pH greater than or equal to 5.6;

(d) Salinity less than 5 parts per thousand;

(e) Pollutants absent or minimally present at low enough levels that they are barely detectable;

(f) Emergent and or submerged vegetation, root masses, undercut banks, fractured rock substrates, or some combination thereof; but emergent vegetation does not completely cover the surface of water bodies;

(g) Nonnative crayfish, predatory fishes, bullfrogs, barred tiger salamanders, and other introduced predators absent or occurring at levels that do not preclude presence of the Chiricahua leopard frog;

(h) Absence of chytridiomycosis, or if chytridiomycosis is present, then conditions that allow persistence of Chiricahua leopard frogs with the disease (e.g., water temperatures that do not drop below 20 °C (68 °F), pH of greater than 8 during at least part of the year); and

(i) Uplands immediately adjacent to breeding sites that Chiricahua leopard frogs use for foraging and basking.

(2) Dispersal habitat, consisting of ephemeral (water present for only a short time), intermittent, or perennial drainages that are generally not suitable for breeding, and associated uplands that provide overland movement corridors for frogs among breeding sites in a metapopulation with the following characteristics:

- (a) Are not more than 1.0 mi (1.6 km) overland, 3.0 mi (4.8 km) along ephemeral or intermittent drainages, 5.0 mi (8.0 km) along perennial drainages, or some combination thereof not to exceed 5.0 mi (8.0 km);
- (b) Provide some vegetation cover for protection from predators, and in drainages, some ephemeral, intermittent, or perennial aquatic sites; and
- (c) Are free of barriers that block movement by Chiricahua leopard frogs, including urban, industrial, or agricultural development; reservoirs that are 50 ac (20 ha) or more in size and stocked with predatory fishes, bullfrogs, or crayfish; highways that do not include frog fencing and culverts; and walls, major dams, or other structures that physically block movement.

#### Effects of the Action

Actions described within the BA refer to effects from aerial delivery of fire retardant for a 10-year period. The BA includes conservation measures intended to minimize the effect of aerial fire retardant delivery which includes mapping avoidance areas where a 300 foot buffer will be delineated as a drop-free zone. These areas are predominantly wetted areas that include perennial, intermittent, or ephemeral streams, estuaries, lakes/ponds, playas, reservoirs, and swamp/marsh lands. The BA also identified other conservation measures that included 1) using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; 2) avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species; and 3) specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. We recognize that the species will benefit from the use of fire retardant by preventing the loss of populations throughout the species' range. Overall, the loss of habitat from catastrophic fire and post-fire scouring floods would be greater and have more adverse effects on Chiricahua leopard frog than implementation of the proposed action.

There is concern that many occupied sites, such as low-volume waters or stock tanks would not be recognized by the original dataset used for avoidance area mapping. However, the BA states that (page 167, August 2011 BA) "avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant on...sites where the Sonoran tiger salamander and Chiricahua leopard frog occur". Email records between Service Region 2 and USFS Region 3 (May 9 and 12, 2011) provide documentation and concurrence from Service with the Fire Retardant Avoidance Mapping justifications. According to the BA, these avoidance mapping requirements are specific to USFS Region 3's listed threatened and endangered species (including designated critical habitat) and will be incorporated in the proposed action. These maps are not available at this time for our review; however, local coordination between Service and USFS is required annually to ensure that "any updates that are needed for retardant avoidance areas on National

Forest System lands are mapped using the most up-to-date information” (page 4, August 2011 BA).

In Appendix B, Tables B-4 and B-5, the BA provides data for individual Forests on the total number of retardant drops, the average number of drops per year, and the number of total fires from 2000 to 2010. These data do not include the 2011 fire season for Arizona which included the largest wildfire in State history (Wallow Fire) in the White Mountains on the A-S as well as other heavily destructive fires that effected Chiricahua leopard frog populations and critical habitat on the Coronado National Forest such as the Monument Fire (Huachuca Mountains), the Horseshoe II Fire (Chiricahua Mountains), and the Greaterville Fire (Santa Rita Mountains). These 2011 fires have worsened the status and baseline for the species and are evidence of the potential effect of wildfire in any given year, and may have been much worse without the use of fire retardant. National Forest lands where the Chiricahua leopard frog occurs are particularly vulnerable to wildfire and therefore, to wildfire suppression activities. The following table summarizes relevant data (adapted from Tables B-4 and B-5).

**Table 22. Adaptation of Tables B-4 and B-5 from 2011 USFS Aerial application of Fire Retardant Biological Assessment.**

<b>National Forest</b>	<b>Number of Wildfires 2000-2010</b>	<b>Total Retardant Drops 2000-2010</b>	<b>Average Retardant Drops/Year 2000-2010</b>	<b>Predicted Number of Misapplications</b>	<b>Extent of Contaminated Habitat (6.2 mi/drop)</b>
Coronado	1,035	1,429	130	6	32.7 mi.
Gila	2,077	1,276	116	5	31 mi.
Tonto	2,451	988	90	4	24.8 mi.
Coconino	4,074	311	28	1	6.2 mi.
A-S	2,475	390	35	2	12.4 mi.
<b>Total</b>	<b>12,112</b>	<b>4,394</b>	<b>399</b>	<b>18</b>	<b>107.1 mi</b>

The BA, in Table ABA-5 and ensuing discussion on page 108, states that despite avoidance area mapping and other precautions in place to minimize exposure of sensitive species and habitat to retardant, misapplications do occur as a result of accidental delivery, drift, and/or surface run-off and leaching. Specifically, the Forest Service anticipates there is a 0.42 percent chance of a misapplication occurring for every one drop.

The programmatic nature of this consultation requires us to predict human error (misapplication), estimate variables such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped, and then estimate a set of operational and environmental factors such as the height and speed of the aircraft, terrain, habitat type, and width of the stream at the time of the retardant drop. Because of the number of

unknown variables associated with analyzing future fire retardant drops, we use the best available information provided in the BA and other correspondence with the USFS to support our discussion and effects determination.

The chemical response of retardants in water and ecological considerations for retardant toxicity were discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels.

The BA provided little discussion of potential effects of retardant on amphibians, likely because of the scarcity of literature on the potential effects of retardants on amphibians. Retardants and other fire fighting products are often ammonia-based, which in itself can be potentially toxic, and may contain other contaminants that may bioaccumulate (Hale et al. 2002; Pilloid et al. 2003; Labat Environmental 2007). Many formulations contain yellow prussiate of soda (sodium ferrocyanide, YPS), which is added as an anticorrosive agent which can increase overall toxicity, however the Phos-Chek family of formulations do not contain sodium ferrocyanide and is therefore not considered in this consultation. Toxicity of fire retardants is typically found to be low in the laboratory, but in the field, toxicity of retardants can be photo-enhanced by ambient UVB and of particular concern to fish and amphibians based on tests involving to the southern leopard frog (*Lithobates sphenoccephala*) and rainbow trout (Calfee and Little 2003). The toxicity of different formulations appear to react differently to UV radiation; Phos-Chek D75-R toxicity was unaffected by UV exposure while that of D75-F doubled (Calfee and Little 2003). Angeler and Moreno (2006) found that retardant “clearly” affected nutrients and indirectly affected other parameters such as chlorophyll a, pH, DO, and steady-state turbidity and that at least two hydrologic cycles may be necessary for a contaminated water body to return to pre-contamination condition.

Calfee and Little (2003) stated that amphibian are perhaps the most at-risk from lethal exposure because they often reside in shallow, low water volume habitat that is not readily visible from the air and therefore more susceptible to direct hits. Another concern expressed by Calfee and Little (2003) was that low water volume habitat has limited recharge from uncontaminated water and therefore is more susceptible to concentrations reaching lethal limits.

To quantitatively assess risk of exposure of Chiricahua leopard frog populations to misapplications of fire retardant, we applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands and then calculated the extent of waterways where adverse effects to Chiricahua leopard frogs are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years. Results of these calculations can be observed in Table CLF-1. Based on the calculations in Table CLF-1, we anticipate 18 retardant drops will occur over the next 10 years affecting Chiricahua leopard frogs in approximately 107.1 acres of occupied habitat. This is an estimate of the number of affected habitat using a 0.42 percent misapplication rate under the methodology of avoidance mapping.

Given the likely affects of fire retardant on the aquatic environment, particularly to low water volume habitat frequently occupied by Chiricahua leopard frogs such as stock tanks proposed as critical habitat, we are reasonably certain that direct exposure will adversely affect the primary constituent elements addressing water quality and the suitability of these sites for continued occupation as a result of altered water chemistry and a time-lag in natural decontamination, resulting in mortality of affected populations and unsuitability of habitat for some time, post exposure. The established buffers are designed as drop-free zones, which should reduce the likelihood of catastrophic effects to the species.

### Cumulative Effects

The cumulative effects in the action area are difficult to analyze, considering the broad geographic landscape included in the action area, the uncertainties associated with non-Federal actions are difficult to predict. Whether those effects will increase or decrease in the future is not known; however, based on the human subpopulation and growth trends effects of non-Federal actions are likely to increase. Effects from these non-Federal 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 less restrictive management standards.

### Conclusion

After reviewing the current status of the Chiricahua leopard frog, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Chiricahua leopard frog or destroy or adversely modify proposed critical habitat. We base these conclusions on the following:

1. The Forest Service has committed to include proposed critical habitat in their avoidance mapping strategy which indirectly includes all, or a majority of, currently-occupied habitat. The protocols in place to minimize the risk to these identified areas will adequately reduce the likelihood for a misapplication to adversely affect any given population.
2. The environmental persistence of fire retardant will cause short-term adverse effects to water quality, the prey resources, and other habitat parameters; however, the effects will dissipate over time and will not render the critical habitat permanently unsuitable.

## **Desert pupfish (*Cyprinodon macularius*)**

### Environmental Baseline

In Arizona, desert pupfish are located on only the Tonto National Forest (TNF). The BA mistakenly identifies topminnow as occurring on the Prescott and Coronado National Forests. No desert pupfish currently exist there (Voeltz and Bettaso 2003). The only designated critical habitat is far away from Forest lands. Desert pupfish only currently occur at Mud Springs in the TNF. Additional sites for release of desert pupfish are being considered on the TNF. Desert

pupfish are also found on Bureau of Land Management (BLM), State, county, and private lands. This consultation will only focus on proposed actions identified on Forest Service lands.

### Effects of the Action

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for ten years. The BA includes measures that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as all waterbodies with a 300-foot buffer; this includes perennial streams, intermittent streams, lakes, ponds, identified springs, reservoirs, and vernal pools. Buffer areas may be adjusted for local conditions and coordinated with the U.S. Fish and Wildlife Service (USFWS).

The BA includes as a proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for listed and proposed species; avoiding aerial application of retardant on mapped avoidance areas for listed and proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to desert pupfish. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, or surface run-off and leaching. The BA states that “any forest with more than one retardant drop over the last 10 years would have a “Likely to Adversely Affect” determination for those species and designated critical habitat that occur there.” The Forest Service “assumes that all drops within the 300 foot buffer will enter waterways and affect aquatic species.”

The BA identifies the average number of retardant drops by National Forests’ in Table B-4. This table erroneously shows National Forests’ where desert pupfish occur have at least one retardant drop over the last 10-years; therefore, we consider the effects of all misapplication scenarios to desert pupfish occupied and critical habitat.

Adverse effects of fire retardant products to aquatic species (fish and invertebrates) are discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels. Other components of the fire retardant product may also have toxic effects.

The programmatic nature of this consultation requires us to predict human error (misapplication); estimate variables that are pre-determined by the IC at the time of the incident such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped (between 799 and 3,000 gallons/drop); and then estimate a set of operational and environmental factors such as the height and speed of the aircraft, terrain, habitat type, and width of the stream at the time of the retardant drop. Because of the unknown



variables associated with future fire retardant drops, we assume the worst case scenario and use the best available information provided in the BA to support our discussion and effects determination for desert pupfish.

We used the information provided in Table ABA-5 and B-4 (from the BA) to support our conclusions for misapplications on Forest Service land over the next 10-years (Table 24). We applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands and then calculated the extent of stream miles where adverse effects to desert pupfish are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years.

**Table 23. Number of Anticipated Drops on Forest Service land over the next 10-years**

<b>National Forest</b>	<b>Total Number of Drops 2000-2010</b>	<b>Desert Pupfish Populations By Forest</b>	<b>Number of Anticipated Drops*</b>	<b>Extent of Stream Miles (6.2miles/drop)</b>
TNF	898	1	3	18.6

\* Table 24 Calculations for number of drops and stream miles ( $898/11 \times 10 = 816$ , and  $816 \times .0042 = 3.43$  or 3 drops)

Most known extant desert pupfish populations are small. To date the desert pupfish has been restricted to small, isolated populations scattered throughout its historical range with occupancy in about 20 populations. No populations are considered sand secure (USFWS 2010). We anticipate three retardant drops will occur over the next 10 years affecting desert pupfish in about 18.6 stream miles. Because all drops that occur within the 300 foot buffer are assumed to enter waterways; small pools, springs, and cienegas where desert pupfish occur are likely to be adversely affected by introduced retardants. We believe adverse effects to individuals and populations will occur from the application of retardants on USFS lands.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Critical Habitat

No desert pupfish critical habitat occurs on or near USFS lands.

### Conclusion

After reviewing the current status of the desert pupfish, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the USFWS’s biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert



pupfish, and is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

1. There are 12 desert pupfish populations that exist beyond USFS lands; therefore, adverse effects to the species on USFS lands will not preclude recovery and survival of the species.
2. The environmental persistence of the chemicals identified in the BA will cause short-term adverse effects to the aquatic food source for desert pupfish; however, the effects will dissipate over time and will not render the affected area unsuitable for desert pupfish establishment in the future.

### **Gila chub (*Gila intermedia*)**

#### Environmental Baseline

Extirpated or much reduced in numbers and distribution in majority of historical range in the upper Gila River basin in Arizona, New Mexico, and detrimentally affected by habitat degradation and interactions with exotic fishes. In Arizona, Gila chub are located on five National Forests (NF) identified as Apache-Sitgreaves (ASNF), Coconino (CNF), Coronado (Cor. NF), Prescott (PNF), and Tonto (TNF) and in New Mexico they are located on the Gila National Forest (GNF). Table 25 below identifies the number of Gila chub populations known to occur on Forest Service lands. Gila chub are also found on Bureau of Land Management (BLM), private, and Tribal lands. This consultation will only focus on proposed actions identified on Forest Service lands.

Gila chubs commonly inhabit pools in smaller streams, springs, and cienegas, and they can survive in small artificial impoundments (Miller 1946, Minckley 1973, Rinne 1975). They are highly secretive, preferring quiet, deeper waters, especially pools, or remaining near cover including terrestrial vegetation, boulders, and fallen logs (Minckley 1973, Rinne and Minckley 1991). Minckley (1973) suggested that spawning may occur over beds of aquatic plants. Most known extant Gila chub populations are small. To date the Gila chub has been restricted to small, isolated populations scattered throughout its historical range with occupancy in about 30 populations. Only one population, Cienega Creek, is considered stable and secure; about two thirds are considered stable but threatened, and a third are unstable and threatened (Weedman et al. 1996). Between 2000 and 2010, the USFS has not documented nor have we attributed adverse effects to Gila chub populations or its critical habitat from a fire retardant misapplication.

#### Critical Habitat

There are 25 Gila chub critical habitat units with 15 of those on USFS lands. Primary constituent elements for Gila chub critical habitat include, but are not limited to: space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and 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.

### Effects of the Action

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for a ten year period. The BA includes measures that are incorporated in the proposed action that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed threatened, endangered or proposed terrestrial plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and/or populations.

The BA includes in the proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to Gila chub and its critical habitat. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, and/or surface run-off and leaching. The BA states that “any forest with more than one retardant drop over the last 10 years would have a “Likely to Adversely Affect” determination for those species and designated critical habitat that occur there.” And the Forest Service “assumes that all drops within the 300 foot buffer will enter waterways and affect aquatic species.”

The BA identifies the average number of retardant drops by National Forests’ in Table B-4. This table shows that all National Forests’ where Gila chub occur have at least one retardant drop over the last 10-years; therefore, we consider the effects of fire retardant application to Gila chub occupied and critical habitat.

Adverse effects of fire retardant products to aquatic species (fish and invertebrates) are discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels. Other components of the fire retardant product may also have toxic effects.

The programmatic nature of this consultation includes predictions of human error rates (misapplication), estimate of variables that are pre-determined by the IC at the time of the incident such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped (between 799 and 3,000 gallons/drop), and then estimate a set of operational and environmental factors such as the height and speed of the

aircraft, terrain, habitat type, and width of the stream at the time of the retardant drop. Because of the unknown variables associated with future fire retardant drops, we use the best available information provided in the BA to support our discussion and effects determination for Gila chub.

We used the information provided in Table ABA-5 and B-4 (from the BA) to support our conclusions for misapplications on Forest Service land over the next 10-years (Table 1). We applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands (i.e.  $390 \div 11 \times 10 = 354.5$ , and  $354.5 \times .0042 = 1.48$  drops or 2 when rounded up) and then calculated the extent of stream miles where adverse effects to Gila chub are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years.

**Table 24. Number of Anticipated Drops on Forest Service land over the next 10-years**

<b>National Forest</b>	<b>Total Number of Drops 2000-2010</b>	<b>Gila chub Populations By Forest</b>	<b>Number of Anticipated Drops</b>	<b>Extent of Stream Miles (6.2miles/drop)</b>
ASNF	355	4	2	12.4
CNF	283	3	1	6.2
Cor. NF	1299	3	6	37.2
PNF	706	3	3	18.6
TNF	898	3	4	24.8
GNF	1160	2	5	31

Based on the calculations in Table 25, we anticipate 21 retardant drops may occur over the next 10 years affecting Gila chub in approximately 130.2 stream miles. Because all drops that occur within the 300 foot buffer are assumed to enter waterways; small pools, springs, and cienegas where Gila chub occur are likely to be adversely affected by introduced retardants. We believe adverse effects to individuals and/or populations will occur from the application of retardants on USFS lands. However, we acknowledge that the proposed action is more protective than the previous 10 years and the actual misapplication rate may be lower.

If all 21 retardant misapplications (Table 25) were to occur within the 10-year timeframe of the consultation approximately 130.2 stream miles of critical habitat could be impacted on USFS lands. Considering the toxicity studies of Phos-Chek to algae and benthic macroinvertebrates were shown to have adverse effects to primary producers and aquatic invertebrates (MacDonald et al. 1995), and the toxicity of field applications are higher than the lab studies (for accidental retardant delivery); the misapplication of retardants to Gila chub critical habitat will likely alter

the biodiversity and trophic dynamics in the stream and will result in short term adverse effects to the food source for Gila chub.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the Gila chub, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Gila chub, and is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

1. Based on the record between 2000 and 2010, the USFS has not documented nor have we attributed adverse effects to Gila chub populations or its critical habitat from a fire retardant misapplication. The proposed action is more protective than the previous 10 years.
2. The environmental persistence of the chemicals identified in the BA will cause short-term adverse effects to the aquatic food source for Gila chub; however, the effects will dissipate over time and will not render the affected area unsuitable for Gila chub establishment in the future.

## **Gila topminnow (*Poeciliopsis occidentalis*)**

### Environmental Baseline

In Arizona, Gila topminnow are located on three National Forests' (NF): the Coconino (CNF), Coronado (Cor. NF), and Tonto (TNF). The BA mistakenly identifies topminnow as occurring on the Prescott National Forest. No Gila topminnow currently exist there (Voeltz and Bettaso 2003). In addition, Gila topminnow are considered extant in Fossil Creek, which is partially within the Coconino National Forest. Table 26 below identifies the number of Gila topminnow populations known to occur on Forest Service lands. Gila topminnow are also found on Bureau of Land Management (BLM), State, county, private, and Tribal lands. This consultation will only focus on proposed actions identified on Forest Service lands.

### Effects of the Action

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for ten years. The BA includes measures that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as all waterbodies with a 300-foot buffer; this includes perennial streams, intermittent streams, lakes, ponds, identified springs, reservoirs, and vernal pools. Buffer areas may be adjusted for local conditions and coordinated with the U.S. Fish and Wildlife Service (USFWS).

The BA includes as a proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for listed and proposed species; avoiding aerial application of retardant on mapped avoidance areas for listed and proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to Gila topminnow. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, or surface run-off and leaching. The BA states that “any forest with more than one retardant drop over the last 10 years would have a “Likely to Adversely Affect” determination for those species and designated critical habitat that occur there.” The Forest Service “assumes that all drops within the 300 foot buffer will enter waterways and affect aquatic species.”

The BA identifies the average number of retardant drops by National Forests’ in Table B-4. This table shows that all National Forests’ where Gila topminnow occur have at least one retardant drop over the last 10-years; therefore, we consider the effects of all misapplication scenarios to Gila topminnow occupied habitat.

Adverse effects of fire retardant products to aquatic species (fish and invertebrates) are discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels. Other fire retardant components may also have toxic effects. The species will also benefit from the use of fire retardant by preventing the loss of the small localized populations.

The programmatic nature of this consultation requires us to predict human error (misapplication), variables such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped (between 799 and 3,000 gallons/drop), and then estimate a set of operational and environmental factors such as the height and speed of the aircraft, terrain, habitat type, and width of the stream at the time of the retardant drop. Because of the unknown variables associated with future fire retardant drops, we use the best available information provided in the BA to support our discussion and effects determination for Gila topminnow.

We used the information provided in Table ABA-5 and B-3 (from the BA) to support our conclusions for misapplications on Forest Service land over the next 10-years (Table 1). We applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands (i.e.  $390 \times 10 = 354.5$ , and  $354.5 \times .0042 = 1.48$  drops or 2 when rounded up) and then calculated the extent of stream miles where adverse effects to Gila topminnow are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years.

**Table 25. Number of Anticipated Drops on Forest Service land over the next 10-years: Gila topminnow**

<b>National Forest</b>	<b>Total Number of Drops 2000-2010</b>	<b>Gila topminnow Populations By Forest</b>	<b>Number of Anticipated Drops</b>	<b>Extent of Stream Miles (6.2miles/drop)</b>
CNF	311	1	1	6.2
Cor. NF	1,429	1	6	37.2
TNF	988	9	4	24.8

Most known extant Gila topminnow populations are very small; usually springs, pools, or short stream segments in about 30 populations. Only one population, Cienega Creek, is considered stable and secure (Voeltz and Bettaso 2003). Based on the calculation in Table 26, we anticipate 11 retardant drops will occur over the next 10 years affecting Gila topminnow in about 67.2 stream miles. Because all drops that occur within the 300 foot buffer are assumed to enter waterways; small pools, springs, and cienegas where Gila topminnow occur are likely to be adversely affected by introduced retardants. We believe adverse effects to individuals and populations will occur from the application of retardants on USFS lands.

Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

Critical Habitat

There is no designated critical habitat for Gila topminnow.

Conclusion

After reviewing the current status of the Gila topminnow, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service’s biological opinion that the proposed action is not likely to jeopardize the continued existence of the Gila topminnow. No critical habitat has been designated, thus none will be affected. We base this no jeopardy conclusion on the following:

1. There are 20 Gila topminnow populations that exist beyond USFS lands; therefore, adverse effects to the species on USFS lands will not preclude recovery and survival of the species.
2. The environmental persistence of the chemicals identified in the BA will cause short-term adverse effects to the aquatic food source for Gila topminnow; however, the effects will dissipate over time and will not render the affected area unsuitable for Gila topminnow establishment in the future.



## **Gila trout (*Oncorhynchus gilae*)**

### Environmental Baseline

The historical distribution of Gila trout is not known with certainty but it is believed to occupy the upper Gila River in New Mexico and parts of the San Francisco River systems of Arizona and New Mexico (Behnke 2002). The Arizona populations were believed to be extirpated around the turn of the 20<sup>th</sup> century (Service 2003a). Gila trout are a typical cold-water species native to higher elevation streams and require well-oxygenated water; coarse sand, gravel, and cobble substrate; stable stream bank conditions; and abundant overhanging banks, pools, and cover for optimal habitat. The Gila trout is currently known from 15 streams in the Gila National Forest, 1 stream (Raspberry Creek) in Apache-Sitgreaves National Forest, 1 stream (Grapevine Creek) in Prescott National Forest, and 1 stream (Frye Creek) in the Coronado National Forest.

In New Mexico, Gila trout occur in the Gila National Forest in the four original pure populations (Main Diamond, South Diamond, Whiskey, and Spruce Creeks) and each population has been replicated at least once. Main Diamond has been replicated four times, South Diamond and Whiskey Creek have been replicated once, and Spruce Creek three times. The Service believes all of the replicated populations are secure, and the viability of the Gila trout is sufficiently protected throughout these populations. In 2006, Gila trout was downlisted from endangered status to threatened based on the replication of the original four populations and the overall increase in the total wild population of Gila trout from less than 10,000 in 1992 to 37,000 fish in 2001 (Brown et al. 2001). Replicated populations in New Mexico are successfully reproducing, indicating that suitable spawning and rearing habitats are available. In addition, Gila trout were introduced into three streams in Arizona.

Thus, Gila trout are located on three National Forests in Arizona: Apache-Sitgreaves (no baseline info), Coronado, and Prescott. Table 27 below identifies the number of Gila trout populations known to occur on Forest Service lands. All known extant Gila trout populations are small; two of which on the Prescott and Coronado National Forests are recent introductions. To date the Gila trout has been restricted to small, isolated populations scattered throughout its historical range with occupancy in about 30 populations. This consultation will only focus on proposed actions identified on Forest Service lands.

On the Prescott National Forest, Gila trout are located at one location, Grapevine Creek; this is a recently introduced population. Grapevine Creek is located within the Bradshaw Mountains, approximately 4.7 miles northwest of Mayer, Yavapai County, Arizona. Its upper reaches are perennial, fed by Grapevine Springs. On this National Forest, Gila trout population is located in an un-grazed pasture in the Big Bug Allotment, Bradshaw Ranger District. This pasture is within the Grapevine Springs Botanical Area. The Forest Service withdrew this area from mining for twenty years in 1995. The headwaters of Grapevine Springs may have burned in the Battle Fire back in May 1972. This is the most recent fire that may have affected this watershed. It occurred prior to Gila trout being present.

On the Coronado National Forest, Gila trout are located at one location, Frye Canyon, on the Coronado National Forest. It is a recently introduced population. Frye Canyon is located on the



north-side of the Pinaleno Mountains, approximately 9.6 miles southwest of Thatcher, Graham County, Arizona. There are five miles of perennial habitat in this canyon. Its upper reaches are fed by Emerald Spring. The uppermost portion of Frye Canyon is located within the Mount Graham Red Squirrel Refugium Area. The headwaters of Frye Canyon are located in the Hawk Hollow Allotment in the Safford Range District, Coronado NF. The adjacent Marijilda Allotment may also contribute to the headwaters. The headwaters of Frye Canyon burned on May 20, 2008 during the Frye Mesa Fire (3,094 acres). More of the headwaters may have burned during the Nuttall Fire in June 2004.

Effects of the Action

We used the information provided in Table ABA-5 and B-4 (USDA USFS 2011) to support our conclusions for misapplications on Forest Service land over the next 10-years (Table 27). We applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands (i.e.  $390 \div 11 \times 10 = 354.5$ , and  $354.5 \times .0042 = 1.48$  drops or 2 when rounded up) and then calculated the extent of stream miles where adverse effects to Gila trout are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years.

**Table 26. Number of Anticipated Drops on Forest Service land over the next 10-years: Gila trout**

National Forest with Gila Trout in Arizona	Expected total number of retardant drops 10 years <sup>1</sup>	Number of drops expected to enter water ways (.42%-multiply by .0042 and round up)
Coronado National Forest	1299	6
Gila National Forest	1160	5
Prescott National Forest	706	3

<sup>1</sup>The expected number of retardant drops is based on taking the total number of drops per forest as presented in the BA on pages 238-241 and dividing that number by 11 and multiplying by 10. The data presented in the BA are based on 11 years and the timeframe for this consultation is 10 years, therefore we adjust for this difference.

**Table 27. Extent of take for Gila Trout in Arizona**

Forest name	Miles of perennial stream on Forest	Miles of occupied streams Forest <sup>1</sup>	% of total perennial streams which are occupied	Number of drops expected to hit stream	Total stream miles affected by retardant (6.2 miles per drop to water <sup>2</sup> )	% Gila Trout occupied streams affected by retardant	Extent of take
Coronado National Forest	151	5.2	3.3	5.45 (6)	37.2	1.2	1.2 miles
Prescott National	79	2.25	2.8	2.96 (3)	18.6	0.53	0.53 miles

Forest							
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Based on the calculations in Table 27, we anticipate 10 retardant drops will occur over the next 10 years affecting Gila trout in approximately 1.75 stream miles. Because all drops that occur within the 300 foot buffer are assumed to enter waterways; small pools, springs, and cienegas where Gila trout occur are likely to be adversely affected by introduced retardants. We believe adverse effects to individuals and/or populations will occur from the application of retardants on Forest Service lands.

In 2003, fire retardant was dropped on Black Canyon, affecting approximately 200 meters (m) (654 feet) of stream in New Mexico. Although some Gila trout were killed, the number of mortalities is unknown because dead fish were carried by the current out of the area by the time fire crews arrived. However, a week after the retardant drop, live Gila trout were observed about 400 m (1.314 feet) below the drop site (Monzingo 2003).

There are no current populations of Gila trout in the Coconino National Forest. There are plans to reintroduce the trout. We expect the Forest Service to consult on the reintroduction of the Gila trout. As such, the proposed action is not likely to adversely affect the Gila trout in the Coconino National Forest.

Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

Conclusion

After reviewing the current status of the Gila trout, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service’s biological opinion that the proposed action is not likely to jeopardize the continued existence of the Gila trout. No critical habitat has been designated for the species; thus, none would be affected. We base these conclusions on the following:

1. The environmental persistence of the chemicals identified in the BA will cause short-term adverse effects to the aquatic food source for Gila trout; however, the effects will dissipate over time and will not render the affected area unsuitable for Gila trout establishment in the future.
2. The chances of a retardant drop hitting 1.75 miles of occupied stream out of 1,226 miles of perennial streams across the three forests is unlikely to occur within the next 10 years.
3. Cooperative management activities (rescue of fish, reestablishment of populations, hatchery management) efforts between the Service, Forest Service, State Game and Fish Agencies, have been successful in the past and will continue to be implemented.
4. Most populations of Gila trout are sufficiently disjunct (e.g., separated by mountain ridges), thereby ensuring that one event would not affect all populations simultaneously.
5. An Emergency Plan has been developed and implemented that addresses wildfire-related impacts (Service 2006).

## **Holy Ghost ipomopsis (*Ipomopsis sancti-spiritus*)**

Proposed action now includes the following conservation measures for Holy Ghost ipomopsis:

1. Wherever practical, the USFS shall prioritize fuels reduction projects within Holy Ghost Canyon and areas that the USFS determines will reduce the risk of fire and the need to use aerially applied fire retardants within habitat occupied by Holy Ghost ipomopsis.
2. Whenever practical, USFS will use water or other less toxic fire retardants than those described in the proposed action within a 0.5-mile avoidance zone around the habitat occupied by Holy Ghost ipomopsis.
3. USFS will coordinate with the New Mexico Ecological Services Field Office each year prior to the onset of the fire season to ensure that: 1) up-to-date information is incorporated in local fire planning and distributed to appropriate resources by the local Fire Management Officer; 2) maps and information are made available to incident commanders and fire teams for the purposes of avoiding application of retardants to Holy Ghost Canyon, whenever possible, including use of best available technologies to avoid areas occupied by the species and 3) any other appropriate conservation measures are included to avoid the likelihood of jeopardizing the species. Such measures may include enhancement of populations or other appropriate contingency measures.

Holy Ghost ipomopsis grows in openings in Rocky Mountain montane conifer forest at elevations of 2,350-2,500 m (7,730-8,220 ft). It is known from a single natural population. Plants are relatively continuous in scattered patches for about 3.5 km (2.2 mi) of Holy Ghost Canyon on the Santa Fe National Forest. There are about 80 ha (200 ac) of occupied habitat. Holy Ghost ipomopsis occurs along a stretch of 1.9 km (1.2 mi) of forest road within a narrow strip of a single canyon. Counts of total plants in Holy Ghost Canyon have ranged from 240 to 2,047 during various years, with about 25 percent of the overall abundance representing flowering plants (Service 2008, Sivinski and Tonne 2008).

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 km (2.5 mi) south of Holy Ghost Canyon. Populations near Panchuela Campground and in Winsor Creek Canyon are about 8 km (5 mi) north of Holy Ghost Canyon. The total size of the three introduced populations is about 6 ha (15 ac). It is still uncertain if the introduced populations will become self-sustaining.

Augmentation of the Holy Ghost Canyon population of Holy Ghost ipomopsis took place in 2007 using transplanted rosettes from the University of New Mexico greenhouse (Sivinski and Tonne 2008). Survival of the rosettes transplanted was high, and many flowered, fruited, and set seed in 2008 (Sivinski and Tonne 2008). The comprehensive surveys conducted in August 2008 found 464 flowering adults and 857 rosettes, and an unknown number of surviving individuals transplanted as rosettes in July of 2007 (Sivinski and Tonne 2008).

Holy Ghost ipomopsis occurs within a fire-adapted community, but also in an area that is heavily utilized by the public. Holy Ghost Canyon contains leased cabins, a forest service campground, and a traditional trout fishing area, making fire management in the canyon a logistical challenge (Service 2008). Fire has been excluded from Holy Ghost Canyon for at least 80 years (Service 2008). Under current Forest Service management, fire suppression has been strictly enforced, resulting in an increased threat of an intense wildfire due to accumulation of fuels. These factors indicate that this area has an increased likelihood of fire and, consequently, the application of fire retardant for suppression efforts. As a result, the area is not grazed by domestic livestock. In 2009, the Forest Service thinned trees in the canyon to open the forest canopy and improve the habitat for the species. Although we believe this action should assist in the conservation of the species, it is too early to conclude that this action will provide long-term benefits.

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 also established in the area, with all of these plants a significant problem in Holy Ghost Canyon (Service 2008). These invasive plants have the potential to displace native vegetation, including Holy Ghost ipomopsis.

Road maintenance, recreation, and catastrophic forest fires pose immediate threats to this species (Service 2008). Avoidance mapping has not been proposed for the species because the threat of fire outweighs the potential adverse effects from the application of fire retardants (USFS R3 2011, FWS 2011).

The Santa Fe is estimated to apply higher amounts of retardant to its landbase (0.01%; less than 88 acres annually). Because historical use of retardant has been 0.01 percent or more annually on the Santa Fe National Forest, there is a higher likelihood that the species may be impacted by applying retardant. As such, the single small population could be significantly impacted. Nevertheless, the Forest Service has committed to implementing conservation measures to limit the direct and indirect effects of fire retardant on Holy Ghost ipomopsis. These include:

1. Wherever practical, the USFS shall prioritize fuels reduction projects within Holy Ghost Canyon and areas that the USFS determines will reduce the risk of fire and the need to use aerially applied fire retardants within habitat occupied by Holy Ghost ipomopsis.
2. Whenever practical, USFS will use water or other less toxic fire retardants than those described in the proposed action within a 0.5-mile avoidance zone around the habitat occupied by Holy Ghost ipomopsis.
3. USFS will coordinate with the New Mexico Ecological Services Field Office each year prior to the onset of the fire season to ensure that: 1) up-to-date information is incorporated in local fire planning and distributed to appropriate resources by the local Fire Management Officer; 2) maps and information are made available to incident commanders and fire teams for the purposes of avoiding application of retardants to Holy Ghost Canyon, whenever possible, including use of best available technologies to avoid areas occupied by the species and 3) any other appropriate conservation measures are included to avoid the likelihood of jeopardizing the species. Such measures may include enhancement of populations or other appropriate contingency measures.

Holy Ghost ipomopsis grows in a single canyon where the fuel loads are high. Under current conditions, fire suppression by any means is necessary to protect Holy Ghost ipomopsis. Fire retardant may be used in suppression efforts because Holy Ghost Canyon has a single road to enter and exit the area and fire fighter safety would be tenuous during a catastrophic wildfire. Nevertheless, water or other less toxic fire retardants will be used within a 0.5-mile avoidance zone around the species. This action will protect the species without compromising fire suppression efforts.

Encroachment of non-native plants into the habitat of Holy Ghost ipomopsis is a current threat to the species. It is possible that the introduction of fertilizers in the form of fire retardant would be likely to increase these invasive exotic plant species by providing them with additional nutrients, thus allowing them to out-compete Holy Ghost ipomopsis. However, the 0.5-mile avoidance zone around the species will reduce the risk of fire retardant being applied to non-native plants and the potential for these non-native plants to then outcompete Holy Ghost ipomopsis.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of Holy Ghost ipomopsis. No critical habitat has been designated for this species; therefore, none will be affected. We conclude the application of retardant is not likely to jeopardize the species for the following reasons: 1) the USFS will prioritize fuel reduction projects to reduce the risk of fire within Holy Ghost Canyon and habitat occupied by Holy Ghost ipomopsis, which will lower the likelihood that aerially applied fire retardants will be used; 2) although fire retardant chemicals have the potential to promote greater growth of competing vegetation, whenever practical, the USFS will use water or other less toxic fire retardants than those described in the proposed action within a 0.5-mile avoidance zone around the habitat occupied by Holy Ghost ipomopsis; and 3) annual USFS coordination will ensure that species information is up-to-date prior to the onset of fire season. Because these measures are part of the proposed action, we determine that the use of fire retardant is not likely to jeopardize the existence of Holy Ghost ipomopsis.

## **Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*)**

### Environmental Baseline

Huachuca water umbel (HWU) is a herbaceous semi-aquatic plant which occurs on the Coronado National Forest (Cor. NF) where 1,429 retardant drops were applied between 2000 and 2010 (Table B-4, BA). HWU occurs in cienegas and require perennial water, gentle stream gradients, in water depths from 5-15 cm (2-6 in), and occasionally in 25 cm (10 in). Critical habitat for

HWU was designated on the upper San Pedro River, Garden Canyon on Fort Huachuca, Scotia Canyon and other areas of the Huachuca Mountains, the San Rafael Valley, and Sonoita Creek on July 12, 1999 (USFWS 1999). On the Cor. NF, HWU are identified in the Scotia, Sunnyside, and Bear Canyon critical habitat units (3, 4, and 6). The remaining units are in lands adjacent to Forest lands.

HWU is sensitive to interspecific competition, requiring both ample light penetration and little competition for nutrients. Population numbers tend to be lower in areas with a high density of native or non-native plant species competition (Zuhlke et al. 2002, poster, Holdsworth and Gori 1996, p. 3, USFWS 2001 p. 3-4). HWU has been out competed by other plant species, especially those with extensive root systems; this could result in a negative impact to the shallow-rooted HWU. Research at other HWU populations report competition with native (cattail at Cottonwood Spring [Falk 1998, p. 2] and above Hog Canyon [Holdsworth and Gori 1996, p. 3], sedges at San Rafael Valley [Warren et al. 1991, p. 12], sedges and rushes in Ojo de Aqua de Cananea Mexico [Warren et al. 1991, p. 12], and both bulrush and cattails at Bingham Cienega Preserve [Zuhlke et al. 2002]) and non-native plants (watercress at Sonoita Creek [USFS 2008, pp. 59-60] and below Hog Canyon [Warren et al. 1991, p. 12], knotgrass above Hog Canyon [Holdsworth and Gori 1996, p. 3], and Bermuda grass in the San Pedro River [Vernadero Group 2011, p. 22]).

#### Effects of the Action

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for a ten year period. The BA includes measures that are incorporated in the proposed action that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed threatened, endangered or proposed terrestrial plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and/or populations.

The BA includes in the proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to HWU. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands.

The BA states that “~~any~~ forest with more than one retardant drop over the last 10 years would have a “Likely to Adversely Affect” determination for those species and designated critical habitat that occur there.” We recognize the benefits from preventing the spread of catastrophic fire are greater than the negative impacts of fire retardant application for HWU. The species will benefit from the use of fire retardant by preventing the loss of populations and their seed banks



from scouring post-fire floods. However, the cumulative loss of habitat from catastrophic fire and post-fire scouring floods would be greater and have more adverse effects on HWU and its habitat than implementation of the proposed action.

As stated previously, two types of fire retardant avoidance buffers may apply to listed species. Because HWU requires perennial water sources all occupied sites on USFS land will require a 300 foot waterway buffer. Because the HWU is limited in distribution USFS Region 3 documented the need to highlight areas occupied by HWU through additional avoidance mapping buffers identified in the BA. Email records between USFWS Region 2 and USFS Region 3 (May 9 and 12, 2011) provide documentation and concurrence from USFWS with the Fire Retardant Avoidance Mapping justifications. We understand these avoidance mapping requirements are specific to USFS Region 3's listed threatened and endangered species (including designated critical habitat) and will be incorporated in the in the final BA. We also understand these maps are not available at this time for our review; however, local coordination between USFWS and USFS is required annually to ensure that "any updates that are needed for retardant avoidance areas on National Forest System lands are mapped using the most up-to-date information" (page 4, August 2011 BA).

Although fire retardant buffers and aircraft operational guidelines will minimize misapplications, the Forest Service anticipates there is a 0.42 percent chance of a misapplication occurring for every one drop. It is unknown how fire retardant will directly impact HWU individuals should retardant with high salt content contact plants directly. Direct effects of fire retardant on plant species and their habitats are not well understood, but can include foliar damage or death, alterations in species composition, and either reductions or increases in plant size and vigor (USFS 2011, p. 29-30, 32). Fire retardant may act as a fertilizer (USFS 2011, p. 30, 32), thus increasing the size or vigor of existing vegetation within HWU habitat. Any increase in competing plant species, especially those with extensive root systems, could result in a negative impact to the shallow-rooted HWU.

The network of small canyons which support HWU populations may be difficult to detect on the landscape from aircraft carrying retardant (USFS 2011, p. 65). Despite avoidance mapping, the probability of either application through an exception or a missed target will impact HWU habitat. Fire retardant may increase herbaceous vegetation growth which could out-compete HWU. HWU is a poor competitor; low levels of disturbance are required to remove competing native or non-native vegetation. USFWS 2008 (p. 18) states, —~~there~~ are no weedy competitors of HWU in its aquatic habitats that might be promoted with the application of fire retardants", but this has been found to not be an accurate assessment of the situation. The impacts of fire retardants on native vegetation, including HWU, are unclear and depend on such factors as species characteristics, soil types, and application timing (USFS 2011, p. 28). In general, it is thought that impacts are transitory (USFS 2011, p. 30); however, should rhizomatous perennial native or non-native plants increase in abundance from nutrient pulses, the shallow-rooted HWU may be out-competed temporarily or indefinitely.

Critical habitat for this species includes native plant species which hold stream banks in place and provide scouring-resistant habitat for HWU. There appears to be a threshold however, when native stabilizing species overtake HWU; such competition may result in the reduction of



population density (Holdsworth and Gori 1996, p. 2-3). A fertilizer effect from fire retardant may not be transitory, as is generally believed, if perennial competing plants are enhanced. However, as HWU may survive both in the seed bank and in underground rhizomes for long periods of time (Titus and Titus 2008 p 398), impacted populations could be restored to previous levels if competition is reduced in the future. Therefore, we believe that the impacts of increased competition are less likely to harm the species than the impacts of catastrophic fire on surrounding slopes followed by severe rains. Such a combination of events could promote flooding events that destabilize stream banks and result in the permanent loss of HWU populations and their seed banks (Titus and Titus 2008, p. 396-397, Warren et al. 1991, p. 9, Warren et al. 1989, p. 59).

### Cumulative Effects

Since the land within the project vicinity is almost exclusively managed by the Forest Service, most activities that could potentially affect HWU or its habitat are Federal activities and subject to additional section 7 consultations. Expected activities on non-Forest lands downstream from HWU habitat are many, though impacts will not likely be enhanced by an inadvertent fire retardant drop on upstream National Forest lands, as retardant concentration is expected to dilute downstream. There are many in holdings on private lands adjacent to the Cor. NF; however, many of these contain riparian areas that could be impacted by nearby retardant drops. Potential activities to HWU habitat on these lands that could be exacerbated by the fertilizer effect of retardants include increased illegal immigration traffic that can increase non-native plant seed sources and fire ignition potential (thus increasing the potential need for fire retardant drops on National Forest lands). Other human activities possible and likely to increase on inholdings and adjacent lands include groundwater pumping, surface water diversion, impoundment and channelization, improper livestock grazing, mining, development, agriculture, and recreation. These activities all contribute to riparian and cienegas habitat loss and degradation in southern Arizona and impacts would likely be exacerbated with increased interspecific competition from the fertilizer effects of fire retardants.

### Conclusion

After reviewing the current status of HWU, the environmental baseline for the action area, the effects of the proposed fire retardant use, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the HWU and is not likely to adversely modify designated critical habitat for the following reason:

- The probability of misapplication affecting an entire population of HWU is very low and there are other populations across four watersheds such that an inadvertent impact to one population would not jeopardize the species.
- Critical habitat is not likely to suffer catastrophic impacts from fire retardant and will not lose its long-term conservation function as a result of fire retardant application.
- The overall benefit of preventing the complete loss of populations and their seed banks from scouring post-fire floods outweighs competition impacts to populations with in-tact seed banks and underground rhizomes that could respond if competition is later reduced.

## **Little Colorado spinedace (*Lepidomeda vittata*)**

### Environmental Baseline

The spinedace historically occupied the Little Colorado River and its northward flowing tributaries off the Mogollon Rim and the White Mountains. Currently, spinedace is found in disjunct locations on the Coconino National Forest (CNF) in the East Clear Creek watershed; and on the Apache-Sitgreaves National Forests (ASNF) in Chevelon Creek, the upper Little Colorado River, and Silver Creek.

In the East Clear Creek drainage, spinedace are found in small perennial pools in otherwise ephemeral drainages in West Leonard and Leonard Canyon (Dines Tank) with populations in Bear, Dane, and Yeager canyons supplemented from the West Leonard Canyon and Dines Tank. In the mainstem of East Clear Creek, spinedace are found above CC Cragin Reservoir in Bear Canyon. Populations of spinedace in this drainage have declined significantly since listing and currently are at particular risk from the continuing drought due to the small isolated pool habitats they occupy. Extensive efforts to salvage spinedace from drying pools and place them in more secure habitats has been done and likely will continue.

In the Chevelon drainage, spinedace are found in the lower eight miles of the creek above the confluence with the Little Colorado River. This is the most robust population of spinedace remaining throughout its current range. As a conservation action, spinedace was stocked into West Chevelon Creek, a tributary stream about 40 miles upstream of the occupied habitat in 2007.

In the Little Colorado River drainage, spinedace are found in the mainstem from Springerville to St. Johns, including the Arizona Game and Fish Department (AGFD) Becker and Wenima Wildlife Areas, and in the reach above Lyman Lake. They are also found in Nutrioso Creek from the ASNF boundary upstream to Nelson Reservoir and from the reservoir upstream to the town of Nutrioso and in Rudd Creek, a tributary to Nutrioso Creek. Spinedace are found in small to moderate numbers at these sites.

In the Silver Creek drainage, spinedace were found in 1997 in the lower portion of the creek above the confluence with the Little Colorado River. Silver Creek is mostly perennial in this reach. Repeated surveys have not documented their presence since that time. Critical habitat for the spinedace was designated in 1987 (52 FR 35034). Areas designated as critical habitat were in the East Clear Creek drainage (East Clear Creek from its confluence with Leonard Canyon upstream 15 miles to CC Cragin Reservoir and from the upper limit of the reservoir upstream 13 miles to Potato Lake), Chevelon Creek (from the confluence with the Little Colorado River upstream eight miles to Bell Cow Canyon), and in the Little Colorado drainage (Nutrioso Creek from the ASNF boundary upstream five miles to Nelson Reservoir dam). The primary constituent elements for spinedace critical habitat include clean, permanent, flowing water, pools, and a fine gravel or silt-mud substrate.

Seven of the eleven populations are on U.S. Forest Service (USFS) lands, and therefore may be subject to fire retardant drops during fire management activities conducted by the USFS. The Chevelon Creek population, located downstream of the ASNF on private land, and the AGFD properties on the Little Colorado River may also be impacted by the proposed action. The proposed action area includes lands known to be at high-risk for high-severity fire per LANDFIRE maps and recent USFS NEPA decisions (e.g., East Clear Creek Watershed Health Project, Nutrioso Fuels Reduction Project, Eager Fuels Reduction Project). From 1983 to 2006, there were a total of 4,103 fire starts in the watersheds surrounding occupied spinedace habitat. Of those, 22 fires were greater than 100 acres in size. Seven of those occurred within 1.0 mile of occupied streams. Also, two of the waterways occupied by spinedace in the ASNF are within the burn perimeter of the recent Wallow Fire, the largest wildfire in Arizona's history.

### Effects of the Action

Direct delivery by misapplication, aerial drift, accidental spills, and surface run-off are potential avenues considered for introduction of retardant into waterways occupied by Little Colorado spinedace on the CNF and ASNF. Potential adverse effects of fire retardant products on aquatic organisms are discussed in detail in the biological assessment (BA). These effects include toxic alteration of water quality due to increased ammonia levels from nitrogen-based fire retardants, and changes in nutrient levels.

The BA calculated an average 0.42% misapplication rate/year (Table ABA-5) and an average of 28 drops/year on the CNF and 35 drops/year on the ASNF (Table B-3). Based on this data, over the next 10 years, we expect 280 drops on the CNF and 350 drops on ANSF, resulting in 1.18 misapplications ( $280 \times 0.0042$ ) on the CNF and 1.47 misapplications ( $350 \times 0.0042$ ) on the ASNF. The probability of a misapplication directly hitting spinedace is related to the total amount of perennial streams, 181 miles on CNF (USFS 2009) and 996 miles on ASNF (USFS 2010), and the total miles occupied by the species. Total stream miles occupied by spinedace vary from year to year and are difficult to verify, so it is difficult to determine the probability of a misapplication hitting occupied spinedace habitat over the next 10 years. However, based on the misapplication rate and the conclusions of Norris and Webb (1989) who showed ammonia concentrations could remain at lethal levels between 0 and 6.2 miles downstream, it is possible that up to 7.32 miles ( $1.18 \times 6.2$ ) of occupied habitat could be affected on the CNF and 9.11 ( $1.47 \times 6.2$ ) miles could be affected on the ASNF.

Site specific information for retardant drops cannot be predicted with certainty over the 10-year timeframe for this consultation. Furthermore, since the distribution of spinedace is not confined to a single stream or watershed, we cannot conclude that the entire range of spinedace is reasonably certain to be exposed to levels of fire retardant that would appreciably reduce the survival and recovery of the species within the next 10 years. However, we do believe the proposed action may affect the spinedace and its designated critical habitat for the following reasons:

- The proposed action has the ability to affect populations that are most needed for survival and recovery of the species on USFS lands.

- Due to the current status of the species, the spinedace has limited ability to absorb additional detrimental effects such as those that may occur from exposure to retardant. The accumulation of various threats and previous actions has degraded the species baseline and placed it at greater risk of extinction.
- Misapplication associated with the proposed action could eliminate or substantially affect one or more of the remaining populations. Each population is small, increasing the likelihood of extirpating a population should fire retardant enter the stream.
- The proposed action area includes lands known to be at high-risk for high-severity fire as described in the Environmental Baseline.

Introduction of retardant could affect water quality and temporarily render critical habitat less suitable, and potentially lethal, for spinedace and its food resources. Also, the effects of fire, while not under consultation here, could compound adverse effects to habitat through increased ash and sediment inputs to streams, and increased water temperatures. Overall, we believe that although the environmental persistence of the retardant chemicals can cause short-term adverse effects to the aquatic environment, the effects will dissipate over time and will not render the affected area unsuitable for spinedace establishment in the future.

The species will also benefit from the use of fire retardant by preventing the loss of the small localized populations. Overall, the loss of habitat from catastrophic fire and post-fire scouring floods would be greater and have more adverse effects on the isolated populations of the species and its habitat than implementation of the proposed action.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conservation Measures

The proposed action includes the following policies and procedures to minimize the risk of fire retardant products reaching aquatic habitats:

- Avoid aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species, or within 300 feet of waterways, including species-specific avoidance mapping (USFS 2011).
- Coordinate with local Fish and Wildlife Service offices each year prior to the onset of the fire season to ensure avoidance areas are up to date and appropriate contingency measures are identified.
- Implement monitoring and reporting procedures for misapplication of retardant.

Conclusion

After reviewing the current status of spinedace, the environmental baseline for the action area, the effects of the proposed action, conservation measures, and cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of spinedace and is not likely to destroy or adversely modify designated critical habitat.

**Mexican Spotted Owl (*Strix occidentalis lucida*)**

The following discussion includes baseline information and effects analysis for MSO and its critical habitat in Arizona, New Mexico, Colorado, and Utah.

Environmental Baseline

In the southwestern U.S., the owl is 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 most favorable. In Arizona, occurs primarily in mixed-conifer, pine-oak, and evergreen oak forests; also occurs in ponderosa pine forest and rocky canyonlands. In southern Utah, commonly used mesa tops, benches and warm slopes above canyons in fall and winter; relatively cool canyons were the primary summer habitat. In New Mexico, breeding and roosting occurred in mixed-conifer forests that contained an oak component more frequently than expected by chance; generally did not use pinyon pine-alligator juniper woodlands for nesting or roosting; selected roost and nest sites in forests characterized by mature trees with high variation in treeheights and canopy closure greater than 75%. Nests on broken tree top, cliff ledge, in natural tree cavity, or in tree on stick platform (dwarf mistletoe), often the abandoned nest of hawk or mammal. Diet varies with locations: woodrats, mice, voles, and cottontails.

The MSO occurs in 11 counties in Utah, 13 in Arizona, 8 in Colorado, 22 in New Mexico, and 4 Texas (Regions 2, 3, and 4). In 2002, U.S. Forest Service reported 987 occupied owl sites on Forest Service lands in Arizona and New Mexico. Current information suggests there are 15 sites in Colorado, 105 sites in Utah, and 43 sites on National Park Service (NPS) lands in Arizona; in total, 1,176 sites have been identified. Based on this number of known owl sites, the Service (69 FR 53182-53298) estimated that the total known owl numbers on Federal lands in the southwestern United States at 1,176-2,352, of which 1,065 occur on USFS lands in Arizona and New Mexico (see Table 29 below).

**Table 28. Number of MSO PACs by Recovery Unit and National Forest in Arizona and New Mexico.**

Recovery Unit	National Forest	# PACs in Arizona	# PACs in New Mexico
Colorado Plateau	Kaibab	0	
	Cibola		22

Recovery Unit	National Forest	# PACs in Arizona	# PACs in New Mexico
	RU sub-total	<b>0</b>	<b>22</b>
Basin and Range West	Apache-Sitgreaves	4	
	Coronado	107	
	Prescott	15	
	Tonto	31	
	RU sub-total	<b>157</b>	
Basin and Range East	Cibola		3
	Lincoln		145
	RU sub-total		<b>148</b>
Southern Rocky Mountains- NM	Carson		2
	Santa Fe		48
	RU sub-total		<b>50</b>
Upper Gila Mountains	Apache-Sitgreaves	138	
	Coconino	186	
	Kaibab	6	
	Prescott	0	
	Tonto	41	
	Cibola		31
	Gila		286
RU sub-total	<b>371</b>	<b>317</b>	
AZ PACs Total		<b>528</b>	
NM PACs Total			<b>537</b>

Status of the MSO species and to CH vary by RU. The following threats by RU are summarized from the MSO recovery plan (USFWS 1995):

***Colorado Plateau***

In the northwest of this RU, the threats are recreation, improper grazing, and road development within canyon habitats used by breeding owls. In upland habitats used for foraging, dispersal, and wintering, the threats are catastrophic wildfire and timber harvest.

In the southeast portion of this RU (including the Kaibab and Cibola NFs), the threats are timber harvest and/or intensive fuels reduction treatments, improper grazing, catastrophic fire, oil, gas, and mining development, and recreation.

***Southern Rocky Mountains-New Mexico***

This RU includes the Carson and Santa Fe NFs. Wildfire and timber harvest are the greatest threats in localized areas within the RU. The threat of timber harvest on both the Santa Fe and Carson NFs is very low. Harvest on the Santa Fe NF has been reduced in areas where owls occur. This area has a small population of owls, and the pairs are isolated due to the fragmented habitat. Other threats in this RU, which are individually small but can be large cumulatively, are unregulated fuelwood harvest, grazing (especially in riparian areas), and recreational development in ski areas.

***Southern Rocky Mountains – Colorado***

Most recently, MSO have been identified only on the Pike and San Isabel National Forest, while more historic observations of individuals have occurred throughout the state. Wildfire continues to be the primary threat, while additional threats include fuels reduction treatments, recreation, and development. Similar to the New Mexico portion of this RU, this area also has a small population of owls with occupation primarily occurring in canyons settings with mixed conifer.

***Upper Gila Mountains (UGMs)***

This RU includes the Apache-Sitgreaves, Cibola, Coconino, Gila, Kaibab, and Tonto NFs. The primary threats in this RU are timber harvest and catastrophic fire. Lesser threats are indiscriminant fuelwood harvest (especially the removal of large oaks, snags, and down logs), and improper grazing by wildlife and livestock.

***Basin and Range-West (BRW)***

This RU includes the Apache-Sitgreaves, Coronado, Gila, Prescott, and Tonto NFs. Threats in this RU are catastrophic fire, recreation (especially on the Coronado, Tonto, and Prescott NFs due to their proximity to large urban areas), and grazing.

***Basin and Range-East (BRE)***

This RU includes the Cibola and Lincoln NFs. The primary threats to owls in this unit are catastrophic fire, some forms of timber harvest, fuelwood harvest, grazing, agriculture or development for human habitation, and forest insects and disease.

A recent review of wildfires affecting the MSO on NF lands was completed by the USFWS (2004). Both the UGM and BRW RUs have experienced multiple high to moderate intensity, stand replacing fires in recent years and the frequency of these fires may be increasing due to prolonged drought. The Southern Rocky Mountains-New Mexico and BRE RUs have also experienced stand-replacing fires within PACs in recent years. Only the Colorado Plateau RU has had fires which, though they occurred in PACs, did not significantly alter the habitat to the point that it was no longer used by MSOs.

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for a ten year period. The BA includes measures that are incorporated in the proposed action that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed threatened, endangered or proposed terrestrial plant or animal species or critical habitat where



aerial application of fire retardant may affect habitat and/or populations. The decision was documented in the BA to allow the aerial application of fire retardant in MSO habitat due to the wide distribution of the species. Forest Service Region 3 further clarified the rationale for not including avoidance mapping for MSO by stating that the benefits of controlling fire far outweigh the potential effects to some individuals as the result of fire retardant use. MSO movement patterns are difficult to track and we understand that yearly monitoring may not always occur or provide specific nest core areas. For this reason, MSO protections through mapped avoidance zones would not provide accurate protection of the owl. Therefore, unless an area is specifically mapped as a waterway or a mapped avoidance buffer for other species, MSO habitat will likely receive aerial application of fire retardants for emergency suppression actions identified in the BA.

Based on the timing of wildfire occurrence the USFS identified peak fire seasons for each USFS Region. We know that MSO are distributed across USFS Regions 2 (Colorado), 3 (Arizona and New Mexico), 4 (Utah). The peak fire seasons for each Region are identified as June through October in R2 and R4, and May through July in R3. The peak fire season for each Region overlaps with the MSO breeding season (March 1 through August 31).

Given the uncertainties that exist regarding the use of fire retardant, the USFS is not able to specify when or where applications will occur. Based on the historic use of fire retardant on USFS lands in Arizona, adverse effects have been identified in past emergency wildfire consultations.

### Effects of the Action

In Arizona, the effects of fire retardant applications on MSO have been documented in numerous Biological Opinions. Since 2000, approximately 16 BO's have been completed and finalized where actions associated with aerial fire retardant use on Forest Service lands likely resulted in adverse effects to MSO. The following BOs and associated consultation numbers are located on the following website <http://www.fws.gov/southwest/es/arizona/Biological.htm> (Pumpkin Fire 22410-2000-F-0326, Peak Wildfire 22410-2000-F-0353, Sycamore Canyon Fire 22410-2001-F-0409, Oversight Emergency Fire 22410-2002-F-0103, Rodeo Chediski Wildfire-Suppression 22410-2002-F-0224, Coon Creek Fire 02-21-00-F-0243, Pack Rat Fire 22410-2003-F-0175, Tram Wildfire 02-21-02-F-0177, Springer Wildfire 02-21-02-F-0199, Nuttall-Gibson Complex 22410-2004-FE-0002, Sunnyside Fire 02-21-04-M-0287, Webber Fire 02-21-04-M-0383, Norris Fire 22410-2006-FE-0552, Sand Emergency Fire 22410-2006-FE-0381, Beaverhead Fire 22410-2006-FE-0452, Chitty Wildfire 22410-2007-FE-0338). Although adverse effects can occur, we recognize fire retardants provide additional protections and if they were not available the impacts of wildfires would likely have greater effects to MSO and its habitat. Also, the USFS will continue to treat acres within the forest to reduce the risk of future landscape fires and these treatments will likely decrease the level of fire retardant use in the future.

Previous BOs identified a single or combination of suppression actions (e.g. retardant or water drops, burnout, hand or dozer lines, etc.) that ultimately led to anticipated take of MSO. A list of actions associated with retardant drops included noise disturbance, injury, or mortality as a single

or combined effect to MSO. The following is a list of potential actions that may affect MSO or its habitat from retardant drop use as described in the BA.

- 1) Noise or visual disturbance during breeding season from low flying aircraft.
- 2) Effects to MSO and prey species from dropping retardant (e.g., getting hit and killed by either retardant and/or trees etc., and potential toxic impacts to prey).
- 3) Effects to habitat from dropping retardant (e.g., knocking down tree limbs or nest roost structures).

For the National Fire Retardant BO we believe the potential effects from retardant drops on MSO and associated critical habitat include disturbance through increased noise, application of fire retardant, and habitat alteration during the breeding season.

#### Disturbance

Mechanical noise and human presence may be disruptive to MSO, particularly during the breeding season. Owls have more sensitive hearing than other birds (Bowles 1995). If noise arouses an animal, it has the potential to affect its metabolic rate by making it more active. Increased activity can, in turn, deplete energy reserves (Bowles 1995). Noisy human activity can cause raptors to expand their home ranges, but often birds return to normal use patterns when humans are not present (Bowles 1995). Such expansion in home ranges could affect the fitness of the birds, and thus their ability to successfully reproduce and raise young. Species that are sensitive to the presence of people may be displaced permanently, which may be more detrimental to wildlife than recreation-induced habitat changes (Hamit and Cole 1987, Gutzwiller 1995, Knight and Cole 1995). If animals are denied access to areas that are essential for reproduction and survival, that population will most likely decline. Likewise, if animals are disturbed while performing behaviors such as foraging or breeding, that population will also likely decline (Knight and Cole 1995).

Owls may respond to disturbance during the breeding season by abandoning their nests or young; by altering their behavior such that they are less attentive to the young, which increases the risk of young being preyed upon; by disrupting feeding patterns; or by exposing young to adverse environmental stress (Knight and Cole 1995). There is also evidence that disturbance during years of diminished prey base can result in increased foraging time, which in turn may cause some raptors to leave an area or to not breed at all (Knight and Cole 1995).

There are a growing number of studies attempting to describe and quantify the impacts of non-lethal disturbance on the behavior and reproduction of wildlife, and MSO in particular. Delaney et al. (1997) reviewed literature on the response of owls and other birds to noise and concluded the following: 1) raptors are more susceptible to disturbance-caused nest abandonment early in the nesting season; 2) birds generally flush in response to disturbance when distances to the source are less than approximately 200 feet and when sound levels are in excess of 95 dBA; and 3) the tendency to flush from a nest declines with experience or habituation to the noise, although the startle response cannot be completely eliminated by habituation. Delaney et al. (1999) found that ground-based disturbances elicited a greater flush response than aerial

disturbances. Our guidance is to limit potentially disturbing activities to areas  $\geq 0.25$  mile from MSO PACs during the breeding season (March 1 through August 31). This corresponds well with the Delaney et al.'s (1999) 0.25 mile threshold for alert responses to helicopter flights. In addition, Delaney et al. (1999) found that MSO did not flee from helicopters when caring for young at the nest, but fled readily during the post-fledgling period. This may be a result of optimal fleeing decisions that balance the cost-benefit of fleeing. Frid and Dill (2002) hypothesize that this may be explained using predator risk-disturbance theory, and perhaps the cost of an adult MSO fleeing during the nestling period may be higher than during the post-fledgling period.

For this programmatic consultation, the above-ground level where aerial retardant drops will be applied will vary between the types of aircraft identified in the BA. Although the distance above ground level necessary for appropriate application of fire retardant were not available, we anticipate all aircraft will fly within the zones that are identified by Delaney et al. (1991 and 1999) and will likely elicit a heightened alert response or flush response by MSO. MSO flushing in response to aircraft dropping retardant may result in decreased nest attendance or prey delivery, failed reproduction efforts, or nest abandonment. MSO flushing in response to low level flights associated with fire retardant delivery, regardless of the aircraft dropping retardant, may also result in decreased nest attendance or prey delivery, failed reproduction efforts, or nest abandonment.

In addition to flushing response elicited from aircraft, the application of fire retardant could lead to direct application on a nest or roost site and contribute to direct mortality or injury of MSO or could lead to nest abandonment.

#### Habitat Alteration

Under the proposed action for this consultation approved aircraft have the capability of dropping between 800 and 3,000 gallons of retardant in a single drop. Direct application of fire retardant on a MSO nest or roost habitat may cause branches to break and snags/trees to fall. The Sunnyside Fire Biological Opinion (02-21-04-M-0287) stated that broken branches and snags/trees knocked over by water and retardant drops were observed during a site visit. The direct application of retardant on MSO habitat may result in the complete loss or modification of a nest or roost structure. The Primary Constituent Elements for MSO critical habitat related to forest structure and prey species will not be adversely affected. However, the short-term modification or complete removal of nest or roost structure will adversely affect MSO's nesting habitat for up to one breeding season.

#### Impacts to Prey Species

Because this species occurs in areas with moderate to high potential for aerial retardant use, there may be negative indirect effects of toxicity from eating prey that have consumed vegetation covered with retardant (LABAT Environmental 2007 - deer mouse toxicity). However, this build up of toxins through prey burden is a long-term process.

### **Arizona**

#### ***Apache-Sitgreaves National Forest***

The ASNFs overlap two RUs for the MSO: the UGM and the BRW RU. Biologists have identified 142 PACs (138 in UGM and 4 in BRW) within the boundaries of the ASNFs. The majority of the Forests contain habitat within the UGM RU, and, therefore, most PACs on the Forest lie within the UGM RU.

We queried our section 7 consultation database from 2000-2010 and found four after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the ASNF. These resulted in the harm and/or harassment of 17 PACs. Nevertheless, there are currently 142 PACs on the ASNF, and we anticipate fire retardant will continue to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

#### ***Coconino National Forest***

The CNF lies completely within the UGM RU for the MSO. Biologists have delineated 186 PACs within or partially within the boundaries of the CNF.

We queried our section 7 consultation database from 2000-2010 and found three after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the CNF. These resulted in the harm and/or harassment of three PACs. Nevertheless, there are currently 186 PACs on the CNF, and we anticipate fire retardant will continue to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

#### ***Coronado National Forest***

The Cor. NF lies completely within the BRW RU for the MSO. Biologists have delineated 107 PACs within the boundaries of the Cor. NF.

We queried our section 7 consultation database from 2000-2010 and found three after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the Cor. NF. These resulted in the harm and/or harassment of four PACs. Nevertheless, there are currently 107 PACs on the Cor. NF, and we anticipate fire retardant will continue to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

#### ***Kaibab National Forest***

The KNF lies within the UGM RU and the CP RU for the MSO. Biologists have delineated 6 PACs within or partially within the boundaries of the KNF, all in the UGM RU. No PACs have been delineated within the CP RU of the KNF.

We queried our section 7 consultation database from 2000-2010 and found one after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the KNF. These resulted in the harm and/or harassment of three PACs. Nevertheless, there are currently 6 PACs on the KNF, and we anticipate fire retardant will continue to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

### ***Prescott National Forest***

The PNF lies almost entirely within the BRW RU for the MSO. A small portion of the forest occurs within the boundary of the UGM RU. However, no PACs have been delineated in the UGM RU. Biologists have delineated 15 PACs within or partially within the boundaries of the PNF.

We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the PNF. Nevertheless, there are currently 15 PACs on the PNF, and we believe the potential exists for retardant to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

### ***Tonto National Forest***

The TNF lies within the UGM and the BRW RUs for the MSO. Biologists have delineated 72 PACs within or partially within the boundaries of the TNF.

We queried our section 7 consultation database from 2000-2010 and found two after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the TNF. These resulted in the harm and/or harassment of three PACs. Nevertheless, there are currently 72 PACs on the TNF, and we anticipate fire retardant will continue to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

### **Critical Habitat**

Based on the information provided in the disturbance section above, we find that the proposed action is not likely to affect any primary constituent elements of MSO designated CH found on the ASNf, CNF, Cor. NF, KNF, PNF, and TNF. Therefore, we conclude that the proposed action **–May Affect, is Not Likely to Adversely Affect”** designated MSO CH on the six National Forests in Arizona.

### **Colorado**

#### ***Pike and San Isabel National Forests***

The Pike and San Isabel NF occur within the SRM RU for the MSO. Biologists have delineated 7 PACs within or partially within the boundaries of this forest. Monitoring of these PACs indicate that they have not been recently occupied, although occupation currently occurs in nearby canyons on land administered by the BLM.

#### ***San Juan National Forest***

The San Juan NF occurs within the Colorado Plateau RU for the MSO. Although some MSO have been identified on this forest, occupation by MSO has been sporadic with no observations of nesting activity. No PACs have been delineated to date on this forest.

### **Critical Habitat**

Based on the information provided in the disturbance section above, we find that the proposed action is not likely to affect any primary constituent elements of MSO designated CH found on the Pike and San Isabel National Forests. Critical habitat has not been designated for the MSO on the San Juan National Forest. Therefore, we conclude that the proposed action **–May Affect, is Not Likely to Adversely Affect”** designated MSO CH on the Pike and San Isabel National Forest in Colorado.

### Utah

In Utah, owls nest in canyon habitats that are unlikely to burn due to sparseness of vegetation. In addition, the Forest Service has agreed to not drop retardant into the Protected Activity Centers where owl activity is the highest on Forest Service lands in Utah. Therefore, we agree with a **–May Affect, is Not Likely to Adversely Affect”** determination for the MSO and its critical habitat in Utah.

### New Mexico

**Mexican spotted owl (*Strix occidentalis lucida*)** (FS Region 3; Cibola, Carson, Gila, Lincoln, and Santa Fe National Forests)

#### ***Carson National Forest***

The Carson NF lies completely within the Southern Rocky Mountains – New Mexico (SRM-NM) RU for the MSO. Biologists have identified 2 PACs within the boundaries of the Carson NF. The 2 PACs are located within the Jicarilla RD on the far western side of the forest. Monitoring of the 2 PACs since 2004 indicates they have not been occupied by owls. In fact, biologists have not detected owls in these two PACs since the 1990s.

The USFS estimates 94,390 ac of protected habitat are present on the Carson NF outside of PACs and 243,234 ac of restricted habitat. Surveys in restricted and protected habitat on the Carson NF have not resulted in the detection of MSOs outside of the Jicarilla RD. We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression. Because of the limited number of PACs on the Carson NF, we do not anticipate retardant would be used in the future within the MSO PACs. Based on this information, we conclude that the proposed action **–May Affect, is Not Likely to Adversely Affect”** the MSO on the Carson NF.

#### Critical habitat

Two CH units occur within the boundaries of the Carson NF: SRM-NM-11 and SRM-NM-12. Both units overlap the Jicarilla RD of the Carson NF. One PAC has been delineated in each of the units. The SRM-NM-11 RU, which overlaps the district on 12,568 ac, contains only 46 ac of identified protected habitat outside of the PAC (PAC#020303) and 634 ac of restricted habitat outside of the PAC. The SRM-NM-12 Unit, which overlaps the district on 10,713 ac and lies completely within the boundaries of the district, does not contain any protected habitat outside of the single PAC (PAC#020301) and contains only 182 ac of restricted habitat outside of the PAC. Within the CH boundaries, only areas that fit the definition of restricted or protected habitat in the Recovery Plan for the MSO. Therefore, only about 862 ac of designated CH occur on the Carson NF. We queried our section 7 consultation database from 2000-2010 and did not find



any after-the-fact formal emergency consultations for MSO CH in response to the application of retardant used in wildfire suppression on the Carson NF. We find that the proposed action is not likely to affect any primary constituent elements of MSO designated CH. Therefore, we conclude that the proposed action **–May Affect, is Not Likely to Adversely Affect”** designated MSO CH on the Carson NF.

### ***Cibola National Forest***

The Cibola NF overlaps three separate RUs for the MSO: Upper Gila Mountains (UGM), Colorado Plateau (CP), and the Basin and Range – East (BR-E) RU. Biologists have delineated 22 PACs in the CP RU, 3 PACs in the BR-E RU, and 31 PACs in the UGM RU within the boundaries of the Cibola NF. A total of 56 PACs are present on the Cibola NF.

Occupancy of monitored PACs varied over a period of three years (2007-2009) between 31 and 66 %. The average occupancy over the three year period was 48.6 % which is below the average of 64 % for all forests in the Region. It is not possible to infer any trends related to the population of owls on the Cibola NF. However, lower than expected occupancy of MSO PACs may be due to prior year precipitation patterns (Seamans et al. 2002) in the mountain ranges of the Cibola NF.

The USFS estimates 112,377 ac of protected habitat are present on the Cibola NF outside of PACs and 300,097 ac of restricted habitat. Surveys in protected and restricted habitat may reveal the presence of additional PACs. We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the Cibola NF. Nevertheless, there are currently 56 PACs on the Cibola NF, and we believe the potential exists for retardant to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

### Critical habitat

Six CHU occur within the boundaries of the Cibola NF: Colorado Plateau–1 (CP-1), CP-2, UGM-2, UGM-3, Basin and Range – East – 5 (BR-E-5), and BR-E-7. The Colorado Plateau CHUs occur within the boundaries of the Mt. Taylor RD totaling approximately 165,636 ac. The UGM CHUs occur in the San Mateo and Magdalena Mountains of the Magdalena RD and total approximately 91,992 ac. The BR-E CHUs are found on the Sandia and Mountaineer RD and total approximately 22,162 ac. Within the CH boundaries, only areas that fit the definition of restricted or protected habitat in the Recovery Plan for the MSO are CH. The areas listed above represent estimated CH within the CHUs. We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for MSO CH in response to the application of retardant used in wildfire suppression on the Cibola NF. We find that the proposed action is not likely to affect any primary constituent elements of MSO designated CH on the Cibola NF. Therefore, we conclude that the proposed action **–May Affect, is Not Likely to Adversely Affect”** designated MSO CH on the Cibola NF.

### ***Gila National Forest***

The Gila NF lies primarily within the UGM RU for the MSO. A small portion of the forest lies within the BRE RU. However, no suitable restricted, protected, or critical habitat occurs in this RU and no owls have been observed in this RU on the Gila NF. Biologists have delineated 286



PACs within or partially within the boundaries of the Gila NF. It is important to note that the Gila NF manages the New Mexico Portion of the Apache NF under the guidance of the Gila NF LRMP.

Occupancy of monitored PACs varied over a period of three years (2007-2009) between 67 and 76 %. The average occupancy over the three year period was 72.3 % which is above the average of 64 % for all forests in the Region for the same time period. It is not possible to infer any trends related to the population of owls on the Gila NF. However, occupancy of MSO PACs may be affected by prior year's precipitation amounts and temporal distribution (Seamans et al. 2002) on the Gila NF.

The USFS estimates 817,580 ac of protected habitat are present on the Gila NF outside of PACs and 50,041 ac of restricted habitat. Surveys in protected and restricted habitat may reveal the presence of additional PACs.

We queried our section 7 consultation database from 2000-2010 and found two after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the Gila NF. These resulted in the short-term harassment of three PACs. Nevertheless, there are currently 286 PACs on the Gila NF, and we anticipate fire retardant will continue to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

#### Critical habitat

Part or all of four CHUs occur within the boundaries of the Gila NF: UGM-5a, UGM-5b, UGM-6, and UGM-7. The CHUs encompass approximately 536,999 ac of protected habitat and approximately 33,702 ac of restricted habitat. Within the CH boundaries, only areas that fit the definition of restricted or protected habitat in the Recovery Plan for the MSO are CH. The areas (acres) listed above represent estimated CH within the CHUs and not the total area for the CHU itself. We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for MSO CH in response to the application of retardant used in wildfire suppression on the Gila NF. We find that the proposed action is not likely to affect any primary constituent elements of MSO designated CH on the Gila NF. Therefore, we conclude that the proposed action **–May Affect, is Not Likely to Adversely Affect”** designated MSO CH on the Gila NF.

#### ***Lincoln National Forest***

The Lincoln NF lies entirely within the Basin and Range –East RU for the MSO. Biologists have delineated 145 PACs within or partially within the boundaries of the Lincoln NF. Occupancy of monitored PACs varied over a period of three years (2007-2009) between 57 and 81 %. The average occupancy over the three year period was 73.4 % which is above the average of 64 % for all forests in the Region for the same time period. It is not possible to infer any trends related to the population of owls on the Lincoln NF. However, occupancy of MSO PACs may be affected by prior year's precipitation amounts and temporal distribution (Seamans et al. 2002) on the Lincoln NF.

The USFS estimates 78,749 ac of protected habitat are present on the Lincoln NF outside of PACs and 184,192 ac of restricted habitat. Surveys in protected and restricted habitat may reveal the presence of additional PACs.

We queried our section 7 consultation database from 2000-2010 and found two after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the Lincoln NF. These resulted in the short-term harassment of three PACs. Nevertheless, there are currently 145 PACs on the Lincoln NF, and we anticipate fire retardant will continue to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

#### Critical habitat

Four critical habitat units (CHU) occur within the boundaries of the Lincoln NF: BR-E-1a, BR-E-1b, BR-E-3, and BR-E-4. The CHUs encompass approximately 69,846 ac of protected habitat and approximately 153,747 ac of restricted habitat. Within the CH boundaries, only areas that fit the definition of restricted or protected habitat in the Recovery Plan for the MSO are critical habitat. The areas (acres) listed above represent estimated critical habitat within the CHUs and not the total area for the CHU itself. We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for MSO CH in response to the application of retardant used in wildfire suppression on the Lincoln NF. We find that the proposed action is not likely to affect any primary constituent elements of MSO designated CH on the Lincoln NF. Therefore, we conclude that the proposed action **“May Affect, is Not Likely to Adversely Affect”** designated MSO CH on the Lincoln NF.

#### ***Santa Fe National Forest***

The Santa Fe NF lies completely within the Southern Rocky Mountains – New Mexico (SRM-NM) Recovery Unit (RU) for the MSO. Biologists have identified 48 PACs within the boundaries of the Santa Fe NF.

Occupancy of monitored PACs varied over a period of three years (2007-2009) between 32 and 43 %. The average occupancy over the three year period was 35.2 % which is below the average of 64 % for all Forests in the Region for the same time period. It is not possible to infer any trends related to the population of owls on the Santa Fe NF. However, occupancy of MSO PACs may be affected by prior year’s precipitation amounts and temporal distribution (Seamans et al. 2002) on the Santa Fe NF.

The USFS estimates 168,543 ac of protected habitat are present on the Santa Fe NF outside of PACs and 350,816 ac of restricted habitat. Surveys in restricted and protected habitat on the Santa Fe NF may lead to the delineation of additional PACs.

We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for the MSO in response to the application of retardant used in wildfire suppression on the Santa Fe NF. Nevertheless, there are currently 48 PACs on the Santa Fe NF, and we believe the potential exists for retardant to be applied in the future within MSO PACs resulting in noise disturbance, injury, or mortality as a single or combined effect to MSO.

### Critical habitat

Four CH units occur entirely or partially within the boundaries of the Santa Fe NF: SRM-NM-1, SRM-NM-4, SRM-NM-5a, and SRM-NM-5b. Units SRM-NM-1 and 4 occur on the Cuba and Jemez RD within the Jemez Mountains of the Santa Fe NF. Units SRM-NM-5a and 5b occur within the Pecos-Las Vegas RD on the eastern side of the Forest. Critical habitat units on the Santa Fe NF contain about 41,383 ac of protected habitat and about 70,011 ac of restricted habitat. Within the CH boundaries, only areas that fit the definition of restricted or protected habitat in the Recovery Plan for the MSO. Significant amounts of habitat defined as protected and restricted habitat occur outside the CHUs on the Santa Fe NF. The CHUs contain areas where most PACs have been delineated. We queried our section 7 consultation database from 2000-2010 and did not find any after-the-fact formal emergency consultations for MSO CH in response to the application of retardant used in wildfire suppression on the Santa Fe NF. We find that the proposed action is not likely to affect any primary constituent elements of MSO designated CH on the Santa Fe NF. Therefore, we conclude that the proposed action **–May Affect, is Not Likely to Adversely Affect”** designated MSO CH on the Santa Fe NF.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that aerially applied fire retardant on Forest Service lands is not likely to jeopardize the continued existence of the MSO. The PCEs of MSO critical habitat will not be adversely affected by the proposed action. Our determination is based on the following:

1. The current section 7 consultation policy provides for incidental take if an activity comprises the integrity of a PAC. We anticipate that retardant application or overflights by air tankers will adversely affect breeding MSO due to disturbance. However, we do not anticipate that the vegetation structure will change as a result of fire retardant being applied to PACs.
2. The implementation of the proposed action is not expected to impede the ability of the survival or recovery of the MSO or range-wide or within any recovery unit.
3. The number of PACs anticipated to be harassed for the life of the project by air tanker overflights or the application of fire retardant represents 5.8 percent (31 of 528) of the PACs located on the National Forest lands in Arizona.
4. The number of PACs anticipated to be harassed for the life of the project by air tanker overflights or the application of fire retardant represents 9.3 percent (50 of 537) of the PACs located on the National Forest lands in New Mexico.
5. The number of PACs anticipated to be harassed for the life of the project by air tanker overflights or the application of fire retardant represents 14 percent (1 of 7) of the PACs located on the National Forest lands in Colorado.

## **New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*)**

### Environmental Baseline

The New Mexico ridge-nosed rattlesnake is a small, montane species, one of five ridge-nosed rattlesnake subspecies known from the southwestern U.S. and western Mexico. The rattlesnake currently occurs in only three known populations; the Animas Mountains in southwestern New Mexico, Peloncillo Mountains in southwestern New Mexico, and southeastern Arizona in part on the Coronado National Forest, and the Sierra San Luis in Sonora and Chihuahua, Mexico. In the U.S., the largest known population occurs in the Animas Mountains. The species was not discovered in the Peloncillo Mountains until 1987; since then, 27 individual snakes have been documented within 13 general areas of the Peloncillo Mountains running from upper Miller Canyon at the southern end of the range to South Skeleton Canyon at the northern end. The Peloncillo Mountains population is the smallest of the three known populations, and is the least dense, and is the only one located on Forest Service lands, within the Coronado National Forest (USFWS 2001). Critical habitat for the subspecies does not include Forest Service lands, nor does it occur within the action area.

New Mexico ridge-nosed rattlesnakes are found in steep, rocky canyons with intermittent streams and on talus slopes at elevations ranging from approximately 5,500 to 8,500 ft (1,676 to 2,591 m) in the Animas Mountains and 5,000 ft to 6,200 ft (1,525 to 1890 m) in the Peloncillo Mountains. This rattlesnake is found among rocks, bunchgrass and leaf litter in steep rocky canyons in the pine-oak and pine-fir belts. Access to rock shelters with moderate interstitial spaces is probably a key habitat component. At lower elevations in the Peloncillo Mountains, ridge-nosed rattlesnakes probably occur primarily in the bottoms and slopes of steep, heavily wooded canyons (Holycross and Smith 2001), while at higher elevations they may be found in woodlands, open woodlands, and chaparral on exposed slopes and plateaus (USFWS 2002). In both cases, mature woodlands appear to be an essential habitat element. Nevertheless, areas in which ridgenose rattlesnakes have been found in the Peloncillo Mountains are characteristically more arid, lower, and less vegetated than typical habitats in the Animas Mountains of New Mexico.

### Effects of the Action

Catastrophic, stand-replacing fire events are a serious threat to the subspecies and its woodland habitat. These type of fires occurred in the snake's habitat in the Animas Mountains and in the Sierra San Luis in 1989 and before 1952. The 1997 Maverick prescribed fire in the Peloncillo Mountains destroyed woodlands in one of the 12 locations where New Mexico ridgenose rattlesnakes have been observed in that mountain range. Additionally, the 2003 Baker prescribed fire burned at high intensity in nine percent of core sites within its boundaries and may have eliminated other core sites in the southwest portion of the range south of the losses from the Maverick Fire. Of the 13 sites known to be occupied, one was damaged by the Maverick Fire and may no longer support a population. Eight of the remaining sites are within an aerial mile of each other and are surrounded by other potential sites extending through the mountains. Information from one study reported that of the nine snakes marked before the Maverick Fire, eight survived. One snake (not a New Mexico ridge-nosed rattlesnake) died in an area exposed to high intensity fire (Smith *et al.* 2001). The other snakes were exposed to low intensity ground fire and survived, including three New Mexico ridge-nosed rattlesnakes (Smith *et al.* 2001).

Threats affecting the New Mexico ridge-nosed rattlesnake and its associated habitat within the action area include illegal collection, wildfires, prescribed fires, and low to moderate levels of recreational activities. Potential threats to the subspecies include fuel wood harvest, mining, improper grazing management, and development (43 FR 34479).

Individuals are known to be active during daylight and crepuscular periods. During those hours, they may be resting under vegetation (bunch grasses, leaf litter, and downed logs) or rocky cover, thermo-regulating in the open, or hunting. Between June and August, young of the year rattlesnakes are also present above ground as the live-born young disperse from their birth sites. May through July is the peak fire season in southern Arizona and New Mexico. Rattlesnakes are active above ground as early as April and as late as October, with a seasonal peak between July and September. Individuals may also be in underground in dens during these hours, indicating that some percentage of the population is likely vulnerable to retardant drops at any given time during their active period.

Avoidance maps were not prepared for this species because there is a higher risk to loss of individuals and habitat from not using fire retardant. The effects associated with the non-use of fire retardant (i.e., through buffers) and the increased potential for severe, type-changing wildfire would be more detrimental to the species than the application of fire retardant in occupied habitat. As a result of altered fire regimes in the southwestern U.S., woody fuel loads have built up in the woodland habitats of the snake, increasing the risk for high intensity stand replacing fires. Nevertheless, because this species occurs in areas with moderate to high potential for aerial retardant use, there may be negative indirect effects of toxicity from eating prey that have consumed vegetation covered with retardant (LABAT Environmental 2007 - deer mouse toxicity). However, this build up of toxins through prey burden is a long term process. The aerial application of fire retardant has low likelihood of direct effects since this species likely avoids wildland fires by retreating into their burrows or under rocks. However, mobility for these species is limited due to their small size and small home range. Direct effects to the rattlesnake may result to individuals covered by retardant or indirectly affected by ingesting prey that have been exposed to retardant.

The majority of the core sites are in the northern half of the range, which has not experienced wildfire in recent years. The topography of the Peloncillo Mountains is such that during a wildfire it is not likely that aerial retardant drops would easily avoid the canyons containing rattlesnake habitat. The vegetation in the canyon bottoms may ameliorate the effects of a retardant drop onto the canyon floor by absorbing some of the falling retardant before it hits the ground. Still, rattlesnakes that are hit by falling retardant may be injured or killed depending on the amount of retardant falling on that location and the amount of protective cover between them and the retardant load. There is limited information on the toxicity of the chemicals in the retardant to reptiles; however, based on toxicity data for other terrestrial species, it is not likely that dermal exposure to the retardant has any significant effect on the individual rattlesnake. Retardant that does hit the ground may attach as dust onto prey species of the rattlesnake, particularly on small mammals or lizards. There may also be an exposure through prey items that have eaten contaminated insects or vegetation that were covered in retardant. The extent to which retardant reaches the ground in densely vegetated areas is low in comparison to more open areas which are less used by rattlesnakes. In studies done by Labat Environmental (2007), the

toxicity of formulated products was slight to very slight for rats and mice although there was an increasing risk of mortality at retardant coverage levels of greater than 2 gallons per 100 square feet. This rate of application was posited as being used in vegetation communities for Arizona (Labat Environmental 2007).

Therefore, exposure to retardants may increase the rate of mortality among prey species, or debilitate them to the extent they are more vulnerable to predation by rattlesnakes. Rattlesnakes may also consume freshly dead prey items, and ingest small mammals that died from exposure to the retardants. The extent of this additional risk is uncertain and likely highly variable due to local conditions including the density of rattlesnakes in the area, the extent of the small mammal die-off, and the availability of carcasses to the snakes. There may also be a longer-term effect to local rattlesnake populations if the small mammal or lizard populations crash as a result of retardant-related mortality. Information on the toxicity of retardants and associated chemicals on reptiles are lacking, and the resulting ingestion of contaminated prey items is unknown. The risk would be to the individual rattlesnakes in the areas affected by retardant and could range from illness and temporary debilitation to death. The toxicity of the retardant quickly decays, and the small mammal and lizard populations would rebound quickly after the initial event. In any one year, it would not be expected that extensive areas would be subject to retardant drops. For these reasons, we believe it is likely that the ingestion of toxic prey items may affect individual rattlesnakes in core habitat areas.

In summary, there is a risk of injury or death to individual rattlesnakes from the application of fire retardant on their habitats. The extent of this risk is difficult to quantify; however, based on the best available information presented above, we believe it is not significant. It is important to note that rattlesnakes may be directly killed by fire in their habitats, and that their suitable habitats may be significantly affected by uncontrolled wildfire such that long-term habitat loss is the result. The potential for habitat loss from uncontrolled wildfires is a greater concern for the species than the potential for loss of individual rattlesnakes due to retardant.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that aerially applied fire retardant on Forest Service lands is not likely to jeopardize the continued existence of the New Mexico ridge-nosed rattlesnake. Critical habitat is not located on Forest Service lands; therefore it would not be affected by the proposed action. Our determination is based on the following:

1. The action area includes only one of the three mountain ranges in which the subspecies is known to occur because only one of the three populations of the rattlesnake is located on Forest Service lands. This will ultimately limit the potential threat of fire retardant on the



species range-wide. While the population is considered the smallest of the three, the low density of rattlesnakes in the habitat reduces the risk that a significant portion of the population could be affected by retardant drops associated with a particular fire or fires over a span of years.

2. The core habitats of the rattlesnake in the Peloncillo Mountains are distributed across the landscape with no particular concentration. This distribution also reduces the risk of a significant portion of the potentially available habitat for the population being affected by retardant drops associated with a particular fire.
3. Rattlesnakes are surface active during the fire season, but, information following the Maverick Fire suggests that high intensity burns may pose a serious threat to the ridgenose rattlesnake, whereas low intensity burns likely have little impact on the species. Moreover, the snake prefers wooded habitat in canyons and while on the surface, is often associated with some additional form of ground cover. A retardant drop on vegetation would be broken up by the vegetation such that the force hitting the ground is reduced. Additional cover on the ground further protects the rattlesnake from injury.
4. Toxicity of the retardant chemicals to prey species of the rattlesnake is thought to be slight to very slight and, based on the best available information, long-term contamination of the prey base is not likely to result. While individual rattlesnakes may be affected by the ingestion of contaminated prey items, the status of the overall population would not be impaired.

### **Sonora chub (*Gila ditaenia*)**

We listed the Sonora chub in the United States and México as threatened on April 30, 1986 (51 FR 16042; USFWS 1986) with critical habitat. The species is also listed by the State of Arizona as Species of Greatest Conservation Need (AGFD 2005) and as a threatened species by the Republic of México (Secretaria de Desarrollo Social 1994). The Sonora chub has been omitted from the Regional Forester's list of sensitive species (Forest Service 2007), though the species did have such status in the past (AGFD 2001).

Critical habitat was designated at the time of Federal listing to include approximately 5 miles of Sycamore Creek, extending downstream from and including Yank Spring (= Hank and Yank Spring), to the International border. Also designated was the lower 1.25 miles of Peñasco Creek, and the lower 0.25 mile of an unnamed stream entering Sycamore Creek from the west, about 1.5 mi downstream from Yank Spring. In addition to the aquatic environment, critical habitat includes a 12-meter (39.3 feet) wide riparian area along each side of Sycamore and Peñasco Creeks. This riparian zone is believed essential to maintaining the creeks' ecosystem and stream channels, and to conservation of the species (FWS 1986). Known primary constituent elements



(PCE) of critical habitat include clean, permanent water with pools, and intermediate riffle areas and/or intermittent pools maintained by bedrock or by subsurface flow, in areas shaded by canyon walls.

Sonora chub is locally abundant in Sycamore Creek, although the habitat is limited in areal extent (Minckley and Deacon 1968). In México, it is found in the ríos Magdalena and Altar where it is considered relatively secure (Hendrickson and Juárez-Romero 1990). In 1995, Sonora chub were found in California Gulch by the Arizona Game and Fish Department (AGFD 1995).

Sonora chub is a stream-dwelling member of the minnow family, Cyprinidae, and can achieve total lengths of 200 mm (7.8 in) (Hendrickson and Juárez-Romero 1990). In the United States, it typically does not exceed 125 mm (5.0 in) (Minckley 1973), although specimens up to 150 mm (6.0 in) have been measured (J. Carpenter, USFWS, pers.com). The Sonora chub has 63 to 75 scales in the lateral line, and the scales bear radii in all fields. The mouth is inferior and almost horizontal. There typically are eight rays in the dorsal, anal, and pelvic fins, although the dorsal fin can have nine (Miller 1945), and the anal and pelvic fins seven (Rinne 1976). The body is moderately chubby and dark-colored, with two prominent, black, lateral bands above the lateral line (whence the specific epithet, *ditaenia*) and a dark, oval basicaudal spot. Breeding individuals are brilliantly colored (Miller 1945).

Sonora chub spawn at multiple times during spring through summer, most likely in response to floods or freshets during the spring and summer rains (Hendrickson and Juárez-Romero 1990). Although Sonora chub is regularly confined to pools during arid periods, it prefers riverine habitats. In lotic waters in México, Hendrickson and Juárez-Romero (1990) found it commonly in pools less than 0.60 m (2 ft) deep, adjacent to or near areas with a fairly swift current, over sand and gravel substrates. It was less common in reaches that were predominately pools with low velocities and organic sediments. Sonora chub are adept in exploiting small, marginal habitats, and can survive under the severe environmental and hydrologic conditions present in Sycamore Canyon and California Gulch. It is also apparent that they can maneuver upstream past small waterfalls and other obstructions to colonize newly-wetted habitats (Carpenter and Maughan 1993).

Based on collection dates of young-of-the-year (YOY), spawning was initially believed to occur in early spring (Minckley 1973). Larval and juvenile Sonora chub were later found in Sycamore Creek and in a tributary to Rio Altar in November, however, which indicated breeding was apparently not limited by season. Adults with breeding coloration were also taken during these periods (Hendrickson and Juárez-Romero 1990). In Sycamore Creek, adults with breeding colors were seen from April through September in 1990 and 1991. Larvae and juveniles 15 to 18 mm (0.6 to 0.7 in) were seen in April, May, and September (Carpenter 1992) suggesting that spawning occurred after the spring and summer rains. Bell (1984) also noted young after heavy flooding, and suggested that post-flood spawning is a survival mechanism evolved by this species. During spawning, Sonora chub apparently broadcast their eggs onto fine gravel substrates in slowly flowing water, where the eggs develop and hatch. There are no nests built nor parental care given. Larvae likely use shallow habitats at pool margins where they feed on

microscopic organisms and algae. As adults they can exploit shallow to deep pools, and runs and riffles as available.

The overall estimated current chub habitat in the U.S. consists of 16.1 km (10 mi) stream miles in Sycamore Creek and California Gulch including a portion of the riparian area along each side of Sycamore and Peñasco creeks. A recovery plan was written in October 1992, for the Sonora chub. One of the conservation efforts provided deals with all the waters occupied by the Sonora chub in the United States that are within the Nogales Ranger District (RD) of the Coronado NF and about one-half of the drainage is within the Pajarita Wilderness and Goodding Research Natural Area (RNA). These special designations were placed on the area because it had a biological community characterized by Mexican floral and faunal elements that did not otherwise occur, or where elsewhere rare, in the United States (Goodding 1961). Management direction for these special units is to maintain the area in climax vegetation. Removal of minerals, livestock grazing, use of motorized vehicles, and harvest of timber or fuelwood is not permitted, and recreation is limited to non-developed and dispersed use. Livestock grazing is permitted within Pajarita Wilderness outside of Goodding RNA. This management direction is applicable to Sycamore Canyon portions of habitat within the Goodding RNA and /or wilderness. The remainder of Sycamore drainage and California Gulch is open to multiple uses.

Potential threats to Sonora chub are related to additional watershed development. Continued and increased grazing and mining operations in upstream watersheds could result in increased siltation and runoff, increased water demand and withdrawal, and introduced pollutants to the stream. Livestock grazing in riparian areas is usually detrimental to fish habitat, though these impacts have been minimized through section 7 consultation on the allotments that include California Gulch and Sycamore Canyon. Further, livestock grazing is prohibited in the portion of Sycamore Canyon within the Goodding RNA. Predation by nonnative vertebrates is also a threat to populations of Sonora chub. Green sunfish is a known predator on native fish in Arizona (Minckley 1973), and has been implicated in population changes in other lotic fish communities (AGFD 1988). Hendrickson and Juárez-Romero (1990) noted smaller populations of Sonora chub in areas where nonnative fishes were present. Sonora chub were absent when nonnative predators were abundant in reservoirs and highly modified stream habitats. Bullfrogs, common in the California Gulch watershed, have also been implicated in the disappearance of native frogs and fishes in other western aquatic habitats (AGFD 1988). The area of the watersheds occupied by trails and roads have likely increased as cross-border traffic and subsequent interdictions activities have expanded.

There currently exists no survey protocol for Sonora chub, though development of a rigorous protocol was identified as a recovery task in the Sonora Chub Recovery Plan (FWS 1992). The AGFD developed a draft Sonora chub monitoring plan and the USFS has informally proposed a linear habitat sampling protocol for Sycamore Canyon. Neither protocol has yet been finalized.

The absence of rigorous and repeatable species abundance surveys renders it difficult to definitively determine population trends either through direct measures of abundance or the surrogate of habitat availability. Like Sonora chub surveys in the historical record, the recent survey history is composed primarily of field notes from site visits by AGFD, USFWS, and USFS staff as well as academic researchers. Notes from site visits by these entities' staffs

indicate that Sonora chub are detected reliably when habitat is available, though the upstream limits of the species' occurrence in California Gulch appears to be variable based on the presence of nonnative fish - largemouth bass (*Micropterus salmoides*) in particular - at a site referred to as the tinaja, a deep, perennial pool situated just below a small dam. There are no data to indicate that Sonora chub numbers are increasing or decreasing in abundance within the United States, nor does it appear that threats identified in the Final Rule (FWS 1986) or Recovery Plan (FWS 1992) have been appreciably ameliorated.

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

In the agency's initial report documenting Sonora chub in California Gulch, AGFD (1995) recommended that other drainages in the Ríos Altar and Magdalena watershed in the United States be investigated. To date, no additional populations of Sonora chub have been confirmed in these waters, though we note that drought conditions have likely reduced the extent of surface water in the region. In May 2006, USFWS staff confirmed the continued presence of Sonora chub in the headwaters of the Río Cocóspera at Rancho el Aribabi in Sonóra (Duncan 2006).

### **ENVIRONMENTAL BASELINE- Sonora chub**

The action area includes the Nogales RD of the Coronado NF, which encompasses Sycamore Canyon, California Gulch and the streams' respective tributaries. With the exception of small inholdings, the entire U.S. range of the Sonora chub is thus within NF System lands and subject to the aerial application of fire retardant. Moreover, the portion of the Status of the Species section, above, pertaining to the status of the species in the U.S. is thus interchangeable with the status of the species – the Environmental Baseline - in the action area. That portion of the prior narrative is thus incorporated herein via reference.

As discussed previously, Sonora chub have been able to survive in Sycamore Canyon and California Gulch due to the species' ability to respond to wet and dry cycles by expanding into riffles, runs, and pools during wet periods, and then shrinking back to deep pools as the stream dries. On an individual basis, a substantial number of Sonora chub die when they become trapped in habitats that do not sustain water during arid periods (Carpenter and Maughan 1993). Recolonization is dependent on individuals that survive the dry period. This species has a large capacity for reproduction and recruitment as its habitat expands; it can seemingly explode from a small number of individuals occupying newly-wetted habitats in just a few weeks or months. The capability of the population to increase by several orders of magnitude within a few months is most likely an adaptation to the harsh climate and intermittent nature of its habitat, which has allowed the Sonora chub to survive to the present (Bell 1984).

Conversely, the potential for extended residence in isolated pools renders Sonora chub vulnerable to the application of retardant, which could kill those fish which otherwise would have survived and recolonized adjacent waters during periods of post-application elevated runoff. Similarly, the entry of retardant into Sonora chub habitat during elevated runoff could harm fish as they attempt to disperse from pools.

## **EFFECTS OF THE PROPOSED ACTION- Sonora chub**

### Proposed Actions and Retardant Use Guidelines

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for a ten-year period. The BA includes measures that are incorporated in the proposed action that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed threatened, endangered or proposed terrestrial plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and/or populations.

The BA includes in the proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on USFS lands to Sonora chub and its critical habitat. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table B-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, and/or surface run-off and leaching. The BA states that “any forest with more than one retardant drop over the last 10 years would have a “Likely to Adversely Affect” determination for those species and designated critical habitat that occur there.” And the USFS “assumes that all drops within the 300 foot buffer will enter waterways and affect aquatic species.”

The BA identifies the average number of retardant drops by NFs in Table B-4. This table shows that the Coronado NF – within which Sonora chub occur - has had least one retardant drop over the last 10-years; therefore, we must consider the effects of misapplications to Sonora chub occupied and the species’ critical habitat.

### Effects Discussion

This consultation will only focus on proposed actions identified on USFS lands but we note that, in the U.S., Sonora chub are located only the Coronado NF.

Adverse effects of fire retardant products to aquatic species (fish and invertebrates) are discussed in the BA prepared for this consultation and are incorporated herein via reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels. Other components of the fire retardant product may also have toxic effects. Sonora chub may also benefit from the use of fire retardant by preventing the loss of the small localized populations.

Sycamore Canyon and California Gulch, by virtue of being occupied by a listed, aquatic species that would be adversely affected by the application of fire retardant, are mapped as Avoidance Areas in the BA. The designation of the streams in which Sonora chub occurs as Avoidance Areas indicates that only water should be used to protect habitat and populations. We recognize that retardant may be applied when human life is at risk and/or by environmental conditions (i.e. high air and ground surface temperatures that render water ineffective).

Furthermore, the programmatic nature of this consultation requires us to predict human error (misapplication); estimate variables that are pre-determined by the IC at the time of the incident such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped (between 799 and 3,000 gallons/drop); and then estimate a set of operational and environmental factors such as the height and speed of the aircraft, terrain, habitat type, and width of the stream at the time of the retardant drop. Because of the unknown variables associated with future fire retardant drops, we use the best available information provided in the BA to support our discussion and effects determination for Sonora chub.

We used the information provided in Tables B-5 and B-4 (from the BA) to support our conclusions for misapplications on USFS land over the next 10-years (Table 30, below). We applied the 0.42% misapplication rate to the average number of drops that occurred within the Coronado NF (i.e. 1,429 drops/11 years of past applications X 10 years of future implementation = 1,299 drops, and  $1,299 \times .0042 = 5.46$  drops or 6 when rounded up). We then multiplied the number of missed drops by the extent of stream miles where adverse effects are anticipated to occur 6.2 miles, per Norris and Webb (1989) to determine the stream miles anticipated to be affected on the entire Coronado NF over the next 10 years.

**Table 29. Number of Anticipated Misapplications on USFS land over the next 10-years: Sonora chub**

NF	Total Number of Drops 2000-2010	Sonora chub populations	Number of Anticipated Misapplications	Extent of Stream Miles (6.2miles/drop)
Coronado	1,429	1	6	37.2

The Sonora chub population (likely consisting of 2 metapopulations) on the Coronado NF is small, geographically confined, and limited in terms of inhabited stream miles. We estimate that no more than 10 stream miles may be occupied under conditions of heavy runoff; the intermittent or perennial/interrupted nature of the streams within Sycamore Canyon and California Gulch, compounded by dry season low-flows and/or extended drought conditions may reduce the



actually occupied mileage appreciably. Based on the calculations in Table 30, above, we anticipate 6 misapplied retardant drops will occur on the Coronado NF over the next 10 years, affecting approximately 37.2 miles of the NF's waterways. Because all misapplications of retardant within the 300-foot buffer are assumed to enter the associated waterway – potentially including the 10 stream miles in which Sonora chub occur - we believe appreciable adverse effects to individuals and/or populations may occur, and that even a single occurrence could be catastrophic to Sonora chub, especially during drought or low water conditions.

Based on a recent history of emergency consultations, the USFWS is not aware of any wildfire during which a retardant drop entered either Sycamore Canyon or California Gulch. We anticipate that there is a low probability that all 6 presumed misapplications of retardant Forest-wide will occur on the Nogales RD in streams occupied by Sonora chub. We can reasonably anticipate, however, that even a single entry of misapplied retardant into the limited habitat occupied by Sonora chub will result in direct mortality to the fish as well as indirect effects via macroinvertebrate prey base losses as described in the Chemical Response of Retardants in Water, Fish Response to Retardant Toxicity, and Macroinvertebrates Response to Retardant Toxicity sections of the BA. If a misapplied retardant drop or drops occur during times when either stream exists in a perennial interrupted or intermittent state with Sonora chub occupying permanent pools, the effects may be spatially limited. Subsequent periods of elevated runoff, however, may then spread the retardant downstream. If a misapplied retardant drops or drops occur during periods when pools are connected via wetted runs and riffles, we anticipate more widespread mortality, spawning, and food-chain effects. Moreover, the mainstem streams of Sycamore Canyon and California Gulch are only approximately 3 miles apart and their headwaters are nearly adjacent in some areas. It is reasonable to assume that a single wildfire could affect both streams; the associated risk of the misapplication of retardant, while potentially reducing the effects of the wildfire itself, could nevertheless kill fish, affect spawning, and/or reduce the habitat occupied by the species in the U.S. in both streams. And while recolonization from downstream areas (i.e. México) is occurring under present conditions and as runoff allows, we are concerned that a retardant drop or drops affecting either or both streams in the U.S. could have long-lasting consequences in terms of recruitment of U.S. fish to the populations in México, thus reducing future, upstream recolonization potential from the latter.

The USFS has proposed two species-specific conservation measures intended to minimize the adverse effects discussed above. These measures are as follows:

1. The USFS will assist the USFWS and the Arizona Game and Fish Department (AGFD) in developing a Sonora chub salvage protocol whereby some fish may be removed from harm's way during a fire event but before suppression actions affecting the chub are implemented. Such salvage would take place only if and when safety considerations permit and specimens from the Sycamore Canyon and/or California Gulch watersheds would be placed into facilities for eventual repatriation, if needed. This salvage plan will be developed prior to the onset of the 2012 fire season.
2. The USFS will also assist the USFWS and AGFD in developing a Sonora chub captive rearing protocol in order to provide stock for repatriation should a retardant drop result in the extirpation of Sonora chub from the U.S. The assistance shall include, but be not

limited to technical input or assistance with locating suitable rearing sites (i.e. stream reaches not occupied due to barriers and/or ponds) on USFS lands within the Sycamore Canyon and California Gulch Watersheds as well as suitable off-site locations (i.e. existing aquaria and hatcheries). This rearing and repatriation plan shall be in place prior to the 2015 fire season.

The effects of retardant misapplication are likely to be severe, though also temporary. The salvage and rearing-related conservation measures described above are intended to ensure that Sonora chub are able to be removed before the effects of a retardant misapplication occur and be repatriated to the stream after the retardant's effects have abated. We anticipate salvage measures will be effective, as the post-fire salvage and subsequent repatriation of Gila chub (*G. intermedia*; a congeneric species to Sonora chub) from streams affected by the 2003 Aspen Fire on the Santa Catalina RD of the Coronado NF was successful. We also anticipate that captive rearing of Sonora chub will be successful; the Arizona-Sonora Desert Museum, under a section 10(a)(1)(A) permit, presently rears the species for display in aquaria.

In summary, the analytical approach described above has led us to determine that there may be at least one misapplication of retardant to Sonora chub habitat over the ten-year term of the proposed action. Given the high endemism of Sonora chub in the U.S. and the limits of its range on the Coronado NF, we anticipate that the proposed action will appreciably, though temporarily, affect the species' reproduction, numbers, and distribution. We anticipate that implementation of the species-specific conservation measures will ensure that Sonora chub will persist in Sycamore Canyon and California Gulch after up to six retardant misapplications over ten years.

### Critical Habitat

There is one Sonora chub critical habitat unit in existence, and it is entirely on USFS lands on the Nogales RD within Sycamore Canyon. Primary constituent elements for Sonora chub critical habitat include clean, permanent water with pools, and intermediate riffle areas and/or intermittent pools maintained by bedrock or by subsurface flow, in areas shaded by canyon walls. Considering the toxicity studies of Phos-Chek to algae and benthic macroinvertebrates were shown to have adverse effects to primary producers and aquatic invertebrates (McDonald *et al.* 1995), and the toxicity of field applications are higher than the lab studies (for accidental retardant delivery); the application of retardants to Sonora chub critical habitat will likely alter the biodiversity and trophic dynamics in the stream and will result in short term adverse effects to the food source for the species.

Sycamore Canyon's designation as critical habitat for Sonora chub has resulted in the area being mapped as an Avoidance Area in the BA. As discussed above, only water is intended to be aerially applied to Avoidance Areas unless human life is at risk or there is a human error in application. The programmatic nature of this consultation, however, necessitates that we anticipate misapplications of retardant to streams. Further, we were informed by the USFS that retardant is a necessity for wildfire suppression on the Nogales Ranger District due to the area's high heat and ground surface temperatures during the summer fire season (B. Barrera, pers. comm.).



Again, we employed the probability-based analytical framework described above to determine that the 10-year proposed action will result in 6 misapplications of retardant to 37.2 miles of waterways on the Coronado NF, possibly including a misapplication to the 6.5 miles of critical habitat in Sycamore Canyon and its tributaries. Norris and Webb (1989) found that retardant drops affect 6.2 miles of stream; one misapplication of retardant could therefore affect nearly the entire critical habitat. This directly affects the component of the PCEs associated with clean water. While these effects may be severe, we do not anticipate that they will be permanent; retardant is likely to enter, affect, and be flushed from the stream within a single season due to the tendency for Sycamore Canyon and California Gulch to exhibit episodes of intense precipitation and flashy hydrology during the summer monsoon season. We anticipate that the streams' aquatic macroinvertebrate communities will be only temporarily affected, as they are adapted to persist within and recolonize sites despite the area's extreme hydrology.

The remaining PCEs - permanent water with pools, and intermediate riffle areas and/or intermittent pools maintained by bedrock or by subsurface flow, in areas shaded by canyon walls – are components of physical habitat and not anticipated to be measurably affected by the misapplication of retardant.

These analyses indicates that the proposed action unlikely to appreciably reduce the Sonora chub's critical habitat's ability to continue to support the species' ability to survive and recover in the wild.

### **Cumulative Effects- Sonora chub**

Cumulative effects to Sonora chub include ongoing activities in the watershed such as livestock grazing and associated activities not administered by the USFS, irrigated agriculture, groundwater pumping, stream diversion, bank stabilization, channelization, and recreation. Some of these activities, such as irrigated agriculture, are declining and are not expected to contribute substantially to cumulative long-term adverse effects to Sonora chub.

Other activities, such as recreation are increasing. Increasing recreational, residential, or commercial use of the private lands near the riparian areas would likely result in increased cumulative adverse effects to occupied Sonora chub habitat through increased water use, increased pollution, and increased alteration of the streambanks through riparian vegetation suppression, bank trampling, and erosion.

Sycamore Canyon and California Gulch also receive substantial and increasing amounts of traffic by undocumented aliens and smugglers. The effects of this cumulative action include erosion from numerous wildcat trails, contamination from garbage and human waste, and wildfires; these effects are largely unmitigated.

In 2009, USFWS documented a substance assumed to be a drilling compound entering California Gulch from a series of drill pads in Sonora, México. The nature of the substance is unknown and beyond the potential for it to be toxic to aquatic life, it appears sufficiently fine to result in the embedding of substrate and occlusion of fishes' gills. We are not presently aware if the material

is still entering the stream, but it unlikely to have been removed or remediated by authorities in México.

### **Conclusion - Sonora chub**

After reviewing the current status of the Sonora chub, the environmental baseline for the action area, the effects of the proposed action (including conservation measures), and the cumulative effects, it is the USFWS's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Sonora chub, and is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

1. Sycamore Canyon and California Gulch have been designated as Avoidance Areas within which the default management direction is to apply water rather than retardant.
2. The misapplication of retardant is likely to temporarily reduce the aquatic macroinvertebrate prey base on multiple occasions over the life of the proposed action. However, although the application of the Phos-Chek chemicals will cause short-term adverse effects, it will not render the affected area unsuitable for Sonora chub reestablishment in the future.
3. The USFS has proposed, with USFWS and AGFD assistance, to implement two species-specific conservation measures (salvage and captive rearing) that will allow for Sonora chub to be temporarily removed from the effects of misapplied retardant and quickly repatriated once conditions are favorable.

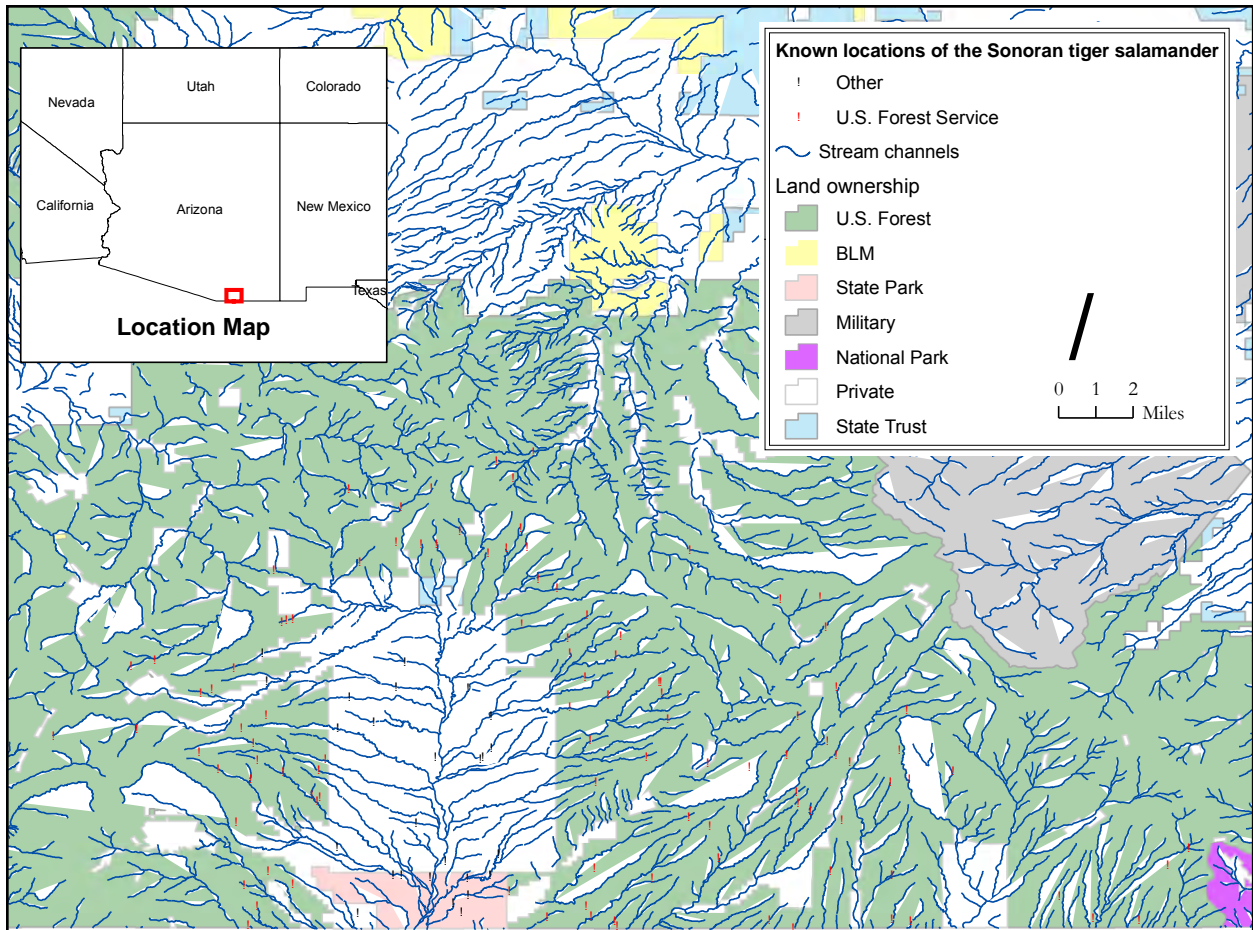
### **Sonoran tiger salamander (*Ambystoma mavortium tigrinum*)**

#### Environmental Baseline

The Sonoran tiger salamander is currently restricted to small, isolated populations scattered throughout its historical range from the crest of the Huachuca Mountains west to the crest of the Patagonia Mountains, including the San Rafael Valley and adjacent foothills from its origins in Sonora north to the Canelo Hills. Most of the historical range and currently occupied habitat of the Sonoran tiger salamander falls within the Sierra Vista Ranger District of the Coronado National Forest. Sonoran tiger salamanders breed almost exclusively in livestock tanks. These livestock tanks host approximately 80% of all populations of Sonoran tiger salamanders, and are vital to preserving genetic diversity and the continued existence and future conservation of the species. Prior to the 20th century, the range of the species contained many more cienegas and vernal pools than it does today. Erosion and arroyo cutting in the late 19th and early 20th centuries caused the water table to drop and natural standing water habitats to disappear (Hendrickson and Minckley 1984, Hadley and Sheridan 1995). At the same time natural standing water habitats were disappearing, livestock tanks (earthen man-made impoundments) were built to water cattle. Many of the remaining springs and cienegas were converted into impoundments, so most of the small standing water habitats remaining are livestock tanks.

During annual Sonoran tiger salamander monitoring conducted from 2001-2011, salamander eggs, larvae, branchiatae, and/or metamorphs were found at least once in 132 livestock tanks, springs, and cienegas (US Fish and Wildlife Service 2007, Service files). Eighty percent (n = 106) of these locations are livestock tanks in drainages on Forest Service lands where wildfires are common and suppression activity has occurred and is expected to occur in the future (Figure 1). Remaining locations are on private and state administered lands. The majority (n = 100) of the locations on Forest Service lands have been occupied by Sonoran tiger salamanders within the past five years. Sonora tiger salamander eggs were detected in livestock tanks during all months that they have been surveyed (November through June), although it is unknown if they breed outside of the survey season (Service files). The proportion of larvae that metamorphose into terrestrial salamanders depends heavily on livestock tank permanence (U.S. Fish and Wildlife Service 2002, Service files). In tanks that dry, all larvae that are large enough (>45 mm snout vent length) metamorphose. Unlike other subspecies of tiger salamanders, Sonoran tiger salamander larvae in permanent water often develop into branchiate adults that stay in the pond throughout their lives, with ponds supporting up to several hundred branchiatae (U.S. Fish and Wildlife Service 2002, Service files). Branchiate adults have been detected in livestock tanks in every month of the year (U.S. Fish and Wildlife Service 2007, Service files). Branchiate adult tiger salamanders prey on zooplankton and a variety of macroinvertebrates, and eat salamander eggs and larvae during the breeding season (Holomuzki 1986). Approximately 17 percent of larvae that are large enough metamorphose in livestock tanks that do not dry (Collins *et al.* 1988).

Figure 1. Sonoran tiger salamander locations detected between 2000 and 2011.



Effects of the Action

Actions described within the BA refer to effects from aerial delivery of fire retardant for a 10-year period. The BA includes conservation measures intended to minimize the effect of aerial fire retardant delivery such as mapping avoidance areas where a 300 foot buffer will be delineated as a drop-free zone. These avoidance areas are predominantly wetted areas that include perennial, intermittent, or ephemeral streams, estuaries, lakes/ponds, playas, reservoirs, and swamp/marsh lands. The BA also identified other conservation measures that included 1) using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; 2) avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species; and 3) specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas.

Some occupied sites, such as low-volume waters or stock tanks might not be recognized by the original dataset used for avoidance area mapping. However, the BA states that (page 167, August 2011 BA) "avoidance area mapping is required to minimize the impacts of the use of aerial fire retardant on...sites where the Sonoran tiger salamander and Chiricahua leopard frog occur". Email records between USFWS Region 2 and USFS Region 3 (May 9 and 12, 2011) provide documentation and concurrence from USFWS with the Fire Retardant Avoidance Mapping justifications. We understand these avoidance mapping requirements are specific to

USFS Region 3's listed threatened and endangered species (including designated critical habitat) and will be incorporated in the final BA. We also understand these maps are not available at this time for our review; however, local coordination between Service and USFS biologists is required annually to ensure that "any updates that are needed for retardant avoidance areas on National Forest System lands are mapped using the most up-to-date information" (page 4, August 2011 BA). All extant populations of Sonoran tiger salamanders on Forest Service lands occur in small livestock tanks. Protection of these populations is essential to preserving the genetic diversity and to the recovery potential of the species.

The BA, in Table ABA-5 and ensuing discussion on page 108, states that despite avoidance area mapping and other precautions in place to minimize exposure of sensitive species and habitat to retardant, misapplications do occur as a result of accidental delivery, drift, and/or surface run-off and leaching. Specifically, the Forest Service anticipates there is a 0.42 percent chance of a misapplication occurring for every one drop. In Appendix B, Tables B-4 and B-5, the BA provides data for individual Forests on the total number of retardant drops, the average number of drops per year, and the number of total fires from 2000 to 2010. This table shows that the Coronado National Forest where Sonoran tiger salamander occurs had 1,429 retardant drops over the last 10-years. All things remaining the same, we would expect 6 misapplication drops in avoidance areas on the Coronado National Forest over the next 10 years ( $1,429/11 \times 10 = 1299.1$ , and  $1299.1 \times 0.0042 = 5.46$  drops or 6 when rounded up). Because all drops that occur within the 300 foot buffer are assumed to enter waterways; stock tanks within or downstream of these waterways where Sonoran tiger salamanders occur are likely to be adversely affected by introduced retardants. However, because of the uncertainty of Sonoran tiger salamander sites to be included in avoidance mapping, this misapplication rate results in a complicated analysis.

We believe adverse effects to individuals and/or populations will occur from the application of retardants on USFS lands. Because all sites occupied by the Sonoran tiger salamander are small and may not be recognized as waterways during avoidance mapping, we expect a higher percentage of drops will affect extant populations resulting in adverse effects to the Sonoran tiger salamander at a minimum, if not we expect 100 percent mortality of affected populations as a result of additional stressors acting on wild populations, such as low dissolved oxygen (DO), ash, increased water temperatures, and other conditions expected as the result of a nearby fire. The chemical response of retardants in water and ecological considerations for retardant toxicity were discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels.

The Forest Service recognizes that many species on its lands, including Sonoran tiger salamander, occur in small isolated populations so that if a retardant misapplication occurs it could have significant effects on such species and their habitats. The BA provides limited discussion of potential effects of retardant on all nine amphibians addressed. Retardants and other fire fighting products are often ammonia-based, which in itself can be potentially toxic, and may contain other contaminants that may bioaccumulate (Hale et al. 2002, Pilloid et al. 2003, Labat Environmental 2007). Many formulations contain yellow prussiate of soda (sodium ferrocyanide, YPS), which is added as an anticorrosive agent which can increase overall toxicity,



however the Phos-Chek family of formulations do not contain sodium ferrocyanide and is therefore not considered in this consultation. Toxicity of fire retardants is typically found to be low in the laboratory, but in the field, toxicity of retardants can be photo-enhanced by ambient UVB and of particular concern to fish and amphibians based on tests involving to the southern leopard frog (*Lithobates sphenoccephala*) and rainbow trout (Calfée and Little 2003). The toxicity of different formulations appear to react differently to UV radiation; Phos-Chek D75-R toxicity was unaffected by UV exposure while that of D75-F doubled (Calfée and Little 2003). Angeler and Moreno (2006) found that retardant “clearly” affected nutrients and indirectly affected other parameters such as chlorophyll a, pH, DO, and steady-state turbidity and that at least two hydrologic cycles may be necessary for a contaminated water body to return to pre-contamination condition. Calfée and Little (2003) stated that amphibians are perhaps the most at-risk from lethal exposure because they often reside in shallow, low water volume habitat that is not readily visible from the air and therefore more susceptible to direct hits. Another concern expressed by Calfée and Little (2003) was that low water volume habitat has limited recharge from uncontaminated water and therefore is more susceptible to concentrations reaching lethal limits.

#### Cumulative Effects

The cumulative effects in the action area are difficult to analyze, considering the broad geographic landscape included in the action area, the uncertainties associated with non-Federal actions are difficult to predict. Whether those effects will increase or decrease in the future is not known; however, based on the human subpopulation and growth trends effects of non-Federal actions are likely to increase. Effects from these non-Federal 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 less restrictive management standards.

#### Conclusion

After reviewing the current status of the Sonoran tiger salamander, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service’s biological opinion that the proposed action is not likely to jeopardize the continued existence of the Sonoran tiger salamander. We base this conclusion on the following:

1. The Forest Service has committed to include known occupied Sonoran tiger salamander habitat in their avoidance mapping strategy. The protocols in place to minimize the risk to these identified areas are expected to reduce the likelihood for a misapplication in Sonoran tiger salamander habitat.

### **Spikedace (*Meda fulgida*) and Loach minnow (*Tiaroga cobitis*)**

Spikedace was listed as a threatened species on July 1, 1986 (51 FR 23769). Critical habitat was designated on March 21, 2007 (72 FR 13356). Critical habitat includes portions of the Verde, middle Gila, lower San Pedro, and upper Gila rivers, and Aravaipa Creek, as well as several

tributaries of those streams. Following a legal challenge to that designation, we filed a motion for voluntary remand and are currently re-evaluating critical habitat. However, those areas designated as critical habitat in the 2007 rule remain in place until a new designation can be finalized. A proposed rule to redesignate critical habitat and reclassify spikedace as an endangered species was published on October 28, 2010 (75 FR 66482), and we anticipate publication of a final rule in early 2012. Additional information regarding the species natural history can be found in the proposed rule published on October 28, 2010 (75 FR 66482) or at <http://www.fws.gov/southwest/es/arizona/Spikedace.htm>.

The proposed action, which will occur over a 10 year span, may have both direct and indirect effects on spikedace and its critical habitat. Misapplication of fire retardant products within the 300-foot buffer area of occupied streams or designated critical habitat, aerial drift of fire retardant from applications outside the buffer area, post-application runoff due to rainfall events (especially where significant vegetation loss may have occurred during a fire), and accidental spills of retardant during transport to staging areas or loading operations can all result in fire retardant entering waters occupied by spikedace and/or designated as their critical habitat. The Biological Assessment (BA) concludes that Norris and Webb (1989) showed ammonia concentrations could remain at lethal levels between 0 and 6.2 miles downstream, depending on stream characteristics and the size of the retardant load.

The adverse effects of fire retardant products to aquatic species are described in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects can be lethal or sublethal. Lethal effects include a build-up of un-ionized ammonia to levels that cause death of aquatic animals. In addition to the ammonia resulting from retardant misapplication, smoke adsorption occurring as a result of the fire can result in increased ammonia levels. Misapplication of fire retardant can further exacerbate the situation by increasing the amount of smoke produced in a fire. The BA details the results of studies, including the persistence and concentration levels of applied retardant, in various scenarios.

Sublethal effects are those which may cause injury, but not death, to an animal. The BA concludes that skin, eye, gill, liver, and kidney damage may occur. Fire retardant application may affect hatching success, and reduce growth rates, as well as impair morphological development. As with lethal effects, misapplication of fire retardant can compound existing habitat quality issues caused by the fire, including low dissolved oxygen, increased water temperatures, and ash in the water.



The BA also describes measures that will be taken to minimize the impacts of the action on aquatic species such as spikedace. These measures include creation of 300-foot Aquatic Avoidance Areas around sensitive species, and development of a transportation and handling plan that will address spill prevention and containment.

The BA concludes that fire retardant misapplications can have biologically significant effects to aquatic communities. The Forest Service has determined that, based on the three years of misapplication data described in the BA, they predict a 0.42% chance of retardant hitting water or the buffer, and as a result, for Forests with more than one retardant drop per year, there is a 0.1 percent probability of hitting water. Because site specific information for retardant drops is not available, we must consider the effects of all possible scenarios to spikedace and loach minnow and to their designated and proposed critical habitat.

## ENVIRONMENTAL BASELINE

### Spikedace (*Meda fulgida*)

The proposed action area includes all National Forest System lands within the continental United States. Spikedace occur in portions of Region 3 of the National Forest System, with occupancy or critical habitat occurring in the Apache-Sitgreaves, Coconino, Prescott, and Tonto National Forests in Arizona and the Gila National Forest in New Mexico. Spikedace occur in five populations: Aravaipa Creek, Eagle Creek, and the Verde River in Arizona, and the Upper Gila and Gila Forks populations in New Mexico. They are common only in Aravaipa Creek and the Upper Gila River. There are small spikedace populations in the Verde River, Eagle Creek, and the three forks of the Gila River. These populations are already at risk, with decreasing spikedace detections over time. The last detections for spikedace in each of these systems was 2011 in Aravaipa Creek; 1980 for Eagle Creek; 1999 for the Verde River; 1989 for Eagle Creek; 2011 for the Gila River mainstem; 2005 for the West Fork Gila River; 1995 for the Middle Fork Gila River; and 2000 for the East Fork Gila River (Marsh *et al.* 1990; M. Brouder, U.S. Fish and Wildlife Service, pers. comm. 2002; Stefferud and Reinthal 2005; Paroz *et al.* 2006; Propst 2007; Propst *et al.* 2009). Spikedace have been translocated into Fossil Creek, a tributary to the Verde River (Robinson 2009a; Boyarski *et al.* 2010); Bonita Creek, a tributary to the Gila River (Robinson *et al.* 2009a); Hot Springs and Redfield canyons, tributaries to the San Pedro River (Robinson 2008) in Arizona; and the San Francisco River in New Mexico. These translocation efforts, however, are relatively recent, and insufficient time has elapsed to determine whether they will be successful in establishing new populations. With the exception of Aravaipa Creek, each of the five spikedace populations occurs at least in part on Forest Service lands. Table 31 provides a summary of species occurrence and critical habitat by individual forest.

**Table 30. Spikedace occupancy and critical habitat by Forest**

Forest	Occupied Streams	Designated and Proposed Critical Habitat
Apache-Sitgreaves National Forests		Campbell Blue Creek, Blue River, Little Blue Creek, San Francisco River
Coconino National Forest – Arizona	Verde River, Oak Creek, Beaver/Wet Beaver Creek, West Clear Creek, Fossil Creek*	Verde River, Oak Creek, Beaver/Wet Beaver Creek, West Clear Creek, Fossil Creek
Gila National Forest – New Mexico	Gila River, West, Middle, and East Forks Gila River, San Francisco River*	Gila River, West, Middle, and East Forks Gila River, San Francisco River, Pace Creek, Dry Blue Creek, Frieborn Creek, Campbell Blue Creek, Blue River
Prescott National Forest – Arizona	Verde River	Verde River
Tonto National Forest	Fossil Creek*, Tonto Creek, Rye Creek, Greenback Creek, Rock Creek, Spring Creek	Fossil Creek, Tonto Creek, Rye Creek, Greenback Creek, Rock Creek, Spring Creek

\*Translocated or reintroduced populations.

Loach Minnow (*Tiaroga cobitis*)

The proposed action area includes all National Forest System lands within the continental United States. Loach minnow occur in portions of Region 3 of the National Forest System, with occupancy or critical habitat occurring in the Apache-Sitgreaves, Coconino, Prescott and Tonto National Forests in Arizona and the Gila National Forest in New Mexico. Loach minnow occur in 7 populations in the following streams and some of their tributaries: Aravaipa Creek, Eagle Creek, the Blue River, White River, and the North Fork East Fork Black River in Arizona, and the San Francisco River and Upper Gila and Gila Forks populations in New Mexico. They are common only in Aravaipa Creek and the Upper Gila River (M. Lopez, AGFD pers. comm. 2000; ASU 2002; Marsh *et al.* 2003; S. Gurtin, AGFD, pers. comm. 2004; Stefferud and Reinthal 2005; Carter 2007; Carter *et al.* 2007; Paroz and Propst 2007; Propst 2007; C. Carter, AGFD, pers. comm. 2008; Clarkson *et al.* 2008; Bahm and Robinson 2009; Propst *et al.* 2009; Robinson 2009b; Robinson *et al.* 2009b). There are small loach minnow populations in Eagle Creek and

the three forks of the Gila River (Marsh *et al.* 1990; Marsh *et al.* 2003; Carter 2007; Paroz and Propst 2007; Propst 2007; Robinson *et al.* 2009b). These populations are already at risk, with decreasing spinedace detections over time. Loach minnow are considered extirpated from the Verde River, where they were last detected in 1937 (ASU 2002). Their status is currently unknown in the White River system. A detailed description of occupancy of these streams and their tributaries is available in the proposed rule for critical habitat designation from 2010 (75 FR 66482).

Loach minnow have been translocated into Fossil Creek, a tributary to the Verde River (Robinson 2009a; Boyarski *et al.* 2010); Bonita Creek, a tributary to the Gila River (Robinson *et al.* 2009a); and Hot Springs and Redfield canyons, tributaries to the San Pedro River (Robinson 2008) in Arizona. These translocation efforts, however, are relatively recent, and insufficient time has elapsed to determine whether they will be successful in establishing new populations. With the exception of Aravaipa Creek, each of the seven loach minnow populations occurs at least in part on Forest Service lands. Table 32 provides a summary of species occurrence and critical habitat by individual forest.

**Table 31. Loach minnow occupancy and critical habitat by Forest**

Forest	Occupied Streams	Designated and Proposed Critical Habitat
Apache-Sitgreaves National Forests	North Fork East Fork Black River, Coyote Creek, Campbell Blue Creek, Blue River, and Eagle Creek. NOTE: The White River and its tributaries, while occupied by loach minnow, are not on Forest Service lands, and are therefore not mentioned further in this analysis.	East Fork Black River, North Fork East Fork Black River, Coyote Creek, Boneyard creek, Campbell Blue Creek, Blue River, Little Blue Creek, San Francisco River
Coconino National Forest – Arizona	Fossil Creek*	Verde River, Oak Creek, Beaver/Wet Beaver Creek, Fossil Creek
Gila National Forest – New Mexico	Gila River, West, Middle, and East Forks Gila River, San Francisco River, Tularosa River, Negrito Creek, Pace Creek, Dry Blue Creek, Frieborn Creek, Campbell Blue Creek, Blue River	Gila River, West, Middle, and East Forks Gila River, San Francisco River, Pace Creek, Dry Blue Creek, Frieborn Creek, Campbell Blue Creek, Blue River

Prescott National Forest - Arizona	Fossil Creek*	Verde River
Tonto National Forest	Fossil Creek*	Fossil Creek

\*Translocated population

### Spikedace and Loach Minnow Critical Habitat

Critical habitat was designated for both spikedace and loach minnow in 2007 (54 FR 13356) and again in 2010 (75 FR 66482). In response to challenges to the 2007 designation under *Coalition of Arizona/New Mexico Counties for Stable Economic Growth, et al. v. Salazar, et al.* (D.N.M.), the Fish and Wildlife Service (Service) requested and was granted a voluntary remand of the 2007 critical habitat designation. In 2010, we published a proposed rule for critical habitat. The 2007 designation will remain in place until such time as the 2010 rule is finalized in 2012.

For both the 2007 and 2010 critical habitat documents, we assessed which physical and biological features are essential to the conservation of the species; however, the terminology used in the two documents differs. In the 2007 designation, these features were called “primary constituent elements,” or “PCEs” whereas in 2010, we changed the term to “physical and biological features,” or “PBFs”. Regardless of the term, under section 7, we analyze the impacts of the proposed action on the physical and biological features essential to the conservation of the species.

### **Apache-Sitgreaves National Forest**

*Spikedace.* Within the ASNF, Eagle Creek is the only river currently considered occupied by spikedace. Spikedace were first identified in the stream in 1985 (Bestgen 1985) and last detected in 1989 (AGFD 2004). The stream is still presumed to be occupied, albeit at low numbers (Marsh 1996; Bahm and Robinson 2009). Plans are underway for a translocation of spikedace into the Blue River. In addition, spikedace have been reintroduced into the San Francisco in New Mexico; however, they are well-upstream of the New Mexico-Arizona state boundary, but are not known to have reached those portions of the San Francisco River within the ASNF.

No critical habitat was designated on the Apache-Sitgreaves for spikedace in 2007. However, for the proposed critical habitat designation in 2010, the ASNF contains significant percentages of the overall stream designation for several streams, including Blue River (84%); Campbell Blue Creek (84%); Little Blue Creek (100%); the San Francisco River (20%); and Eagle Creek (27%) (75 FR 66482). Each of these streams is considered perennial throughout its length on the ASNF (TNC 2006). As a result, the proposed action has the ability to affect significant portions of proposed critical habitat.

*Loach minnow.* Within the ASNF, the North Fork East Fork Black River, Coyote Creek, Campbell Blue Creek, Blue River, and Eagle Creek are currently considered occupied by loach minnow (Carter 2007; Carter *et al.* 2007; Clarkson *et al.* 2008; Bahm and Robinson 2009; Robinson 2009; Robinson *et al.* 2009b). Critical habitat was designated on the Apache-Sitgreaves for loach minnow in 2007, and proposed again in 2010. Streams included in the 2007

designation are East Fork Black River, North Fork Black River, Boneyard, Creek, Campbell Blue Creek, Blue River, Little Blue Creek, and the San Francisco River (72 FR 13356). The 2010 proposed designation includes these streams, as well as Coyote Creek (75 FR 66482).

Of streams proposed as critical habitat, the Apache-Sitgreaves contains significant percentages of the overall stream designation for several streams, including Blue River (84%); Campbell Blue Creek (84%); Little Blue Creek (100%); the San Francisco River (20%); and Eagle Creek (27%) (75 FR 66482). Each of these streams is considered perennial throughout its length on the ASNF (TNC 2006). As a result, the proposed action has the ability to affect significant portions of proposed critical habitat.

### **Coconino National Forest**

*Spikedace.* Within the Coconino National Forest, the Verde River is considered to be occupied by spikedace. The last spikedace was observed on the Verde River in 1999 (Brouder 2002). Historical records do exist for Beaver Creek (1937 and 1938) and for West Clear Creek (1937) (ASU 2002). In 2007, wildlife management agencies translocated spikedace into Fossil Creek as part of the species' recovery efforts. Monitoring in 2011 resulted in visual detection of 69 spikedace in Fossil Creek (C. Crowder, Arizona Game and Fish Department, pers. comm. 2011).

In 2007, critical habitat was designated on the Verde River for spikedace, and includes 43 miles of the Verde River, of which 5.75 miles form the western boundary of the Coconino National Forest. Of the 2007 designated critical habitat, the Coconino National Forest contains 13% of the overall designation on the Verde River.

In 2010, the proposed designation included within Unit 1 approximately 106.7 miles of the Verde River, as well as tributary channels to the Verde River that fall within the Coconino National Forest boundaries. Of streams proposed as critical habitat for spikedace in 2010, the Coconino contains significant percentages of the overall stream designation for several streams, including the Verde River (31%); Beaver and Wet Beaver Creeks (100%); Fossil Creek (100%); Oak Creek (31%); and West Clear Creek (52%). Each of these streams is considered perennial throughout its length (TNC 2006). As a result, the proposed action has the ability to affect significant portions of proposed critical habitat.

*Loach minnow.* Within the Coconino National Forest, the Verde River is not considered to be occupied by loach minnow, as the last known loach minnow was detected in 1938 (ASU 2002). Loach minnow are not known to occupy any other streams within the Coconino National Forest; however, in 2007, wildlife management agencies translocated loach minnow into Fossil Creek as part of the species' recovery efforts. Monitoring in 2011 resulted in visual detection of one loach minnow in Fossil Creek (C. Crowder, AGFD, pers. comm. 2011). Insufficient time has elapsed to determine if Fossil Creek will ultimately support a self-sustaining population of loach minnow.

In 2007, no critical habitat was designated on the Verde River for loach minnow; however, the proposed designation published in 2010 includes 74.4 miles of the Verde River, of which 5.75 miles form the western boundary of the Coconino National Forest. In addition, tributary

channels to the Verde River that fall within the Coconino National Forest boundaries are part of Unit 1 of the proposed critical habitat designation from 2010. Of streams proposed as critical habitat in 2010, the Coconino contains significant percentages of the overall stream designation for several streams, including the following percentages of the proposed critical habitat designation: 8% - Verde River, 31% - Beaver and Wet Beaver Creeks; 100% - Fossil Creek; and 31% - Oak Creek. Each of these streams is considered perennial throughout its length. As a result, the proposed action has the ability to affect significant portions of proposed critical habitat.

### **Gila National Forest**

*Spikedace.* Within the Gila National Forest, occupied spikedace streams include the Gila River, West Fork Gila River, Middle Fork Gila River, East Fork Gila River, and Mangas Creek (Paroz *et al.* 2006, pp. 62–67; Propst 2007; NMDGF 2008; Propst *et al.* 2009). The Gila River currently supports the largest remaining population of spikedace. In addition, spikedace were reintroduced into the San Francisco River were in 2008. Insufficient time has elapsed to determine if the San Francisco River will ultimately support a self-sustaining population of loach minnow.

In 2007, critical habitat was designated on the Gila River, West Fork Gila River, Middle Fork Gila River, and East Fork Gila River. The 2010 critical habitat proposal includes all of these areas, in addition to the San Francisco River, Mangas Creek, and portions of Campbell Blue Creek, the Blue River, and Pace, Frieborn, and Dry Blue creeks. Of streams proposed as critical habitat, the Gila contains significant percentages of the overall stream designation for several streams, including the San Francisco River (43%); Dry Blue Creek (100%); Pace Creek (100%); Frieborn Creek (100%); mainstem Gila River (48%); West Fork Gila River (54%); Middle Fork Gila River (92%); and East Fork Gila River (79%). As a result, the proposed action has the ability to affect significant portions of proposed critical habitat.

*Loach minnow.* Within the Gila National Forest, occupied loach minnow streams include the San Francisco River, Tularosa River, Negrito Creek, Dry Blue Creek, Frieborn Creek, Pace Creek, Blue River, Campbell Blue Creek, Gila River, West Fork Gila River, Middle Fork Gila River, and the East Fork Gila River (ASU 2002; Carter 2007; Carter *et al.* 2007; Clarkson *et al.* 2008; Propst 2007; NMDGF 2008; Bahm and Robinson 2009; Propst *et al.* 2009; Robinson 2009; Robinson *et al.* 2009b). Three additional streams, Whitewater, Mangas, and Bear creeks, occur just off of the Gila National Forest or on private inholdings within the Gila National Forest. The Gila River currently supports the largest remaining population of loach minnow.

In 2007, critical habitat was designated on the San Francisco River, Tularosa River, Negrito Creek, Dry Blue Creek, Frieborn Creek, Pace Creek, Blue River, Campbell Blue Creek, Gila River, West Fork Gila River, Middle Fork Gila River, and the East Fork Gila River. The 2010 critical habitat proposal includes all of these areas, as well as portions of Bear Creek and Mangas Creek. Of streams proposed as critical habitat, the Gila contains significant percentages of the overall stream designation for several streams, including the San Francisco River (38%); Dry Blue Creek (100%); Pace Creek (100%); Frieborn Creek (100%); the mainstem Gila River (48%); West Fork Gila River (54%); Middle Fork Gila River (60%); and East Fork Gila River



(79%). As a result, the proposed action has the ability to affect significant portions of proposed critical habitat.

### ***Prescott National Forest***

*Spikedace.* Within the Prescott National Forest, the Verde River is considered to be occupied by spikedace, with the last spikedace was observed on the Verde River in 1999 (Brouder 2002).

In 2007, critical habitat was designated on the Verde River for spikedace, and included 43 miles, of which approximately 30 miles, or 70%, was on the Prescott National Forest. The proposed critical habitat designation in 2010 included 106.7 miles of the Verde River for spikedace, of which 49% is on the Prescott National Forest. Although the Verde River may experience periods of extreme low flow during warmer months, it is considered perennial throughout the designated and proposed critical habitat area (TNC 2006).

*Loach minnow.* Within the Prescott National Forest, the Verde River is not considered occupied by loach minnow. The last loach minnow was observed on the Verde River in 1938 (ASU 2002). In 2007, critical habitat was designated on the Verde River for spikedace, but not for loach minnow. The proposed critical habitat designation in 2010 included 36.6 miles of the Verde River for loach minnow within the Prescott National Forest boundaries. The Prescott contains approximately 90% of the total proposed designation of critical habitat for loach minnow on the Verde River.

### ***Tonto National Forest***

*Spikedace.* Within the Tonto National Forest, there are no streams currently occupied by spikedace. Spikedace records exist for Tonto Creek from 1937 (ASU 2002). In 2007, wildlife management agencies translocated spikedace into Fossil Creek as part of the species' recovery efforts. Monitoring in 2011 resulted in visual detection of 69 spikedace in Fossil Creek (C. Crowder, Arizona Game and Fish Department, pers. comm. 2011). Insufficient time has elapsed to determine if this population of spikedace will become self-sustaining in Fossil Creek.

Critical habitat was not designated for spikedace on the Tonto National Forest in 2007; however, it is proposed for designation in 2010, and includes portions of Tonto Creek, Greenback Creek, Rye Creek, Spring Creek, and Rock Creek. In addition, 4.7 miles of Fossil Creek form the boundary between the Tonto and Coconino national forests, and are included within the 2010 designation. Of streams proposed as critical habitat, the Tonto National Forest contains significant percentages of the overall stream designation, including Fossil Creek (100%); Greenback Creek (88%); Rock Creek (100%); Rye Creek (89%); Spring Creek (92%); and Tonto Creek (79%). The majority of these streams are considered perennial. Portions of Tonto Creek, Greenback Creek, and Spring Creek are considered intermittent (TNC 2006).

*Loach minnow.* Within the Tonto National Forest, no streams are currently considered occupied by loach minnow. Loach minnow were introduced into Fossil Creek in 2007. There has been one visual observation (C. Crowder, AGFD, pers. comm. 2011); however, insufficient time has elapsed to determine if the introduction effort in this stream will prove successful in establishing



a loach minnow population. In addition, resource agencies have begun the initial states of determining whether or not to place spikedace and loach minnow in Rock and/or Spring creeks as part of ongoing recovery efforts for the two species.

No streams were designated as critical habitat under the 2007 rule. Under the 2010 critical habitat proposal, Fossil Creek, which forms a portion of the boundary between the Coconino and Tonto National Forests, has been proposed as critical habitat. This stream segment is 4.7 miles long, and is perennial, and 100% of the designation falls on the Tonto National Forest.

## EFFECTS ANALYSIS

### *Apache-Sitgreaves National Forest*

Since 1970, there have been 435 fires 10 acres or larger in size on the Apache-Sitgreaves National Forests, which is equivalent to approximately 11 fires per year (Apache-Sitgreaves 2011). According to the BA, there have been 390 drops of retardant between 2000 and 2010, or an average of 39 drops per year.

An individual misapplication event, drift, or spill associated with transporting fire retardant products or loading them onto aircraft on the ASNF could result in impacts to spikedace or loach minnow and their designated and/or proposed critical. These spills, which could be as large as 3,000 gallons, could be released directly into proposed or designated critical habitat, and could travel as far as 6.2 miles downstream.

Spikedace have been located at the ASNF boundary at and downstream of Sheep Wash, and on the Forest in the southwest corner just downstream of the Sycamore Canyon confluence. Spikedace have also been located in the area between these two sites, and further downstream of the Forest's boundary. From the first detection at the Forest Service boundary, it is approximately 17 miles downstream to the next detection. Eagle Creek through this area is considered a perennial system. Retardant would likely not carry throughout this entire reach of stream; however, should retardant be inadvertently dropped in Eagle Creek at or near the occupied area, it could potentially carry for at least 6.2 miles downstream, per the BA, impacting any fish located there. Similarly, up to 6.2 miles of the stream downstream of the southernmost boundary of the ASNF could be affected if a misapplication of fire retardant occurred at Eagle Creek at the southernmost boundary of the ASNF.

The BA describes both sub-lethal and lethal effects from the proposed action. The BA notes that, in terms of sub-lethal effects, detectable levels of ammonia were present in one study for an entire year following retardant introduction. The BA also notes potential impacts to macroinvertebrates. Based on its presence in Eagle Creek, we anticipate that the proposed action is likely to adversely affect spikedace. Similarly, based on its presence in streams in the Black River system, the Blue River system, and Eagle Creek, we anticipate that the proposed action is likely to adversely affect loach minnow.

For the critical habitat designated in 2007, we anticipate that the proposed action is likely to adversely affect critical habitat by impacting PCEs 1e (water with no or minimal pollutant levels)

and 3d (abundant aquatic insect base) for loach minnow. No critical habitat was designated on the ASNF for spikedace in 2007.

For the critical habitat proposed in 2010, we anticipate that the proposed action may impact PBFs 2 (abundant aquatic insect base) and 3 (no more than low levels of pollutants) for spikedace and loach minnow. We anticipate these impacts could occur on the Black River system (loach minnow); Blue River system (both species); and Eagle Creek (both species).

### ***Coconino National Forest***

The BA notes that there have been 311 retardant drops and 4,074 fires on the Coconino National Forest between 2000 and 2011. This is equivalent to an average of 31 fire retardant drops and 407 fires per year. The figures indicate a strong likelihood for wildfire and retardant drops to occur in this area over the next 10 years.

For Oak Creek, the proposed designation includes 33.7 miles, of which 10.6 is on the Coconino National Forest. However, due to the interspersed private land parcels with Coconino National Forest lands, should retardant misapplications occur on lands managed by the Coconino National Forest, they could affect water quality as it flows into private land parcels. This same situation exists for the 20.8 miles of Beaver and Wet Beaver Creek; 6.5 miles of Beaver and Wet Beaver Creek, and the 3.5 miles of West Clear Creek (spikedace only). In addition, the BA notes that the effects of retardant can flow for at least 6.2 miles, and the entire designated areas for Beaver and Wet Beaver Creek and West Clear Creek are approximately that length or less, and therefore within the potential dispersal distance. The 4.7 miles of Fossil Creek are on Forest Service lands, forming the boundary between the Coconino and Tonto National Forests, and are well within the dispersal distance for fire retardant. For all of these streams, the Coconino National Forest is the predominant landowner upstream of the proposed critical habitat designation, and misapplications of fire retardant in these portions of the Forest, if within reasonable distance of the proposed critical habitat, could also have effects on the critical habitat, assuming appropriate flow regimes are present. For these reasons, we conclude that the proposed action is likely to adversely affect critical habitat for both species on the Verde River, Oak Creek, Beaver/Wet Beaver Creek and Fossil Creek, and is likely to adversely affect critical habitat in West Clear Creek for spikedace only.

The Verde River is considered occupied by spikedace, and we anticipate that, based on the discussions above and in the BA, sublethal and lethal effects may occur to spikedace on the Verde River but the species is very rare and incidental take is not reasonably certain to occur. We therefore conclude that the proposed action may affect and is likely to adversely affect spikedace. Fossil Creek currently supports individuals of both spikedace and loach minnow that were translocated into the Creek; however, insufficient time has elapsed to determine if the two species will persist in this stream, therefore, we are not assessing take at Fossil Creek at this time. No other streams within the Coconino National Forest boundaries are currently occupied by loach minnow.

For the critical habitat designated in 2007, we anticipate that the proposed action will adversely affect critical habitat by impacting PCEs 1d (water with no or minimal pollutant levels) and 3d

(abundant aquatic insect base) for spikedace on the Verde River. No critical habitat was designated for loach minnow in 2007.

Similarly, for the critical habitat proposed in 2010, we anticipate that the proposed action will adversely affect PBFs 2 (prey base) and 3 (water quality) for proposed spikedace and loach minnow critical habitat on the Coconino National Forest.

### ***Gila National Forest***

The BA notes that there have been 1,276 retardant drops and 2,077 fires on the Gila National Forest between 2000 and 2011. This is equivalent to an average of 128 fire retardant drops and 208 fires per year. The figures indicate a strong likelihood for wildfire and retardant drops to occur in this area over the next 10 years.

The largest known populations of spikedace and loach minnow occur on the Gila River. Portions of this area are within the Gila National Forest; however, approximately 15 miles of the area in which this population occurs are on private lands. We anticipate that fire retardant drops at the downstream end of the Gila National Forest could flow for at least 6.2 miles into the private land area, but do not anticipate that any retardants dropped on the Gila National Forest would flow throughout this entire portion of the stream.

The BA describes both sub-lethal and lethal effects from the proposed action. Based on its presence in the Gila River, West, Middle, and East Forks of the Gila River, and Mangas Creek, we anticipate the proposed action may affect and is likely to adversely affect spikedace in these streams. For loach minnow, we anticipate the proposed action may affect and is likely to adversely affect loach minnow in the Gila River, West, Middle, and East Forks of the Gila River, Mangas Creek, the San Francisco River, Tularosa River, Negrito and Whitewater Creeks, the Blue River, and Campbell Blue, Pace, Dry, and Frieborn creeks (where they occur on the Gila National Forest).

For the critical habitat designated in 2007, we anticipate that the proposed action will adversely affect critical habitat by impacting PCEs 1d/1e (water with no or minimal pollutant levels) and 3d (abundant aquatic insect base) for spikedace and loach minnow on the Gila River, West, Middle, and East Forks of the Gila River, Mangas Creek, and the San Francisco River. For loach minnow, we anticipate that the proposed action could also affect PCEs 1e and 3d for the Tularosa River, and Negrito, and Whitewater Creek.

For the proposed critical habitat designation in 2010, we anticipate that the proposed action will adversely affect affect PBFs 2 (prey base) and 3 (water quality) for designated and proposed spikedace critical habitat on the Gila National Forest. As noted above, Pace, Frieborn, and Dry Creeks are entirely within the Gila National Forest. For the San Francisco River, the proposed designation occurs on multiple private inholdings; however, these areas are typically narrow and linear along the stream corridor, and are immediately surrounded by the Gila National Forest. The same is true for the West Fork Gila River. Any fires that occur in these areas would result in a Forest Service response. On the mainstem Gila River, large portions of the River are not on Forest Service lands, but occur on a mix of private, state, and Bureau of Land Management

lands. Therefore, the proposed action would only affect them if a fire starting on Forest Service lands required the use of retardant which subsequently drifted downstream onto these areas. The portions of Mangas Creek included within the proposed critical habitat designation are not on Forest Service lands.

### ***Prescott National Forest***

According to the BA, there have been 835 fires and a total of 777 drops of retardant between 2000 and 2010. This is equivalent to an average of 84 fires and 78 fire retardant drops per year. The figures indicate a strong likelihood for wildfire and retardant drops to occur in this area over the next 20 years.

There is a large stretch of the Verde River which flows through private lands around the Town of Camp Verde. Fire retardant misapplications occurring above this reach would likely not disperse downstream through the private lands and back onto Forest Service property. Therefore, there is a gap in the middle of the Verde River segment which would, for the most part, not be affected by the proposed action. The upper 6.2 miles of this private stretch could be affected if fire retardant were applied on the Forest lands immediately upstream.

The Verde River is considered occupied by spikedace, and we anticipate that, based on the discussions above and in the BA, sublethal and lethal effects may occur to spikedace on the Verde River, but the species is very rare and incidental take is not reasonably certain to occur. We therefore conclude that the proposed action may affect and is likely to adversely affect spikedace. No streams within the Coconino National Forest boundaries are currently occupied by loach minnow.

For the critical habitat designated in 2007, we anticipate that the proposed action will adversely affect critical habitat by impacting PCEs 1d (water with no or minimal pollutant levels) and 3d (abundant aquatic insect base) for spikedace on the Verde River. No critical habitat was designated for loach minnow in 2007.

We anticipate that misapplication of fire retardant would adversely affect PBFs 2 (prey base) and 3 (water quality) for proposed spikedace and loach minnow critical habitat on the Prescott National Forest. Those portions of the Verde River included within the critical habitat designation and proposed critical habitat designation are currently classified as perennial stream (TNC 2006).

### ***Tonto National Forest***

The BA notes that 988 fire retardant drops and 2,451 fires have occurred on the Tonto National Forest between 2000 and 2010. This results in an average of 91 fire retardant drops and 245 fires annually. The figures indicate a strong likelihood for wildfire and retardant drops to occur in this area over the next 20 years. Large wildfires that have occurred in close proximity to proposed critical habitat streams on the Tonto National Forest include the Edge, Ord, and Oak fires.

With the exception of Fossil Creek, neither spikedace nor loach minnow are present on the Tonto National Forest. As noted above, spikedace and loach minnow have been placed in Fossil Creek as a recovery effort; however, insufficient time has elapsed to determine if the species will persist in this stream. Therefore, we are not providing an analysis of the impact of the proposed action on the species at this time.

No critical habitat was designated on the Tonto National Forest in 2007. Under the 2010 proposal for critical habitat, we anticipate that the proposed action would adversely affect PBFs 2 (prey base) and 3 (water quality) for proposed spikedace and loach minnow critical habitat on the Tonto National Forest. The Tonto National Forest encompasses high percentages of proposed critical habitat streams for spikedace.

NOTE: Because Fossil Creek occurs on the boundary between the Coconino and Tonto National Forests, it is discussed under both forests. Because it is possible that fire suppression efforts would be required for a fire starting on either Forest, we have included discussions of impacts for both Forests in regards to Fossil Creek.

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### CONCLUSION

After reviewing the current status of spikedace and loach minnow, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the U.S. Fish and Wildlife Service's biological opinion that the nationwide application of fire retardant, as proposed, is not likely to jeopardize the continued existence of spikedace or loach minnow, and is not likely to destroy or adversely modify designated or proposed spikedace and loach minnow critical habitat.

### **Three Forks springsnail (*Pyrgulopsis trivialis*)**

#### ENVIRONMENTAL BASELINE

The Three Forks springsnail (*Pyrgulopsis trivialis*) is proposed endangered with critical habitat (76 FR 20464; April 12, 2011). 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-Sitgreaves National Forests (ASNF). 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 11.1 acres has been proposed as critical habitat on ASNF, though this acreage will increase due to the discovery of additional populations since publication of the proposed rule. The primary constituent elements of proposed critical habitat are clean spring water, periphyton, substrates,

and absence of nonnative species. Threats to the species and its habitats include fire, exposure to fire retardant, predation by nonnative crayfish, and habitat degradation caused by elk wallowing.

## EFFECTS OF THE ACTION

Direct delivery by misapplication, accidental spills, aerial drift, and surface run-off are potential avenues considered for introduction of retardant into waterways occupied by Three Forks springsnail on the ASNF. Potential adverse effects of fire retardant products on aquatic organisms are discussed in detail in the biological assessment (BA) prepared by the U.S. Forest Service (USFS). These effects include toxic alteration of water quality due to increased ammonia levels from nitrogen-based fire retardants, and changes in nutrient levels. We would expect the level of toxicity from direct misapplication or accidental spills to exceed that from aerial drift or surface run-off, though we are unable to quantify the difference.

The BA calculated an average 0.42% misapplication rate/year and an average of 35 drops/year on the ASNF. Based on these data we expect 350 drops over the next 10 years, resulting in 1.47 misapplications ( $350 \times 0.0042$ ) on the ASNF. To evaluate probability of a misapplication directly hitting the species we took into account the total 996 miles of perennial streams across the ASNF (USFS 2010) and the 4 miles along Boneyard Creek where springs occupied by Three Forks springsnails occur. This gave us 0.4% total stream miles ( $4/996$ ) across the ASNF occupied by springsnail habitat. To determine the probability of a misapplication hitting occupied springsnail habitat over the next 10 years, we multiplied the misapplication rate, 1.47, by the percentage of streams miles occupied, 0.004, to arrive at 0.6% probability.

Although this probability is low, it could be significant because exposure to fire retardant drift has been identified as one of the primary threats to the species, and is suspected in the near extirpation of the species from Three Forks springs after fire retardant drops in 2004 (76 FR 20464). Furthermore, Norris and Webb (1989) showed ammonia concentrations from retardant could remain at lethal levels between 0 and 6.2 miles downstream. This exceeds the total four miles of habitat occupied by Three Forks springsnail, meaning a single misapplication at a critical location could potentially have devastating consequences across the entire range of the species.

Although exposure to fire retardant chemicals is of critical concern for this species, we believe implementation of the expanded buffer/avoidance area will substantially decrease the probability that Three Forks springsnail will be exposed to lethal doses of fire retardant. Additionally, the salvage and captive rearing conservation measures are intended to ensure that the species will be safeguarded in the event that a misapplication, or other exposure, occurs. Captive springsnails would be repatriated after the retardant's effects have abated. We anticipate salvage measures and captive rearing will be successful because an interagency effort to salvage and rear the species following the Wallow Fire is already showing success. In summary, we anticipate that implementation of the species-specific conservation measures will contribute to the survival and recovery of the Three Forks springsnail.

Introduction of retardant could affect water quality and temporarily render critical habitat less suitable, and potentially lethal, for springsnails and their food resources. Also, the effects of fire,



while not under consultation here, could compound adverse effects to habitat through increased ash and sediment inputs to springs. Overall, we believe that although the environmental persistence of retardant chemicals can cause short-term adverse effects to the aquatic environment, the effects will dissipate over time and will not render the affected area unsuitable for springsnails in the future.

## CUMULATIVE EFFECTS

Since the species occurs entirely on ASNF lands, most activities affecting the species would fall under the jurisdiction of USFS. One stressor beyond the jurisdiction of the USFS is elk management. Elk wallowing has been identified a threat to the species (76 FR 20464). The Arizona Game and Fish Department (AGFD) is currently working to develop a conservation program to reduce the effects of elk wallowing on Three Forks springsnail habitat.

## CONCLUSION

After reviewing the current status of Three Forks springsnail, the environmental baseline for the action area, the effects of the proposed action, conservation measures, and cumulative effects, it is the Service biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Three Forks springsnail, and is not likely to destroy or adversely modify proposed critical habitat. This conclusion is based on our belief that implementation of the conservation measures minimizes the potential for a catastrophic event related to exposure to fire retardant to the point where the proposed action does not appreciably reduce the likelihood of survival and recovery of the Three Forks springsnail.

## **Yaqui catfish (*Ictalurus pricei*)**

### Environmental Baseline

In Arizona, Yaqui catfish are located on only the Coronado National Forest. The only designated critical habitat is far away from Forest lands. Yaqui catfish only currently occur in ponds near West Turkey Creek, just downstream of the Coronado National Forest, on private land. Retardant drops in or near West Turkey Creek could flow downstream and impact the catfish populations there. Yaqui catfish are also found on U.S. Fish and Wildlife Service (USFWS) lands. Most known extant Yaqui catfish populations in the United States are small, and non-reproducing. Populations in Mexico are larger, but threatened by introgression from non-native catfishes. This consultation will only focus on proposed actions identified on Forest Service lands.

### Effects of the Action

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for a ten year period. The BA includes measures that are incorporated in the proposed action that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed



threatened, endangered or proposed terrestrial plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and populations.

The BA includes in the proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to Yaqui catfish and its habitat. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, and/or surface run-off and leaching. The BA states that ~~any~~ forest with more than one retardant drop over the last 10 years would have a ~~“likely to Adversely Affect”~~ determination for those species and designated critical habitat that occur there.” And the Forest Service ~~assumes~~ that all drops within the 300 foot buffer will enter waterways and affect aquatic species.”

The BA identifies the average number of retardant drops by National Forests’ in Table B-4. This table shows the National Forest where Yaqui catfish occur have at least one retardant drop over the last 10-years; therefore, we consider the effects of all misapplication scenarios to Yaqui catfish occupied and its habitat.

Adverse effects of fire retardant products to aquatic species (fish and invertebrates) are discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels. Other components of the fire retardant product may also have toxic effects. The species will benefit from the use of fire retardant by preventing the loss of small, localized populations.

The programmatic nature of this consultation requires us to predict human error (misapplication), estimate variables such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped (between 799 and 3,000 gallons/drop), and then estimate a set of operational and environmental factors such as the height and speed of the aircraft, terrain, habitat type, and width of the stream at the time of the retardant drop. Because of the unknown variables associated with future fire retardant drops, we use the best available information provided in the BA to support our discussion and effects determination for Yaqui catfish.

We used the information provided in Table ABA-5 and B-4 (from the BA) to support our conclusions for misapplications on Forest Service land over the next 10-years (Table 33). We applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands (i.e.  $390 \div 11 \times 10 = 354.5$ , and  $354.5 \times .0042 = 1.48$  drops or 2 when rounded up)

and then calculated the extent of stream miles where adverse effects to Yaqui catfish are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years.

**Table 32. Number of Anticipated Drops on Forest Service land over the next 10-years: Yaqui Catfish**

<b>National Forest</b>	<b>Total Number of Drops 2000-2010</b>	<b>Yaqui Catfish Populations By Forest</b>	<b>Number of Anticipated Drops*</b>	<b>Extent of Stream Miles (6.2miles/drop)</b>
Cor. NF	1,429	0 (occur on private lands downstream)	6	37.2

\* Table 33 Calculations for number of drops and stream miles ( $1429 \div 11 \times 10 = 1299$ , and  $1299 \times .0042 = 5.45$  drops or 6 when rounded up)

We anticipate six retardant drops will occur over the next 10 years affecting Yaqui catfish on private lands in about 37.2 stream miles. Because all drops that occur within the 300 foot buffer are assumed to enter waterways; Yaqui catfish are likely to be adversely affected by introduced retardants. We believe adverse effects to individuals and populations on private land will occur from the application of retardants on USFS lands.

Critical Habitat

There is one Yaqui catfish critical habitat unit, with none of those on USFS lands.

Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

Conclusion

After reviewing the current status of the Yaqui catfish, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service’s biological opinion that the proposed action is not likely to jeopardize the continued existence of the Yaqui catfish. No critical habitat occurs on USFS land; therefore, none will be affected. We base the conclusion on the following:

1. There is one Yaqui catfish population that exist beyond USFS lands in the U.S. and larger populations still occur in Mexico. Therefore, adverse effects to the species from actions on USFS lands will not preclude recovery and survival of the species.
2. The environmental persistence of the chemicals identified in the BA will cause short-term adverse effects to the aquatic food source for Yaqui catfish; however, the effects will dissipate over time and will not render the affected area unsuitable for Yaqui catfish establishment in the future.

## **Yaqui chub (*Yaqui purpurea*)**

### Environmental Baseline

The Yaqui chub occurs in a very small range in southeastern Arizona and adjacent Mexico. Most known extant Yaqui chub populations are small and restricted to isolated populations scattered throughout its historical range (with occupancy in about 10 populations). In Arizona, Yaqui chub are located at West Turkey Creek on the Coronado National Forest. The only designated critical habitat is far away from Forest lands. Yaqui chub are also found on U.S. Fish and Wildlife Service and private lands. This consultation will only focus on proposed actions identified on Forest Service lands.

The species status is vulnerable to habitat dewatering and introductions of exotic fishes, but overall has improved with habitat acquisition, management, and reintroduction. The very small area of occupancy makes this species susceptible to localized events that could result in major declines. Habitat includes deep pools in creeks, springheads, scoured areas of cienegas, and other stream-associated quiet waters (USFWS 1994); this fish seeks shade, often near undercut banks or debris; it is often associated with higher aquatic plants (Lee et al. 1980). Similarly, in artificial ponds, adults tend to occupy the lower part of the water column and seek shade (USFWS 1994). Young occupy near-shore zones, often near the lower ends of riffles (USFWS 1994). Spawning occurs probably in deep pools where there is aquatic vegetation (Matthews and Moseley 1990).

### Effects of the Action

Actions described within the National Fire Retardant Biological Assessment (BA) refer to effects from aerial delivery of fire retardant for a ten year period. The BA includes measures that are incorporated in the proposed action that are intended to minimize the effect of aerial fire retardant delivery. One option was to map avoidance areas where fire retardant will not be used. These avoidance zones were described in the BA as locations of one or more federally listed threatened, endangered or proposed terrestrial plant or animal species or critical habitat where aerial application of fire retardant may affect habitat and populations.

The BA includes in the proposed action retardant use guidelines that incorporate decisions such as using less toxic fire retardants in areas of occupied or designated critical habitat for threatened, endangered, or proposed species; avoiding aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways; and specific operational guidelines for pilots to ensure retardant drops are not made within the waterways or mapped avoidance areas. These guidelines are expected to minimize the potential chemical effect of retardant use on Forest Service lands to Yaqui chub and its habitat. However, with all the avoidance buffers and operational guidelines in place, the Forest recognizes there is still potential for misapplications to occur within the 10-year timeframe of the project. Table ABA-5 includes three-year misapplication data and based on their calculations predict retardant drops have a 0.42% chance of hitting water or buffer on USFS lands. A misapplication is considered to have occurred when fire retardant enters a waterway or mapped avoidance zone through accidental delivery, drift, and/or surface run-off and leaching. The BA states that ~~any~~ forest with more than one retardant drop over the last 10 years would have a ~~Likely to~~ Adversely Affect” determination for those species and designated critical habitat that occur

there.” And the Forest Service –assumes that all drops within the 300 foot buffer will enter waterways and affect aquatic species.”

The BA identifies the average number of retardant drops by National Forests in Table B-4. This table shows the National Forest where Yaqui chub occur have at least one retardant drop over the last 10-years; therefore, we consider the effects of all misapplication scenarios to Yaqui chub occupied habitat.

Adverse effects of fire retardant products to aquatic species (fish and invertebrates) are discussed in the BA prepared for this consultation (USDA USFS 2011) and are incorporated by reference. These effects include alteration of water quality due to increased ammonia levels from the nitrogen-based fire retardants which can be toxic to aquatic species and also affect nutrient levels. Other components of the fire retardant product may also have toxic effects. The species will also benefit from the use of fire retardant by preventing the loss of the small localized populations.

The programmatic nature of this consultation requires us to predict human error (misapplication), estimate variables that are pre-determined by the IC at the time of the incident such as the aircraft type (airtanker or helicopter), type of chemical used, application rate of the retardant, volume of chemical dropped (between 799 and 3,000 gallons/drop), and then estimate a set of operational and environmental factors such as the height and speed of the aircraft, terrain, habitat type, and width of the stream at the time of the retardant drop. Because of the unknown variables associated with future fire retardant drops, we use the best available information provided in the BA to support our discussion and effects determination for Yaqui chub.

We used the information provided in Table ABA-5 and B-4 (from the BA) to support our conclusions for misapplications on Forest Service land over the next 10-years (Table 34). We applied the 0.42% misapplication rate to the average number of drops that occurred within Forest Service lands and then calculated the extent of stream miles where adverse effects to Yaqui chub are anticipated to occur, which is 6.2 miles (Norris and Webb 1989), when applied to the number of drops over the next 10 years.

**Table 33. Number of Anticipated Drops on Forest Service land over the next 10-years: Yaqui Chub**

<b>National Forest</b>	<b>Total Number of Drops 2000-2010</b>	<b>Yaqui Chub Populations By Forest</b>	<b>Number of Anticipated Drops*</b>	<b>Extent of Stream Miles (6.2miles/drop)</b>
Cor. NF	1,429	1	6	37.2

\* Table 34 Calculations for number of drops and stream miles ( $1429 \div 11 \times 10 = 1299$ , and  $1299 \times .0042 = 5.45$  drops or 6 when rounded up)

We anticipate six retardant drops will occur over the next 10 years affecting Yaqui chub in about 37.2 stream miles. Because all drops that occur within the 300 foot buffer are assumed to enter waterways; small pools, springs, and cienegas where Yaqui chub occur are likely to be adversely

affected by introduced retardants. We believe adverse effects to individuals and populations will occur from the application of retardants on USFS lands.

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### Conclusion

After reviewing the current status of the Yaqui chub, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Yaqui chub. There is one Yaqui chub critical habitat unit, with none of those on USFS lands. We base the no jeopardy conclusion on the following:

1. There are nine Yaqui chub populations that exist beyond USFS lands; therefore, adverse effects to the species on USFS lands will not preclude recovery and survival of the species.
2. The environmental persistence of the chemicals identified in the BA will cause short-term adverse effects to the aquatic food source for Yaqui chub; however, the effects will dissipate over time and will not render the affected area unsuitable for Yaqui chub establishment in the future.

### **Region 6 Mountain Prairie: Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming**

*Lead for two (2) Species Total*

#### **Greenback cutthroat trout (*Oncorhynchus clarki stomias*)**

##### Environmental Baseline

Greenback cutthroat trout (GBCT) currently occupies small isolated streams in six national forests in Colorado and one national forest in Utah; these populations no longer function as metapopulations. The original distribution of the GBCT is believed to have included the South Platte and Arkansas River drainages on the eastern slope of Colorado and a few headwater tributaries of the South Platte River in a small area of southwestern Wyoming (Behnke 1992). It is assumed that the original distribution included all mountain and foothill habitats of the two drainage systems, including drainages at lower elevations than it occupies today (Behnke and Zarn 1976). Habitat occupied by the GBCT has been drastically reduced since the late 1800's for a variety of reasons including introduction of non-native salmonids, loss of habitat from water exploitation, mining, agriculture, logging, and un-regulated fishing. The introduction of non-native salmonids has had the greatest impact on GBCT population declines through

hybridization and competition for limited resources on their remaining habitat. The original distribution of the subspecies is not precisely known due to its rapid decline in the 1800s.

More recently, a number of genetic studies have been conducted (Mitton et al. 2006, Metcalf et al. 2007, Metcalf 2007, and Rogers 2008) that indicate that some cutthroat populations on the western slope of Colorado contain genetic markers that are consistent with the GBCT; these populations have been previously considered to be the Colorado River cutthroat trout (*O. clarki pleuriticus*). Furthermore, these studies also indicate that some cutthroat streams on the eastern side of Colorado, which have been considered to be GBCT, contain genetic markers that are more consistent with the Colorado River Cutthroat trout. However, the results of these genetic studies have not been conclusive in terms of the genetic identities of the GBCT and Colorado River cutthroat trout. Until this taxonomic issue is settled, the Service is conducting section 7 consultations on all projects involving cutthroats on the eastern slope of Colorado and on project involving cutthroats on the western slope that contain the GBCT marker, which also includes a cutthroat stream on the Manti-Lasal National Forest in Utah.

### Effects Analysis

Fire retardants are known to kill many aquatic species, including salmonids, due to the presence of ammonium compounds that represent approximately 10 percent of fire retardant slurry; other ingredients in fire retardant include gum thickener, coloring agent, and corrosion inhibitors, and water (Norris and Webb 1989; Gaikowski *et al.* 1996a; Gaikowski *et al.* 1996b; McDonald *et al.* 1996; McDonald *et al.* 1997; Buhl and Hamilton 1998; Adams and Simmons 1999; Buhl and Hamilton 2000; Calfee and Little 2003a; Wells *et al.* 2004). If ammonia concentrations are high enough, the ammonia could inhibit growth of juvenile GBCT, cause tissue damage, and cause direct mortality. High concentrations of ammonia can inhibit growth and cause mortality of rainbow trout (Burkhalter and Kaya 1977). Thurston *et al.* (1978) found that high concentrations of ammonia can result in tissue damage to cutthroat trout. Although tests of the effects of ammonia on GBCT have not been conducted, it is highly likely results would be similar as for other salmonids. Indirect effects also could occur to GBCT from the retardant adversely affecting the aquatic and terrestrial macroinvertebrates that comprise their diet.

When fire retardants initially enter a stream, there is an immediate spike in ammonia concentration and the toxic concentrations can extend up to 10 km (6.2 mi) downstream from where retardant enters the water (Norris and Webb 1989). The peak of the spike and area affected depends on many factors, such as volume of retardant to hit the water, volume of water to dilute the retardant, and turbulence of the stream. In simulations of only 1,011 L (267 gallons) (a normal load being approximately 5,678 L (1,500 gallons)) of fire retardants entering the surface of a stream, peak ammonia concentrations reached 5,026 mg/l (Buhl and Hamilton 1998). The LC50 (the concentration at which half of the effected population will die in an established time period) for rainbow trout varies depending on the type of retardant used. For example, when exposed to Phos Chek 259, the LC50 for rainbow trout was between 94 and 250



mg/l (Johnson and Sanders 1977). Buhl and Hamilton (2000) found the LC50 of rainbow trout to Phos Chek 259-F was 168 mg/l. When the volume of retardant entering the stream is doubled, the zone of mortality is extended 10 times farther downstream (Norris *et al.* 1991). This ammonia concentration was caused by fire retardant alone, whereas in a natural situation during a fire, ammonia levels would also be elevated due to smoke adsorption (Gresswell 1999).

While direct application of long-term fire retardants onto the stream surface was the primary source of retardant contamination in streams (Norris *et al.* 1991), runoff from fire retardant applied in terrestrial uplands adjacent to waterways or dry stream also may pose problems to GBCT in 1) areas of recently disturbed riparian vegetation, 2) areas without riparian vegetation, and 3) areas where retardant was unburned. Retardants that have been applied to terrestrial areas and have not been consumed by a fire can remain toxic for 21 days (Little and Calfee 2002). Therefore, rain events that occur within three weeks after application in riparian area or across dry stream beds pose a risk of introducing lethal levels of ammonia to a stream. Small buffers (i.e., 3-meter buffer) have been beneficial in eliminating retardant runoff into stream waters (Norris *et al.* 1991).

The severity of fire retardants effects can vary among the life stages of the fish present. Swim up fry often are found to be the most sensitive life stage to fire retardants and are clearly less capable of vacating an impacted area (Johnson and Sanders 1977, Gaikowski *et al.* 1996, Poulton *et al.* 1997, Kalambokidis 2000). Other researchers have found that swim up fry are just as susceptible as juveniles and adult fish, but that eggs and alevins are clearly more resistant (Rice and Stokes 1975). GBCT are spring spawners, therefore, GBCT swim up fry could be present during the later part of the fire season and juveniles would also be present on USFS lands during the entire fire season.

Due to low numbers of remaining GBCT populations throughout its range, the loss of any historic GBCT population is of concern for the survival and recovery of this species. Streams that contain historic GBCT populations are particularly vulnerable to fire retardant because they are small headwater streams (typically 1, 2, and 3 order) with low flows and little opportunity for dilution of contaminants. Many of these populations occupy only short sections of stream, often less than 5 miles in length, with little opportunity to escape to tributaries in the event of contamination by fire retardant or to escape downstream (due to presence of barriers that protect greenbacks from downstream threats of non-natives and diseases). Likewise, the presence of barriers prohibits the recolonization of populations.

Studies on the toxicity of fire-fighting chemicals can be summarized by: 1) long-term fire retardants are toxic to aquatic species, mainly due to ammonia; 2) long-term fire retardants are less toxic than most foaming and water-enhancing agents; 3) toxicity is likely to persist on the ground and may be released into streams in rainwater runoff; 4) high organic soils rapidly decrease chemical persistence; 5) combustion appears to remove the toxicity of the chemicals; and 6) fish are capable of avoiding exposure if an avenue of escape is available (Little and Calfee 2002).



Effects Analysis for Each Forest

Each forest will have a retardant avoidance area mapped as 600 feet on both sides of streams and around lakes for all waters occupied by GBCT, as shown in the avoidance zone maps provided by the forests. To estimate the probability that retardants would enter occupied GBCT habitat for each Forest, we calculated the area that was potentially covered by retardants during the 2000-2010 period by Forest. To do this, we assumed retardant drops did not overlap and were dropped randomly. The BA states (page 14) that typical retardant drops are 15-23 m (50-75 ft) wide by 244 m (800 ft) long, which is approximately 1.4 acres. By multiplying 1.4 acres x number of drops during 2000-2010, the total area directly affected by retardant drops can be calculated. Dividing the area affected by the total area of each Forest, the probability of a drop affecting each acre of Forest can be estimated using the following table:

<b>National Forest</b>	<b>Area</b>	<b>Retardant Drops 2000-2010</b>	<b>Acres Affected /10 Years</b>	<b>Probability of Retardant Drop in Each Acre</b>
<b>Colorado</b>				
Arapaho-Roosevelt NF	1876891	99	139	0.00001
GMUG NF <sup>1</sup>	351715	27	38	0.000003
Medicine Bow-Routt NF	1403892	119	167	0.0001
Pike and San Isabel NF	1288379	336	470	0.0004
San Juan NF	2108313	186	260	0.0001
White River NF	2477646	110	154	0.00006
<b>Utah</b>				
Manti-Lasal NF	1338015	163	228	0.0002

<sup>1</sup> Grand Mesa, Uncompahgre, and Gunnison National Forests

Next, to estimate the probability of retardants getting into occupied GBCT habitat, we multiplied the acres of occupied habitat by the probability of retardants affecting each acre of Forest from the table above.

**Table 34. Tables used for misapplication Effects Analysis**

<b>Forest</b>	<b>Expected total number of retardant drops 10 years<sup>1</sup></b>	<b>Number of drops expected to enter water ways (.42%- multiply by .0042 and round up)</b>
<b>Colorado</b>		
Arapaho-Roosevelt NF	90	0.4
GMUG NF <sup>2</sup>	25	0.1
Routt NF	108	0.5
Pike and San Isabel NF	306	1.3
San Juan NF	169	0.7
White River NF	100	0.4
<b>Utah</b>		
Manti-Lasal NF	148	0.6

<sup>1</sup>The expected number of retardant drops is based on taking the total number of drops per forest as presented in the BA on pages 238-241 and dividing that number by 11 and multiplying by 10. The data presented in the BA is based on 11 years and the timeframe for this consultation is 10 years, therefore we must account for this difference in magnitude.

<sup>2</sup> Grand Mesa, Uncompahgre, and Gunnison National Forests

For Species: Greenback cutthroat trout

<b>Forest Name</b>	<b>Miles of perennial stream on Forest</b>	<b>Miles of occupied streams on Forest<sup>1</sup></b>	<b>Percent of total perennial streams that are occupied</b>	<b>Number of drops expected to hit streams</b>	<b>Total stream miles affected by retardant (6.2 miles per drop in water<sup>2</sup>)</b>	<b>Percent of GBCT occupied streams affected by retardant</b>	<b>Extent of Take</b>
<b>Colorado</b>							

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Arapaho-Roosevelt NF	1915.4	78.6	4%	0.4	0.4x6.2= 2.5	(.04x2.5=0.1 mi)/78.6= 0.13%	0.1 miles
GMUG NF <sup>2</sup>	2092.1	57.2	2.7%	0.1	0.1x6.2= 0.6	(.027x0.6=.0 2 mi)/57.2= 0.03%	0.02 miles
Medicine Bow-Routt NF	3592.6	24.1	0.7%	0.5	0.5x6.2= 3.1	(.007x3.1=.0 2mi)/24.1= 0.09%	0.02 miles
Pike and San Isabel NF	2068.6	50.5	2.4%	1.3	1.3x6.2= 8.1	(.024x8.1= .19 mi)/50.5= 0.38%	0.19 miles
San Juan NF	1851.2	17.2	0.9%	0.7	0.7x6.2= 4.3	(.009x4.3= .04 mi)/17.2 = 0.23%	0.04 miles
White River NF	2617.9	19.6	0.7%	0.4	0.4x6.2= 2.5	(.007x2.5= .02 mi)/19.6 = 0.09%	0.02 miles
<b>Utah</b>							
Manti-Lasal NF	917.9	7.9	0.9%	0.6	0.6x6.2= 3.7	(.009x3.7= .03 mi)/917.9 =<0.01%	0.03 miles

<sup>1</sup>Based on occupied habitat. Data available at the Colorado Field Office.

<sup>2</sup>The BA states that lethal effects extend 10 km (6.2 mi) downstream and sublethal may occur much further downstream. For purposes here, we will use the 10 km (6.2 mi) as the furthest extent of downstream effects.

<sup>3</sup>Grand Mesa, Uncompahgre, and Gunnison National Forests

Several lakes containing GBCT are present in Colorado. No data was presented in the BA regarding misapplication of fire retardant into high mountain lakes. However, the probability of an accidental drop in a lake is low since lakes are easily seen from the air. The effects on GBCT of fire retardant in lakes is potentially less severe due to a greater volume of water, as compared to small streams typically occupied by GBCT; consequently, fire retardants introduced into a lake have a greater dilution potential. Fish are capable of avoiding exposure if an avenue of escape is available (Calfee and Little 2002) and GBCT could potentially swim to another part of the lake or a side creek. For these reasons, an accidental retardant drop into a lake is unlikely to occur and is anticipated to have insignificant and discountable impacts to GBCT in the event that a misapplication occurs in a lake. Therefore, no exemption from take for GBCT in lake habitat is authorized in this BO.

### Conclusion

After reviewing the current status of the GBCT, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of GBCT. The Service bases this conclusion on the following: 1) The probability of a retardant drop entering an occupied stream is small; and 2) increasing the retardant avoidance area from 91 to 183 m (300 to 600 ft). No critical habitat has been designated for GBCT; therefore, none will be affected.

## **Pawnee montane skipper (*Hesperia leonardus montana*)**

### Environmental Baseline

The range of the Pawnee montane skipper (skipper) is restricted to four Colorado counties (Teller, Park, Jefferson, and Douglas) within an area approximately 23 miles long and 5 miles wide along the South Platte River drainage system (ERT 1986). The skipper's small range is inherently restricted by the overlap of the distribution of its primary nectar plant (i.e., prairie gayfeather) and the distribution of its larval host plant, blue grama grass, within a ponderosa pine and Douglas-fir woodland (USFWS 1998). The total area of skipper habitat is 24,830 acres, of which 70 percent (17,380 acres) occurs on USFS land.

The skipper's range can be divided into three populations (USFWS 1998): 1) Mainstem South Platte population (12,787 acres), which includes the main stem of South Platte River from the North Fork/South Fork confluence up to Deckers, including Horse Creek; 2) Cheesman Reservoir population (5,758 acres); and 3) North Fork population (6,285 acres). Due to the relatively close proximity of these populations, there appears to some opportunity for exchange of individuals between the populations.

Population estimates were conducted in 1985, 1986, and 1987 and were based on census survey transects and distribution survey counts (ERT 1986, 1988). The 1985 population estimate was 80,000 to 140,000; in 1986, the estimate was 67,900 to 166,100; and in 1987, the estimate was 116,000. The range in the population estimate relates to the use of both census survey data and the distribution survey data to develop the total population estimate (ERT 1986). These population estimates correlate to skipper densities of 2.1 to 3.6 per acre (ERT 1986, 1988, 1989). Currently, skipper populations are recovering from the severe drought and wildfires of 2002, and since that time, have averaged less than 1 skipper per acre, until 2010, in which an average of approximately 2 skippers per acre was reached (CNHP 2011).

### Habitat Conditions

*Effects of Wildfires* - The skipper is adapted to a fire-dependent habitat type, occurring in open ponderosa pine woodlands that would typically experience frequent, low-severity surface wildfires. These types of fires allow for the persistence of the skipper and its host plants by maintaining a more open forest condition. With fire suppression and the resulting higher fuel loading, the lower montane ponderosa and Douglas-fir forests (6,000 to 7,500 feet elevation) are experiencing larger, more severe fires than typically occurred (USFS 2000), often resulting in the loss of the ponderosa pine and Douglas-fir overstory.

Recent wildfires have severely impacted skippers and their habitat. Since 1996, a total of 11,296 acres of skipper habitat has burned in four separate fires, comprising 46 percent of the total skipper habitat. Of these fires, the 2002 Hayman and Schoonover fires caused the greatest damage to skipper habitat, burning 8,978 acres of skipper habitat (approximately 36 percent of the total habitat) (B. Banks, pers. comm. 2009). Of the skipper populations, the Cheesman population has experienced the greatest impact from these fires, within which the Hayman Fire burned 5,511 acres of skipper habitat (96 percent of Cheesman population). At this time, it is uncertain if the skipper will persist in the areas of moderate-to-high severity burns, given the anticipated long-term absence (approximately 70 years) of the ponderosa pine and Douglas-fir overstory.

*Alteration of Forest Condition* - In addition to increased fire severity, fire suppression over the past 100 years has altered ponderosa pine forest stand conditions and has resulted in a reduction in the quality of skipper habitat by creating more uniform and denser forests with fewer forest openings, as compared to historical forests with a greater mosaic of tree ages and densities across the landscape (USFS 2000). The typical crown closure in the area under pre-European conditions is estimated to have averaged around 30 percent while currently much of the USFS land within the skipper's range has a canopy of 40 percent or greater (USFS 2000). The optimum conditions for skipper habitat include a tree canopy cover of 25 percent from ponderosa pine and 5 percent from Douglas-fir (USFWS 1998). Recent fuels reduction projects by land management agencies have demonstrated that skipper habitat and skipper densities can be

improved by forest thinning treatments (Natural Perspectives 2008). Twenty-seven percent of skipper habitat has received fuels reduction treatments, with additional forest thinning planned on 4 percent of the skipper habitat.

### Effects Analysis

The effects of the aerial application of fire retardants on the skipper can be manifested primarily as a physical hazard, ranging from misting or coating of individual skippers to the crushing of individuals, but may also result from effects to skipper habitat. The effects of fire retardant on the skipper are likely influenced by the season of use and associated life-stage of the insect, canopy cover at the retardant drop site and retardant application rates.

The skipper's range is within the Southern Rocky Mountain Ecoregion, which has a fire season from June to September. Past fire history within skipper habitat indicates a peak fire season from May through August (USFS 2011), with larger fires occurring in the early summer months. During these early summer months, the skipper is in the larval stage and then pupation generally occurs in late July, though little is known of the details of these stages (Keenan and others 1986). Adult butterflies emerge as early as late July and begin feeding, mating, and ultimately laying eggs. Adults likely continue to fly into the early fall until a major killing frost occurs (ERT 1986). Below are effects to the species analyzed by life-stage.

*Adult life-stage* - Adults are mobile and may fly away from sites impacted by smoke and heat, reducing the risk of exposure to retardant. However, if the retardant coats the adult skippers' wing surface, they would not be able to expand their wings and fly because of the tacky nature of the retardant and/or added weight load. The aerial application of fire retardant is also anticipated to result in the injury or mortality of adult skippers by crushing or smothering individuals. Population densities for the skipper are low (i.e., approximately 2 skippers per acre (CNHP 2011)), however, and it is unlikely that many skippers would be affected by the dropping of retardant, unless there was a widespread application of retardant. Fire retardant may also affect the available food source for the adult skipper. If retardant covers the flowering plant (i.e., prairie gayfeather), the nectar source could be temporarily unavailable. This plant has flowers that open sequentially down its flowering spike, so it is likely that new flowers would continue to open over time and there would not be a notable loss of nectar sources.

*Egg life-stage* - Eggs are deposited on blue grama grass during late summer and early fall. Eggs are deposited singly on blades of grass. We anticipate that it is possible for an egg to be dislodged by the impact of a retardant drop, but recognize that the bond of the egg and grass probably withstands the force of rainstorm events. If an egg were coated by retardant material, this would likely harm the egg by reducing the exchange of gases between the egg and the

environment. We do not know the density of skipper eggs per acre as these are extremely difficult to detect.

*Larval and pupal life-stages* - Most large fires in skipper habitat occur during the early summer months when the skipper is in the larval or pupal life-stages. Both stages occur exclusively on the grama grass. Because of the limited mobility of the larvae and pupae, these stages are the most vulnerable to adverse impacts from fire retardant as the insects cannot leave the area and avoid retardant. The aerial application of fire retardant is likely to result in the injury or mortality of larvae and pupae by crushing or smothering individual (Ellis 2008). The retardant is tacky and may impede larvae movement and could cover some feeding surfaces of the larval host plant, blue grama grass. While it is thought that the larval form may be able to “groom” and remove some of this material (Opler 2008), it likely would not be able to remove material from the plant surface to expose feeding surfaces. Feeding source material would be reduced short term and could affect survival of the larvae. The blue grama grass may intercept the retardant, if it were a low volume, and reduce the skipper’s exposure to the retardant. We do not know the density of skipper larvae or pupae per acre as these are extremely difficult to detect.

The impact of the fire retardant on the all life-stages of the skipper is dependent on the location of the application within the forest. Fire retardant dropped over a ponderosa pine and Douglas-fir forest will be intercepted some by the tree canopy before reaching the ground level vegetation, therefore having less impact on skippers. However, most skipper activity is concentrated in small forest openings where feeding on nectar plants and egg laying occurs, resulting in a reduced potential for vegetation to intercept fire retardant.

### Conclusion

It is the Service’s biological opinion that effects of the proposed action will not jeopardize the continued existence of the Pawnee montane skipper. While the skipper has a restricted range and may experience take of some individuals due to retardant use on a specific fire event, this take would not jeopardize the survival and recovery of the species. The risk of exposure is low, based on low skipper population densities and the mobility of adult skippers. Impacts to the skipper are anticipated but are expected to be offset by the benefits of reducing the spread of a large scale crown fire and by maintaining functional skipper habitat. The proposed action will not adversely modify or destroy critical habitat for the skipper, as it has not been designated.

## **Region 8 Pacific Southwest: California and Nevada**

*Lead for forty-three (43) Species Total*

### ***Arroyo toad (Anaxyrus californicus (Bufo microscaphus californicus))***



## Environmental Baseline

### ***Angeles National Forest***

On the Angeles National Forest, arroyo toad populations exist along Castaic Creek, Big Tujunga Canyon including associated lower reaches of Mill and Alder creeks, Soledad Canyon and on the desert side of the San Gabriel Mountains along Little Rock Creek. Besides Castaic Creek, these areas were apparently not known to be occupied by arroyo toads at listing. These populations lie near or within the forest boundary and, in some cases, extend beyond it (USFWS 2005).

Approximately 2,586 acres of occupied habitat is present on the Angeles National Forest (Waln, pers. comm. 2011). Arroyo toads in Big Tujunga Canyon are threatened by exotic species including crayfish (*Procambarus clarkii*), bullfrogs (*Rana catesbeiana*), and giant reed (*Arundo donax*). Portions of Little Rock Creek have been closed by the Angeles National Forest to protect the arroyo toad. Threats to the arroyo toad on the Forest include recreation, road use and maintenance, and mining activities..

### ***San Bernardino National Forest***

On the San Bernardino National Forest, arroyo toads occur in lower Deep Creek and Kinley Creek; the West Fork of the Mojave River; and Little Horsethief Creek. In the eastern San Gabriel Mountains, arroyo toads have been detected in Cucamonga Canyon and Cajon Wash. Along the western base of the San Jacinto Mountains, arroyo toads occur in Bautista Creek and along the San Jacinto River (USFWS 2005). The San Bernardino National Forest supports approximately 4,615 acres of occupied arroyo toad habitat (Waln, pers.comm. 2011). Threats to the arroyo toad on the Forest include recreation, road use, and maintenance, and the Little Horsethief population is also threatened by gold prospecting activities (USFWS 1999).

### ***Cleveland National Forest***

There are many arroyo toad occurrences on the Cleveland National Forest and surrounding lands; however, most of these populations are small in size. Approximately 17,408 acres of arroyo toad occupied habitat are present on the Cleveland National Forest (Waln, pers. comm. 2011). Most populations occur near the Cleveland National Forest boundary with the bulk of prime breeding habitat often lying just off national forest land (USFWS 2005). This is the case at the Sweetwater River; the upper San Diego River; Santa Ysabel Creek and associated lower reaches of Temescal Creek (Pamo Valley); and at Cottonwood Creek which includes the lower reaches of Kitchen, Morena, and Potrero creeks. Other occupied drainages include: San Mateo Creek; San Juan Creek; and the upper forks of the San Luis Rey River (above Lake Henshaw) including Agua Caliente Creek. Threats to the arroyo toad on the Cleveland National Forest include off-highway vehicle use; recreation; campgrounds at upper San Juan Creek, upper San Luis Rey River, and Cottonwood Creek; road use and maintenance; exotic species; and grazing.

### ***Los Padres National Forest***

On the Los Padres National Forest, substantial arroyo toad populations exist on Piru Creek,

Agua Blanca Creek, Sespe Creek, and interconnected reaches of the upper Santa Ynez River, Mono Creek, and Indian Creek. A smaller population occurs along the Sisquoc River. All of these populations are predominantly on national forest land. The northernmost population of arroyo toads, on the San Antonio River in Monterey County, lies just off the forest on the Fort Hunter Liggett Military Reservation (USFS 2000). The Forest Service indicates that the arroyo toad populations in the Upper Santa Ynez River, Upper Piru Creek, and Sespe Creek are comparable in size to those inventoried in the early 1990's. Arroyo toad populations in lower Piru Creek and the Sisquoc River appear to have declined. The Los Padres National Forest supports approximately 10,160 acres of occupied arroyo toad habitat (Waln, pers. comm. 2011). The Los Padres National Forest has closed and decommissioned the Lion, Beaver, Juncal and Blue Point campgrounds to protect the arroyo toad (USFS 2005).

#### *Recovery Plan for the Arroyo Toad*

Since the listing of the arroyo toad, new locations in areas that were not previously known to be occupied by arroyo toads have been discovered as a result of site-specific surveys. The largest of these newly discovered populations was found on Fort Hunter Liggett Army Reserve Training Center in 1996 (U.S. Army Reserve Command 2004). Although a substantial proportion of currently occupied habitat is found on Forest Service lands, recovery of the arroyo toad on privately-owned lands will likely be necessary for recovery of the species. When listed in 1994, only 6 of the 22 extant populations south of Ventura County were known to contain more than a dozen adults (59 FR 64859). The recovery plan (USFWS 1999) describes 22 river basins in the coastal and desert areas of 9 counties along the central and southern coast of California that were known in 1999 to be occupied by arroyo toads at that time. Three recovery units (Northern, Southern, and Desert) were established to reflect the ecological and geographic distribution of the species and its current and historic range (USFWS 1999). Recovery and delisting will be facilitated by meeting the recovery criteria: (1) stabilize and maintain populations throughout the range of the arroyo toad in California by protecting sufficient breeding and nonbreeding habitat; (2) monitor the status of existing populations to ensure recovery actions are successful; (3) identify and secure additional suitable arroyo toad habitat and populations; (4) conduct research to obtain data to guide management efforts and determine the best methods for reducing threats; and (5) develop and implement an outreach program.

#### Effects of the Action

The Forest Service proposes to avoid fire retardant application in arroyo toad occupied habitat by providing maps and guidance to aerial fire-fighting personnel so that the potential for an application to occur in occupied habitat is minimized. A 600-ft buffer will be applied to streams with occupied habitat for arroyo toads. However, the possibility remains for accidental application of retardant (misapplication) or application by exception to protect human life. While there is no way to predict when an exception to protect human life would occur, in the case of misapplication only 3 years of data were gathered by the Forest Service (from 2008 to 2010) indicating misapplications do not occur often, i.e. less than 0.1 percent of all fire retardant applications (USFS 2011).

Because there is the possibility of an application by exception to protect human life, the most direct adverse effect of the action would be if retardant was dropped directly into a waterbody containing arroyo toads. The biological assessment states that most wildfires occur on the Forests during the primary fire season in southern California, which is typically from August to October. However, recent fires have occurred much earlier on the Los Padres National Forest: the Wolf Fire - June 5, 2002; Indians Fire - June 8, 2008; the Basin Complex Fire joined with the Indians Fire - June 21, 2008; Zaca Fire - July 4, 2007; San Rafael Fire - July 23, 2006. On the Angeles National Forest, the Bouquet Fire started on May 11, 2002 and the Copper Fire started on June 5, 2002. It appears that fire season on these Forests typically starts earlier than in the more southern Cleveland and San Bernardino National Forests.

To capture the exposure risk for arroyo toads, we analyzed how the timing of wildfires and consequently, retardant drops, relate to arroyo toad life history. The arroyo toad breeding season typically occurs from February to July on streams with persistent water (Griffin et al. 1999). Arroyo toads breed and deposit egg masses in the shallow, sandy pools of these streams and tadpoles begin to disperse from the pool margin into surrounding shallow water, where they spend an average of 10 weeks. After metamorphosis (June and July), the newly metamorphosed arroyo toads remain on the bordering gravel bars until the pool dries out, usually from 8 to 12 weeks depending on the site and rainfall. Therefore, we expect that arroyo toad tadpoles and toadlets (toads that have recently metamorphosed from tadpoles) could be exposed to applications or misapplications of retardant on wildfires that start in June and July, which is typically the beginning of fire season on the Los Padres and Angeles National Forest.

The historical fire data provided in the biological assessment covers 11 years but the timeframe for this consultation is 10 years. Assuming that national forests will continue to drop retardant at the same rate in the future, we extrapolated those numbers over the next 10 years. Table 1 shows this difference in magnitude of retardant drops for each Forest. The biological assessment also assumes that 0.42 percent of all retardant drops will result in misapplication to a waterway. Based on this assumption, we expect that over the life of the consultation, 0.42 percent (0.0042) of all drops on each Forest will result in delivery to a waterway with potential adverse effects to arroyo toads if the stream is occupied downstream, as shown in Table 36 below.

**Table 35. Number of Applications of Retardant Expected to Enter Waterways**

Forest	Total number of fires in 2000-2010 (11 years)	Total number of retardant drops in 2000-2010	Expected total number of retardant drops over 10 years	Number of drops expected to enter water ways (multiplied by 0.42 percent (0.0042) and rounded up)
Los Padres	433	2,811	2,555	11

Angeles	1,240	1,257	1,143	5
Cleveland	762	314	285	1
San Bernardino	1,463	1,607	1,461	6

To capture the extent of exposure risk for arroyo toads, we calculated the number of miles of perennial streams within each Forest and how many miles of arroyo toad occupied habitat in those perennial streams are within Forest boundaries, as shown in Table 37. Finally, Table 38 presents the total percentage of occupied arroyo toad habitat that may be adversely affected by retardant in the next 10 years. Our calculations show a potential for arroyo toad tadpoles and toadlets to be adversely affected within 6 percent of occupied habitat for the arroyo toad that may also be degraded from misapplications of retardant in a 10 year period.

**Table 36. Miles of Arroyo Toad Occupied Habitat on Streams Within Each Forest**

Forest	Miles of perennial streams on Forest	Miles of arroyo toad occupied streams on Forest (number of streams x 6.2 miles)
Los Padres	776	105
Angeles	489	116
Cleveland	169	167
San Bernardino	732	52

**Table 37. Percentage of Occupied Arroyo Toad Habitat That May Be Adversely Affected**

Forest name	Miles of perennial streams on Forest	Miles of Arroyo Toad occupied streams on Forest	% of total perennial streams which are occupied	Number of drops expected to hit stream	Total stream miles affected by retardant (6.2 miles per drop to water <sup>2</sup> )	% Arroyo Toad occupied steams affected by retardant
Angeles	489	40	8%	5	5 x 6.2 = 31 miles	0.08 x 31 = 6% (2.5 miles)
Los Padres	776	116	15%	11	11 x 6.2 = 68.2 miles	0.15 x 68 = 9% (10 miles)
Cleveland	169	167	99%	1	1 x 6.2 = 6.2 miles	0.99 x 6 = 4% (6 miles)
San	732	52	7%	6	6 x 6.2 =	0.07 x 37 = 6%

Bernardino					37.2 miles	(3 miles)
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Although the toxicity of fire retardants has not been determined for arroyo toads, if a retardant drop were to accidentally land directly in a body of water that contained arroyo toad tadpoles or toadlets, those animals could be exposed to toxic retardant chemicals, i.e. ammonium (NH<sub>4</sub>), phosphate (PO<sub>4</sub>) and sulfate (SO<sub>4</sub>), and could be injured or killed by the toxic effects of these chemicals (USFS 2011). According to the biological assessment, lethal effects of retardant could extend at least 6.2 miles downstream and sublethal effects may occur much farther downstream (USFS 2011). Consequently, arroyo toad tadpoles and toadlets may be indirectly affected if a misapplication is applied upstream of arroyo toad occupied habitat and toxic chemicals reached downstream arroyo toad localities. If a retardant drop occurred upstream, how much of the retardant chemicals would be diluted before reaching a pool containing tadpoles and toadlets would also depend on the distance away from occupied habitat, the amount of water in the stream, and rate of flow. Little and Calfee (2003) found rapid recovery of fish when removed from exposure, indicating the duration of exposure and hence the residence time of the chemical in the habitat is an important variable.

Arroyo toad habitat could also be adversely affected by eutrophication processes that would degrade habitat that resulted from the fertilizer effects of retardant. Because the fire retardants used by Forest Service are nitrogen based, retardants that enter a body of water will eventually break down to become nitrogenous nutrients. Eutrophication is the excessive growth of aquatic vegetation resulting from the input of nutrients, particularly phosphate and nitrate (Ricklefs 1990). Oxygen depletion occurs as a result of eutrophication and can also cause fish kills. This is because oxygen reduction is usually associated with abundant growth of rooted vegetation, heavy algal blooms, or high concentration of organic matter (e.g., fertilizers, sewage, livestock feces). The oxygen required during the decay of plants and breakdown of organic matter by bacterial flora, coupled with consumption by fish and other biota, may exceed the oxygen available in the water and arroyo toads could suffocate from lack of sufficient oxygen in the water.

Outside of the breeding season, arroyo toads are essentially terrestrial and use a variety of upland habitats for foraging, burrowing, and dispersal. Adult arroyo toads seek shelter during the day and other periods of inactivity by burrowing into the sandy areas of upland terraces. They also use the marginal zones between stream channels and upland terraces for burrowing, especially during late fall and winter (Sweet 1992). Although arroyo toads may be found along relatively long stretches of some creeks and rivers, suitable breeding or upland habitat may not occur throughout the entire distance. The proportion of suitable habitat may change during the year and from year to year, depending on climatic conditions, fires, or other natural (e.g., flooding) or human-related events. Because of this, it is difficult to estimate the exact distribution of arroyo toads or the extent of suitable habitat on any particular system at a given time. In addition, the highly variable nature of arroyo toad habitat results in similar levels of variation in population density. For example, arroyo toad densities can range from fewer than 25 to over 200 adults over different stretches of the same stream (Bloom 1998).

### *Species Recovery*

The proposed action should not impede the recovery of the arroyo toad with respect to the recovery plan because the Forest Service proposes to avoid fire retardant application in arroyo toad occupied habitat by establishing a 600-ft buffer to streams with known occupied habitat for arroyo toads. This measure would partially meet recovery task (1), which is to protect sufficient breeding and nonbreeding habitat for the arroyo toad. The Forest Service also proposes to monitor and implement actions to remove nonnative plants if enhancement of nonnative plants due to fire retardant application is observed in arroyo toad occupied habitat, which would partially meet recovery task (2), which is to monitor the status of existing populations to ensure recovery actions are successful. The proposed action does not involve securing additional suitable arroyo toad habitat and populations, conducting research, or developing an outreach program for arroyo toads, and is therefore neutral as to tasks (3), (4) and (5).

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the arroyo toad, environmental baseline for the action area, effects of potential misapplication of retardant on occupied arroyo toad habitat, and cumulative effects, it is our biological opinion that the use of aerially-applied fire retardant on National Forest System lands is not likely to jeopardize the continued existence of the arroyo toad. The proposed action would not lead to a substantial decline in number of arroyo toads and would not preclude the recovery of arroyo toads. This conclusion is based on the following reasons:

1. The Forest Service will establish a 600-foot buffer on known arroyo toad occupied habitat and retardant applications in occupied habitat will only occur due to misapplications, which occur rarely, or to save human life.
2. The breeding population of adult arroyo toads and future breeding population of juvenile arroyo toads would be in their burrows and protected from exposure to toxic chemicals during the time of year when fire retardant is most likely to be applied.
3. Direct impacts from the toxic chemical effects of retardant should be effectively avoided or minimized because the application of fire retardant in arroyo toad occupied habitat would occur primarily outside of the breeding season when most juvenile and adult toads are underground in their burrows.
4. The Forest Service proposes to conduct monitoring after a fire retardant application in arroyo toad occupied habitat and remove invasive nonnative plants so that impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary.



5. Due to the expected short term and temporary nature of the potential impacts, we do not expect that the proposed action will impact the ability of this species to recover.

The USFS determined there would be no effect from the use of aerially-applied fire retardant on National Forest System lands on critical habitat for this species; therefore, the USFWS did not address critical habitat for this species.

## **California jewelflower (*Caulanthus californicus*)**

### Environmental Baseline

One metapopulation of *Caulanthus californicus* (scattered groups of plants that may function as a single population due to occasional interbreeding) occurs on the Los Padres National Forest in Santa Barbara Canyon on approximately 30 acres near the Cuyama Valley, primarily on private inholdings within the forest (CSUS 2011). Small population size remains a threat to *C. californicus* in Santa Barbara Canyon because more than 90 percent of the population occurs on private land that is subject to cattle grazing throughout the growing season of the plant. Other threats include development, competition from exotic plants, and the effects of insecticides on pollinators, although specific information regarding the nature or extent of this threat is limited.

### Effects of the Action

Since *Caulanthus californicus* seeds begin to germinate in the start of the rainy season with flowering and seed set continuing until the plant dies, which may occur as late as May, well before most wildfires occur on the Los Padres National Forest, it is anticipated that fire retardant applications in habitat for this species would occur after seed-set and after plant senescence. Studies indicate that *C. californicus* probably forms a persistent seed bank (CSUS 2011). A persistent seed bank ensures that some seeds will be available to produce plants in succeeding years, even if no individuals survive to set seed in one unfavorable growing season. Thus, the portions of a *C. californicus* population subject to the impacts of a fire retardant application are likely to recover either by re-establishment from directly adjacent *C. californicus* individuals or via the seed bank. Therefore, we do not anticipate direct effects of fire retardant use to this species. However, a significant threat to *C. californicus* is invasion and competition from nonnative plants.

Retardant formulations in use today are primarily inorganic fertilizers (USDA 2011) and based on the general effects of the action, nonnative plants could be enhanced by fire retardant application. *Caulanthus californicus* habitat includes slightly alkaline sandy loams, in which other plants do not thrive because of low nitrogen levels. Nitrogen and phosphorus could be increased in the soil through the application of ammonium-based retardants. Increases in



nutrients to the soil might encourage the growth of nonnative invasive species and give them a competitive advantage over *C. californicus*. While fire retardant could enhance nonnative plants, it could also enhance *C. californicus* growth. Yet, if retardant were dropped on *C. californicus*, we would expect increased competition from nonnative plants that would likely reduce population numbers and reproductive efforts of *C. californicus* in that area. However, given the proximity to other populations occurring on private lands, the metapopulation dynamics of the *C. californicus* on the Los Padres NF, and the temporary nature of the increased nutrient levels, we do not anticipate the proposed action would result in extirpation of the *C. californicus* populations on the Los Padres NF.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, it is the Service's biological opinion that the proposed actions are not likely to jeopardize the continued existence of *Caulanthus californicus*.

Our conclusion is based on the following reasons: (1) the spatial extent of the anticipated effects is small in comparison to the species' current distribution; (2) the Service does not anticipate the loss of plant populations within the action area; and (3) the likelihood of any single population on Forest Service lands being hit by a retardant drop is extremely low.

## **California red-legged frog (*Rana draytonii*)**

### Environmental Baseline

The Plumas National Forest is known to contain two breeding populations of California red-legged frog located within ponds occupying a total of approximately 0.3 acre. One location consisting of approximately 10 adults is located along a tributary to French Creek and occupies an approximately 0.25 acre pond. The frog population at this location is currently being affected by reduced habitat suitability due to sedimentation of the breeding pond which is partially attributed to off-road vehicle use. The second known population on the Plumas National Forest is located adjacent to Little Oregon Creek and consists of two small ponds totaling approximately 0.05 acre which have been documented to contain six adult frogs. This location is currently overgrown by nonnative blackberries and the pond levels have not remained high enough to allow for successful reproduction over the last several years.

The Eldorado National Forest is currently known to contain California red-legged frogs within the Bear Creek watershed. Surveys of this area resulted in the detection of one adult frog within a tributary to Little Silver Creek and a juvenile within a tributary to Bear Creek. Although there are no known breeding populations located on National Forest System Lands within the Eldorado National Forest, the frog is known to breed within a 0.5 acre pond along Bear Creek which is immediately downstream of Forest System Lands. In 2010 a total of 17 adult frogs were documented within the private pond which is known to contain stocked fish.

The Los Padres National Forest (LPNF) has many watersheds where occupancy has been confirmed for the California red-legged frog, although we do not have an estimate of the total population of California red-legged frogs on the forest. There are approximately 13 localities on the forest where California red-legged frog breeding has been detected:

<b>CRLF Locality</b>	<b>Watershed</b>	<b>LPNF Ranger District</b>
Laffler Canyon	Big Sur	Monterey
East Fork Morro Creek	San Luis Obispo	Santa Lucia
Alamo Creek	Lower Cuyama	Santa Lucia
North Fork La Brea Creek	Sisquoc River	Santa Lucia
Manzana Creek	Sisquoc River	Santa Lucia
Lower Santa Ynez River	Middle Santa Ynez	Santa Barbara
White Rock Day Use Area	Lower Santa Ynez	Santa Barbara
Lower Oso Day Use Area	Lower Santa Ynez	Santa Barbara
Mono Creek	Upper Santa Ynez	Santa Barbara
Aqua Caliente Creek	Upper Santa Ynez	Santa Barbara
Indian Creek	Upper Santa Ynez	Santa Barbara
Matilija Creek and Tributaries	Ventura River	Ojai
Sespe River	Upper Sespe	Ojai

There are two known populations on the Angeles National Forest, San Francisquito Creek, and a recently discovered population (2009) in Aliso Canyon.

San Francisquito Creek: California red-legged frogs occupy a 1,300 to 3,280 foot segment of San Francisquito Creek, referred to as the Saint Francis Dam reach (Forest Service 2002, Hitchcock *et al.* 2002). The primary ongoing threats to California red-legged frogs in San Francisquito Canyon are from exotic species and disease. The exotic species include mosquitofish (*Gambusia affinis*), green sunfish (*Lepomis cyanellus*), goldfish (*Carasius auratus*), crayfish (*Procambarus clarkii*), and arundo. Fortunately, bullfrogs have not been reported from San Francisquito Canyon. In a recent survey, 66 tadpoles, 2 egg masses, 3

metamorphs, 11 juveniles, and 43 adult California red-legged frogs were detected in San Francisquito Canyon (Gallegos et al. 2010).

Aliso Canyon: A 2009 survey in Aliso Canyon observed 3 adult California red-legged frogs (Lalo, pers. comm. 2009). This discovery reconfirmed a location for California red-legged frogs that had been collected just upstream in 1959 by Bill Wilder (Fisher, pers. comm. 2009). Goldfish were the only exotic species observed during the same survey. In a subsequent survey later that year, 3 metamorphs, 2 juveniles, and 23 adult California red-legged frogs were detected in Aliso Canyon (Gallegos et al. 2010).

### Effects of the Action

Data from other anuran species seems to indicate that the tadpole life stage is most sensitive to fire-retardant, with little to no data on effects to eggs (Calfee and Little 2003), and data suggesting that adults might become ill but would not likely die. Breeding occurs at these sites from winter to early spring (January through March), a time of year when weather and fuel conditions are not as favorable for wildfires as in the summer and fall. This is well before most wildfires occur on the Los Padres National Forest during the primary fire season, August to October, in southern California.

Although all aquatic features will be buffered by a minimum of 300 feet, there is the possibility of accidental application of retardant (misapplication) or application by exception to protect human life. While there is no way to predict when an exception to protect human life would occur, in the case of misapplication, 3 years of data from 2008 to 2010 indicate that misapplications do not occur often, i.e. less than 0.1 percent of all fire retardant applications (USFS 2011). Although the toxicity of fire retardants has not been determined for California red-legged frogs, if a retardant drop were to accidentally land directly in a body of water that contained California red-legged frogs, those frogs could be exposed to toxic retardant chemicals, i.e. ammonium (NH<sub>4</sub>), phosphate (PO<sub>4</sub>) and sulfate (SO<sub>4</sub>), and could be injured or killed from the toxic effects of these chemicals (USFS 2011). Such exposure could be transient and of limited duration, depending on how much water remained in the pool and, if water was still flowing, the rate of flow. Little and Calfee (2003) found rapid recovery of fish when removed from exposure, indicating the duration of exposure and hence the residence time of the chemical in the habitat is a critical variable. If a retardant drop occurred upstream, how much of the retardant chemicals would be diluted before reaching a pool containing frogs would also depend on the distance away from occupied habitat, the amount of water in the stream, and rate of flow; however, the retardant has the potential to kill California red-legged frog tadpoles and injure adults up to 6.2 miles downstream of the application site.

California red-legged frogs typically lay eggs in December to late March, thus eggs are highly unlikely to be exposed to fire retardant. Tadpoles are present from hatching to ~10 weeks later; most populations have completed metamorphosis by late July. Thus, exposure of tadpoles within

the Sierra Nevada to retardant would be limited. Most California red-legged frogs populations are in small ponds, thus retardant would be diluted less than it would in a stream. Given the time for retardant to break down, the effects of retardant should not last more than a single breeding season. Since breeding occurs at the Los Padres sites from winter to early spring (January through March), it is a time of year when weather and fuel conditions are not as favorable for wildfires as in the summer and fall. Therefore it is not anticipated that fire retardant will likely affect either the egg or larval life stages of the frog on the Los Padres National Forest. However, since adult frogs are primarily restricted to within 300 feet of aquatic environments during the summer months, it is anticipated that any application of fire retardant to occupied aquatic habitat or within 300 feet of the aquatic habitat would likely affect the adult and subadult frogs.

Misapplications of fire retardant would be less likely to occur where the 2 populations on the Angeles NF are located for several reasons. In 2002, the Copper Fire burned through San Francisquito Canyon and eliminated riparian habitat on San Francisquito Creek. The effects to frogs did not come from retardant but from the post-fire erosion in the area that filled up the existing breeding pools. Because of the relatively low fuels in the area resulting from that fire, it is unlikely that another wildfire requiring retardant drops would occur near California red-legged frog habitat in San Francisquito Canyon. Likewise, the 2009 Station Fire burned within 1 mile of Aliso Canyon and the likelihood of a large fire requiring retardant drops in the Aliso Canyon area is extremely low due to low fuel load in the areas adjacent to the California red-legged frog population.

### Conclusion

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant Project is not likely to jeopardize the continued existence of California red-legged frog. The proposed action would not lead to a substantial decline in number of California red-legged frogs, a substantial reduction in range of California red-legged frog and it would not preclude the recovery of California red-legged frog.

Our conclusion is based on the following: (1) the spatial extent of the species outside the proposed action area is large; (2) the occurrences and potential habitat that are in or near Forest Service lands are geographically dispersed; (3) effects of a retardant drop would be short term (single season); and (4) the likelihood of a retardant drop hitting an occupied water body is extremely low.

Fire retardant is not anticipated to adversely affect designated critical habitat due to potential effects on PCE's and essential features being considered short-term and/or insignificant.

### **Camatta Canyon amole (*Chlorogalum purpureum* var. *reductum*)**

## Environmental Baseline

### ***Los Padres National Forest***

The Camatta Canyon amole occurs in one region in the La Panza Range on the Los Padres National Forest in San Luis Obispo County. It is currently known from only two sites. The larger site is located adjacent to a two-lane State highway; a smaller site is located approximately 3 to 5 miles farther to the south. The larger locality is located on a narrow, flat-topped ridge or plateau supporting blue oak (*Quercus douglasii*) savannah. North of the highway, the population occurs on private lands. The plants south of the highway are on Forest Service lands within the Los Padres National Forest. A few plants may extend into the California Department of Transportation (Caltrans) right-of-way along the highway. Caltrans has designated both sides of the highway right-of-way in this area as Botanical Management Areas.

Various agencies have provided different population estimates for the Camatta Canyon amole. The Center for Plant Conservation (2007) states that as many as 100,000 Camatta Canyon amole may exist, with most of these plants on approximately 5 ac to 7 ac of land. However, records of the California Department of Fish and Game (2007 *in* USFWS 2008) state that the location comprises 127 ac. Regardless, this particular area could be targeted for fire retardant drops because it is on a mountain ridge, where retardant is often dropped.

The second known locality of the Camatta Canyon amole was first documented by botanists in the mid-1990s. It is located 3 to 5 miles south of the Los Padres National Forest population in an area with similar soils and topography. This occurrence has been estimated to occupy less than 0.25 acres and consists of several hundred plants in two or more patches on private land. The landowner has expressed an interest in the plant and its protection.

*Recovery Plan for Camatta Canyon Amole:* A recovery plan has not been prepared for this species.

***Critical Habitat:*** Critical habitat for Camatta Canyon amole was designated on October 24, 2002 (67 FR 65414), and comprises one unit. The Camatta Canyon Unit is 4,378 acres, of which 25 percent is managed by the Los Padres National Forest. This unit encompasses the plateau on both the north and south sides of Highway 58 near Camatta Canyon and extends south approximately 3 miles to include two private inholding areas within the Los Padres National Forest boundaries. The primary constituent elements of critical habitat for the Camatta Canyon amole are those physical and biological features that are essential to the conservation of the species and that may require special management considerations and protections. There are two primary constituent elements (PCEs) for the Camatta Canyon amole.

*PCE 1: Well-drained, red clay soils with a large component of gravel and pebbles on the upper soil surface.* This primary constituent element addresses the soil characteristics, essential nutrients, and water retention capabilities that are essential for Camatta Canyon amole survival and resistance to disease, insects, drought and other stresses.

*PCE 2: Plant communities in functioning grassland-type ecosystems that support associated plant and animal species.* This second primary constituent element describes the conservation role of various grassland ecosystems that the Camatta Canyon amole depends upon for survival and recovery. The grassland component of critical habitat are defined as plant communities composed of perennial grasses with scattered shrubs and cryptogamic soil crusts (composed of lichens, mosses, algae, and bacteria) that protect soil between shrubs from erosion and absorb moisture and provide nitrogen and other nutrients for plant growth.

### Effects of the Action

Because the Forest Service proposes to avoid fire retardant application in Camatta Canyon amole occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in Camatta Canyon amole occupied habitat is minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in Camatta Canyon amole occupied habitat and misapplications do not occur often. Data from 2008-2010 indicate that misapplications occur in less than 0.1 percent of fire retardant applications (USFS 2011).

The average fire retardant application covers about 1-1.5 acres in a linear fashion, so only a small portion of a given application could potentially cover Camatta Canyon amole occupied habitat. Based on the general effects of the action described above for plant species, fire retardant applications could impact Camatta Canyon amole via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application (*i.e.*, the average fire retardant application covers about 800 feet (ft) (244 meters (m)) by 50-75 ft (15-23 m) (USFS 2011)). However, since the flowering season for Camatta Canyon amole is February to April and seeds are released by early summer, most fire retardant misapplications in habitat for this species would occur after seed-set or when the plant is dormant.

A primary threat to Camatta Canyon amole is invasion and competition from nonnative plants and based on the general effects of the action described above, nonnative plants could be enhanced by fire retardant application. Camatta Canyon amole habitat occurs on reddish, gravelly or rocky clay soils in chaparral and oak savannah. Nitrogen and phosphorus could be increased in the soil through the application of ammonium-based retardants. Increases in nutrients to the soil might encourage the growth of nonnative invasive species and give them a competitive advantage over Camatta Canyon amole. These plant species may have the ability to displace the Camatta Canyon amole by outcompeting and monopolizing the limited resources (soil nutrients, water, sunlight, pollinators), with the potential effects of preventing growth and recruitment.

An increase in abundance of the invasive, non-native plant species may also alter characteristics of the fire regime, such as frequency, intensity, and seasonality of fires (Brooks et al. 2004). Fires at certain times of the year have the ability to prevent annual reproductive success of the purple amole (Niceswanger 2002 *in* USFWS 2008), and likely also of the Camatta Canyon



amole. The Camatta Canyon amole is susceptible to damage by fire when the living structures, including the seeds, are above ground or near the soil surface.

If fire retardant is applied to Camatta Canyon amole occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants if enhancement of nonnative plants due to fire retardant application is observed. With implementation of monitoring and removal of nonnative species, impacts to the Camatta Canyon amole population due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

#### Effects to critical habitat

While fire retardant application in Camatta Canyon amole occupied habitat is not likely to affect the red clay soil characteristics that are described in PCE 1, non-native plants introduced into critical habitat from the fertilizer effects of fire retardant could remove, disturb, or fragment the cryptogamic crusts associated with the Camatta Canyon amole, which is the second PCE of critical habitat. Cryptogamic crusts consist of nonvascular photosynthetic plants (primarily cyanobacteria, lichens, mosses, and fungi) that form a layer on the soil surface (Beymer and Klopatek 1992 *in* USFWS 2008). Cryptogamic crusts increase the stability of otherwise easily eroded soils, increase water infiltration in regions that receive little precipitation, and increase fertility in soils often limited in essential nutrients such as nitrogen and carbon. The invasion and growth of nonnative invasive species could disturb cryptogamic crusts, which are very fragile and take many years to form and mature. However, the Forest Service will monitor the site and implement actions to remove nonnative plants if enhancement of nonnative plants due to fire retardant application is observed. With implementation of monitoring and removal of nonnative species, impacts to the Camatta Canyon amole primary constituent elements due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### Conclusion

After reviewing the current status of the Camatta Canyon amole, environmental baseline for the action area, effects of potential misapplication of retardant on occupied Camatta Canyon amole habitat, and cumulative effects, it is our biological opinion that the use of aerially-applied fire retardant on National Forest System lands is not likely to jeopardize the continued existence of the Camatta Canyon amole and is not likely to destroy or adversely modify critical habitat for the Camatta Canyon amole. The proposed action would not lead to a substantial decline in number of Camatta Canyon amole and would not preclude the recovery of Camatta Canyon amole. This conclusion is based on the following reasons:

6. Direct impacts should be effectively avoided or minimized due to the application of fire retardant in Camatta Canyon amole occupied habitat primarily outside the flowering season and when the plant is dormant.



7. Due to the proposal to conduct monitoring after a fire retardant application in Camatta Canyon amole occupied habitat and remove nonnative plants, as appropriate, impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary and are not likely to adversely affect the primary constituent elements of Camatta Canyon amole critical habitat.
8. Due to the expected short term and temporary nature of the potential impacts, we do not expect that the proposed action will impact the ability of this species to recover.

**Carbonate Plants (Cushenbury Oxytheca [*Oxytheca parishii*], Cushenbury Milk-vetch [*Astragalus albens*], Cushenbury Buckwheat [*Eriogonum ovalifolium var. vineum*], Parish's Daisy [*Erigeron parishii*])**

Environmental Baseline

The San Bernardino National Forest identifies 455 ac (184 ha) of Cushenbury oxytheca (oxytheca?) occupied habitat, 991 ac (401 ha) of Cushenbury milk-vetch occupied habitat, 1,065 ac (431 ha) of Cushenbury buckwheat occupied habitat and 553 ac (224 ha) of Parish's daisy occupied habitat along its northeastern side (USFWS 2009a, USFWS 2009b, USFWS 2009c, USFWS 2009d).

Five previous formal consultations have addressed Federal actions that may affect carbonate plants on the San Bernardino National Forest:

1. On January 8, 1997, the Service issued non-jeopardy biological and conference opinions on the Wild Burro Management Plan for the San Bernardino National Forest, San Bernardino County, California (1-6-97-F-4) (USFWS 1997a). This consultation addressed the establishment of two wild burro management areas (HMA's) and associated impacts to carbonate plants. HMA1 covers approximately 21,000 ac (8,498 ha) and supports a herd of free-roaming burros, and HMA2 is maintained burro-free. All of the carbonate plants except San Bernardino Mountains bladderpod occur within HMA1. The proposed action contains measures to monitor burro use and impacts in HMA1 and remedy impacts through burro exclusion and/or herd-reduction. Burros are expected to have minimal effects to carbonate plant species due to the low numbers of burros present (about 60), the dispersal of the burros across a large area, the burros preference for wetter habitats, and the short stature and scarce nature of carbonate plants, which makes foraging on them unlikely (USFWS 2001b).
2. On February 5, 2001, the Service issued a non-jeopardy biological opinion on the effects of ongoing San Bernardino National Forest activities such as road use and maintenance and recreation on five listed carbonate plant species (Cushenbury milk-vetch, Parish's daisy, Cushenbury buckwheat, oxytheca, and San Bernardino Mountains bladderpod) on the San Bernardino National Forest (1-6-99-F-26) (USFWS 2001b).

3. On May 2, 2005, the Service issued a non-jeopardy biological opinion on the effects of implementation of the Carbonate Habitat Management Strategy on Cushenbury milk-vetch, Parish's daisy, Cushenbury buckwheat, and oxytheca and their critical habitats. This opinion addressed the strategic direction for future mining activities within carbonate plant habitat (USFWS 2005b).
4. On May 4, 2005, the Service issued a non-jeopardy biological opinion on the Right Star Mine Project regarding potential effects to Cushenbury milk-vetch and Parish's daisy (USFWS 2005c). The project involved the boring of a tunnel to evaluate the feasibility of limestone mining. The proposed project impacted 0.2 ac (0.1 ha) of habitat.
5. On February 6, 2009, the Service issued a non-jeopardy biological opinion on the San Bernardino National Forest Off-Highway Vehicle Route Designation and Travel Management Project. The project involved the decommissioning of roads and the reclassification of roads as administrative use only, which was expected to benefit these species. However, the project also included the additional of green-sticker vehicle use within 0.36 ac (0.15 ha) of occupied habitat for oxytheca, 0.86 ac (0.35 ha) of occupied habitat for Cushenbury milk-vetch, 1.2 ac (0.49 ha) of occupied habitat for Cushenbury buckwheat, and 0.21 ac (0.08 ha) of occupied habitat for Parish's daisy.

Mining activity remains the primary threat for these species (USFWS 2005a). Since listing of these species, the Forest Service and Bureau of Land Management have partnered to develop the Carbonate Habitat Management Strategy (Olson 2003), as mentioned above. Upon successful implementation of the Carbonate Habitat Management Strategy, habitat preservation will meet or exceed recovery criteria 1 and 2 in the draft Recovery Plan (USFWS 2005a). However, mining projects can still be proposed and implemented outside the confines of the Carbonate Habitat Management Strategy (Olson 2003).

#### Effects of the Action

Fire retardant application in occupied habitat should occur rarely. Only a small portion of the San Bernardino National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, the San Bernardino National Forest averaged 315 ac (127 ha) of fire retardant applications per year over 677,628 ac (274,226 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area of occupied habitat for these species is generally low. Also, since the Forest Service proposes to avoid fire retardant application in occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

#### Direct Effects

Fire retardant applications could impact these species via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant

death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)]. However, a fire retardant application on Cushenbury buckwheat in 2010 did not result in direct effects to this species (USFS 2011). Legumes, such as Cushenbury milk-vetch, may be especially susceptible to impacts due to fire retardant. Larson and Duncan (1982) found that legumes germinated, but did not mature with fire retardant application.

Fire retardant application within the range of these species is most likely to occur during the primary fire season in southern California, which is August to October. Since the flowering season for oxytheca and Cushenbury milk-vetch is March to May (67 FR 78570), the flowering season for Cushenbury buckwheat is May to August (67 FR 78570), and the flowering season for Parish's daisy is May to June (67 FR 78570), most fire retardant applications in habitat for these species would occur after seed-set.

Also, while the average fire retardant application covers about 1-1.5 ac (0.4-0.6 ha), applications are linear, so only a small portion of a given application would be expected to occur in occupied habitat. Since this species occurs over a long and linear area, across 15 mi (24 km), the re-establishment of an occurrence is likely from nearby occurrences, if necessary.

#### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact carbonate plant species. Nonnative plants could decrease water availability via competition and create a thatch from dead grasses that prevents seedling establishment. Also, nonnative plants could shade these species and reduce access to sunlight and photosynthesis. Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties resulting in alterations in plant community composition (Ehrenfeld et al. 2001). Finally, enhanced nonnative plants could help attract additional grazing animals, which may trample or consume these species. Burro grazing may impact carbonate plant species and could be enhanced by fire retardant application.

While fire retardant could enhance nonnative plants, it could also enhance native plant growth. Fire retardants contain nitrogen and phosphorus that could act as nutrients. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on these species.

Regardless, if fire retardant is applied to occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

### Effect on Recovery

In September 1997, the Service completed the draft San Bernardino Mountains Carbonate Endemic Plants Recovery Plan (USFWS 1997b). This plan indicated that these species should be considered for downlisting upon the development of a reserve system which includes 5,000 ac (2,000 ha) of protected land in an initial preserve and an additional 4,600 ac (1,860 ha), including some specific areas. Regardless, based on the discussion above, fire retardant application in occupied habitat should occur rarely, especially during the flowering season. If fire retardant application does occur in occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications compared to the amount of occupied habitat and the size of the proposed reserves and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to populations or habitat conditions are not likely to occur and implementation of the draft recovery plan for this species should not be impeded. Thus, the ability of these species to recover should not be affected.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of oxytheca, Cushenbury buckwheat, Cushenbury milk-vetch, or Parish's daisy. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Direct impacts should be effectively avoided or minimized due to the application of fire retardant in occupied habitat primarily outside the flowering season and the size and linear nature of fire retardant applications.
3. Due to the proposal to conduct monitoring after a fire retardant application in occupied habitat and remove nonnative plants, as appropriate, impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary.
4. Due to the expected short term and temporary nature of the potential impacts and size of potential impacts compared to the proposed reserves in the recovery plan for this species, we do not expect that the proposed action will impact the ability of these species to recover.

We concur that these designated or proposed critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the Forest Service will map and avoid application of fire retardant to these areas, to the extent feasible; and 3) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated or proposed critical habitats. Finally, the potential impact to the primary constituent elements of these critical habitats would occur from nonnative plants. However, the Forest Service will monitor areas of fire retardant application within critical habitats and remove nonnative plants, as appropriate. Thus, any potential enhancement of nonnative plants would be short term and temporary.

## **Encinitas Baccharis (*Baccharis vanessae*)**

### Environmental Baseline

There is one known occurrence of Encinitas baccharis (~~–baccharis~~) on national forest lands. Baccharis occurs in Devil’s Canyon in the San Mateo Wilderness of the Cleveland National Forest. Only 12 plants have been detected at this location (USFS 2005). This occurrence is 33 miles (53 kilometers) from the closest known occurrence and on the northern periphery of the range of this species (USFS 2005).

### Effects of the Action

Fire retardant application in baccharis occupied habitat should occur rarely. Only a small portion of the Cleveland National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, this Forest averaged 61 ac (25 ha) of fire retardant applications per year over 439,035 ac (177,671 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area occupied by baccharis is generally low. Also, since the Forest Service proposes to avoid fire retardant application in baccharis occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in baccharis occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in baccharis occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

### Direct Effects

Fire retardant applications could impact baccharis via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)].

Fire retardant application within the range of baccharis is most likely to occur during the primary fire season in southern California, which is August to October. Since the flowering season for baccharis is September to November (USFWS 2005), fire retardant applications could occur within occupied habitat during the flowering season. Also, given the small size of the population, the entire population could be covered by fire retardant.

However, baccharis is able to re-sprout after the aboveground portion of the plant is destroyed (EDAW 2001). In addition, individuals burned in the 2007 Witch Creek Fire re-sprouted vigorously with stems growing faster and longer, and plants flowering more profusely than undisturbed individuals. In addition, the occurrence on the Cleveland National Forest represents a small portion of the remaining individuals of this species.

### Indirect Effects

Nonnative plants could be enhanced by a fire retardant application and result in impacts to native plants. However, nonnative plants have not specifically been identified as a threat to the baccharis population on the Cleveland National Forest; therefore, they are unlikely to be enhanced by a fire retardant application and affect baccharis. Regardless, if fire retardant is applied to baccharis occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts to baccharis due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

While fire retardant could enhance nonnative plants, it could also enhance baccharis growth. Fire retardants contain nitrogen and phosphorus that could act as nutrients to baccharis. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on baccharis.

### Effect on Recovery

No recovery plan or 5-year review exists for baccharis. Based on the discussion above, fire retardant application in baccharis occupied habitat should occur rarely, due to the amount of fire retardant applied compared to the amount of Forest Service land and the small size of the population. Regardless, in the unlikely event that fire retardant is applied to this species and the aboveground portion of the plant is impacted by phytotoxicity, this species has shown the ability to re-sprout. Thus, the proposed action should not impact the ability of this species to recover.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion



After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of baccharis. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in baccharis occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land and the small size of the population on Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Direct impacts should be effectively avoided or minimized due to the ability of this species to re-sprout after the potential loss of the aboveground portion of the plant and the temporal nature of the potential impact. In addition, the population on the Cleveland National Forest represents a small portion of the remaining individuals of this species.
3. Due to the remote location of the population on Forest Service lands and the lack of a threat from nonnative plants, the potential for impacts due to nonnative plants enhanced from a fire retardant application is low. Regardless, the Forest Service will remove nonnative plants, if nonnative plant enhancement is detected from a fire retardant application.
4. No recovery plan or 5-year review for this species exists. Regardless, due to the expected short term and temporary nature of the potential impacts, we do not expect that the proposed action will impact the ability of this species to recover.

## **Greene's tuctoria (*Tuctoria greenei*)**

### Environmental Baseline

On the Modoc National Forest, *Tuctoria greenei* occupies relatively undisturbed vernal pools as well as the margins of stock ponds and reservoirs (USFWS 2005; USDA 2010). These montane pools underlain by volcanic material have been classified as Northern Basalt Flow, Northern Claypan, and Northern Hardpan vernal pools, depending on the precise nature of the underlayer (USFWS 2005). The vegetation surrounding Modoc-Cascades vernal pools is generally a pine forest of *Pinus ponderosa* or *P. jeffreyi* or both (yellow pines) and *Juniperus occidentalis* (western juniper), or an open habitat of grasses, sagebrush, and other shrubs (Lepley and Merriam 2011). On the margins of vernal pools, where *T. greenei* occurs, there is typically a sparse to moderate cover of herbs and forbs (Lepley and Merriam 2011). The species composition in a vernal pool can vary significantly in different years, depending on rainfall and temperature (Holland and Jain 1984), and can vary according to geography and management as well.

In addition, a highly invasive grass species *Pascopyrum smithii* (western wheatgrass) occurs within the vernal pool of the largest population of *T. greenei* sites on the Modoc NF (Lepley and



Merriam 2011). It can tolerate seasonally inundated clay soils and threatens the Modoc's largest occurrence of *T. greenei*. As an aggressive rhizomatous species, it may become dominant over time in vernal pool habitats and convert them to grasslands (Lepley and Merriam 2011).

The current threats to *Tuctoria greenei* on the Forest Service lands within northeast California are associated with anthropogenic hydrologic alterations, livestock activity, recreational/OHV use, and vegetative competition (Lepley and Merriam 2011). Current conditions of vernal pool habitats on the Modoc and Lassen National Forest are driven by these factors. In addition, livestock grazing on Federal lands in the Modoc-Cascade region resulted in heavy use of vernal pools by livestock as a water source (Lepley and Merriam 2011). Off-highway vehicle and recreationalists will, in many cases, drive through vernal pools creating deep ruts and compacting the soil thereby altering the hydrology of the pool (Lepley and Merriam 2011). If left undisturbed vernal pools are generally resistant to invasive species (Stone 1990). However, disturbance and alteration of their hydrologic functions allows for colonization of nonnatives that are adapted for shorter or longer periods of water inundation (Lepley and Merriam 2011).

Surveys have occurred on the Modoc National Forest in an attempt to determine the locations of more populations on Federal lands (J. Perkins, personal communication, 2011). Approximately 12,396 acres of vernal pool habitat have been surveyed at least one time since 2001 (J. Perkins, personal communication, 2011). Currently there are 2 known populations of *Tuctoria greenei* on the Modoc National Forest. Population size estimates range from 150 individuals-1,000,000 individuals. Total population estimate for *T. greenei* on the Modoc National Forest is 1,000,150 individuals. There is very little population trend data available for *T. greenei* on the Modoc National Forest. However, limited monitoring suggests that these populations appear stable (J. Perkins, personal communication, 2011).

### Effects of the Action

Retardant formulations in use today are primarily inorganic fertilizers (USDA 2011). The best available science suggests that any misapplications and situations with extenuating circumstances that result in an aerial drop of retardants on vernal pool habitats will result in the introduction of both nitrogen and phosphorus into the terrestrial and aquatic systems. These two nutrients are consumed in relatively large quantities by plants (Gardiner 2011). Subsequently, if they are absent from the system they are limiting to plant growth and are therefore commonly added as fertilizers (Gardiner 2011). This increase of nutrients availability has the potential to induce the growth of non-native plants outside the vernal pools that could invade the vernal pools when the vernal pool is dry or during *Tuctoria greenei*'s terrestrial and dry phases (Kneitel and Lessin 2010). While periodic water inundation creates inhospitable habitats for most nonnative species, a vernal pool would be vulnerable to this effect of a retardant drop under two scenarios: 1) the retardant drop occurs in a vernal pool during a year with limited water inundation and/or prior to a year with limited water inundation; or 2) if that vernal pool has sustained hydrologic alterations. Increased competition from nonnative plants would likely reduce population numbers and reproductive efforts. In addition, an increase of upland grasses due to an increase of limited nutrients can change the hydrologic function of a vernal pool by decreasing run-off into the vernal pool (Barry 1998). The alteration of the hydrologic function of the vernal pool has the potential to affect *T. greenei* through the reduction in available habitat. However, at this

time, there is no information available to indicate that the interactions with nonnative plant species or reduction in habitat that may be facilitated by the proposed action will result in the extirpation of individual *T. greenei* populations.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, it is the Service's biological opinion that the proposed actions are not likely to jeopardize the continued existence of *Tuctoria greenei*.

Our conclusion is based on the following reasons: (1) the spatial extent of the anticipated effects is small in comparison to the species' current distribution; (2) adverse effects are considered relatively minor; and/or (3) the Service does not anticipate the loss or reduced viability of plant populations within the action area.

We concur that these designated critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated critical habitats; and 3) the potential effects to the primary constituent elements and essential features is considered short-term and/or insignificant

## **Laguna Mountains Skipper (*Pyrgus ruralis lagunae*)**

### Environmental Baseline

Since the entire range of the species occurs within the action area, the environmental baseline is the same as the status of the species. There are about 2,899 ac (1,173 ha) of Laguna Mountains skipper (–skipper”) occupied habitat in the Palomar Mountains. The skipper has not been observed in the Laguna Mountains since 1999 despite surveys and the status of the species in this area is unclear.

### Effects of the Action

Fire retardant application in skipper occupied habitat should occur rarely. Only a small portion of the Cleveland National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, the Cleveland National Forest averaged 61 ac (25 ha) of fire retardant applications per year over 439,035 ac (177,671 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area occupied by skipper is generally low. Also, since the Forest Service proposes to avoid fire retardant application in skipper occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in skipper occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in skipper occupied

habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

### Direct Effects

Data on the potential toxicity of fire retardants to skipper are lacking. However, fire retardants do not appear to be acutely toxic to invertebrates that feed on vegetation to which the retardant has been applied. Also, fire retardant does not appear to render plants inedible. In one set of laboratory tests, Phos Chek G75 was found to be non-toxic to earthworms at the highest concentration tested (>1000 mg/kg soil), which is comparable to the concentration that might occur in the top inch of soil following a single application at 1 gallon/100 square ft (Beyer and Olson 1996). However, fire retardant applications could harm or kill adults, larvae, pupae, and eggs of skipper by covering and immobilizing or suffocating individuals.

In addition to impacts to individual skippers, fire retardant applications could impact host plants such as Cleveland's horkelia (*Horkelia clevelandii*) via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)].

In order to estimate the extent of fire retardant application that would occur within skipper occupied habitat over the life of the project (ten years), we can use the data provided by the Forest Service regarding the acres of fire retardant applications per year. By multiplying the acres of fire retardant applications per year by ten years, we can find the total acreage of fire retardant that would be applied on the Cleveland National Forest over the life of the project. This can then be divided by the total acreage of the forest to find the percentage of this forest that will have fire retardant applications. Assuming that skipper occupied habitat will have the same percentage of applications as the rest of the forest, we can find the acreage of skipper occupied habitat affected by multiplying the amount of skipper occupied habitat by the percentage of land that will have fire retardant applications. This will likely overestimate the potential impact to skipper occupied habitat since the Forest Service proposes to avoid fire retardant applications in these areas, to the extent feasible.

Thus, based on the number of acres per year affected by fire retardant on the Cleveland National Forest, about 610 ac (247 ha) of forest land will have fire retardant applications over the 10-year timeframe of the project. Further, 0.1 percent of the Cleveland National Forest [610 ac (247 ha) divided by 439,035 ac (177,671 ha) of Cleveland National Forest land] will have fire retardant applications. Considering that an estimated 2,899 ac (1,173 ha) of skipper occupied habitat occurs on the Cleveland National Forest, about 3 ac (1.2 ha) of occupied habitat [0.1 percent multiplied by 2,899 ac (1,173 ha)] on this forest will have fire retardant applications.

Impacts to 3 ac (1.2 ha) on the Cleveland National Forest should be effectively minimized by the amount of occupied habitat on this forest compared to the potential extent of fire retardant applications and the linear nature of fire retardant applications, which should prevent any

localized extirpations. In addition, fire retardant applications are not expected to result in the permanent loss of occupied habitat.

### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact skipper. Nonnative plants have been identified as a threat to this species (USFWS 2007c). Nonnative plants could degrade habitat quality for skipper by competing with and replacing host and nectar plants (USFWS 2003). Nonnative plants could decrease water availability for host and nectar plants via competition and create a thatch from dead grasses that prevents seedling establishment. Also, nonnative plants could shade host and nectar plants and reduce access to sunlight and photosynthesis. Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties, resulting in alterations in plant community composition (Ehrenfeld et al. 2001). Finally, enhanced nonnative plants could help attract additional grazing animals, which may trample or consume host plants such as Cleveland's horkelia.

Impacts to skipper due to enhanced nonnative plants could extend beyond the impacts to host and nectar plants. Fire retardant application may have resulted in lower activity levels for some ant species in Australia due to increased nonnative plant species and litter accumulation (Seymour and Collett 2009) and similar impacts could occur to skipper larvae.

While fire retardant could enhance nonnative plants, it could also enhance the growth of host plants. Fire retardants contain nitrogen and phosphorus that could act as nutrients. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on skipper host plants.

Regardless, if fire retardant is applied to skipper occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts to skipper due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

### Effect on Recovery

No recovery plan exists for skipper, but a 5-year review was completed on August 24, 2007, which provided management recommendations for the next five years for this species (USFWS 2007c). Based on the discussion above, fire retardant application in skipper occupied habitat should occur rarely. If fire retardant application does occur in skipper occupied habitat, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications compared to the occupied habitat and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to skipper populations or habitat conditions are not likely to occur and implementation

of the recommendations for this species in the 5-year review should not be impeded. Thus, the ability of this species to recover should not be affected.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of skipper. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in skipper occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Impacts should be effectively avoided or minimized due to the size and linear nature of fire retardant applications compared to the amount of occupied habitat and the temporary nature of the impacts to habitat.
3. No recovery plan exists for skipper and implementation of the management recommendations from the 5-year review should not be impeded. Due to the expected short term and temporary nature of the potential impacts to habitat and the expected extent of impacts, we do not expect that the proposed action will impact the ability of this species to recover.

We concur that these designated or proposed critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the Forest Service will map and avoid application of fire retardant to these areas, to the extent feasible; and 3) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated or proposed critical habitats. Finally, the potential impact to the primary constituent elements of these critical habitats would occur from nonnative plants. However, the Forest Service will monitor areas of fire retardant application within critical habitats and remove nonnative plants, as appropriate. Thus, any potential enhancement of nonnative plants would be short term and temporary.

## **Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*)**

## Environmental Baseline

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem, within the action area. The environmental baseline is a snapshot of a species' health at a specified point in time. It does not include the effects of the action under review in this consultation. Factors that historically influenced the decline in the species include: 1) hybridization, predation, and competition with introduced species; 2) blockage of migrations and genetic isolation due to diversion dams and other impassable structures; 3) degradation of habitat due to logging, grazing management, road construction, irrigation practices, recreational use, channelization, and dewatering due to irrigation and urban demands; and 4) changes in water quality and water temperature. The effects of many of these actions continue today.

## **Status of the Species within the Action Area**

LCT occupy approximately 285 km (177 mi) of stream habitat on Forest Service lands (28 percent of all occupied streams) in all three Basins (Eastern, Northwest, and Western) as well as out-of-basin populations in Nevada and California (Table 39). Self-sustaining stream populations occur on the Humboldt-Toiyabe National Forest (HTNF), Tahoe National Forest, and Lake Tahoe Basin Management Unit (LTBMU) (Table 40). Out-of-basin stream populations also occur on the HTNF, Tahoe National Forest, Stanislaus National Forest, Sierra National Forest, and Inyo National Forest (Table 40). One self-sustaining lacustrine LCT population occurs in Independence Lake which is surrounded by the Tahoe National Forest. Fallen Leaf Lake and Marlette Lake, located on the Lake Tahoe Basin Management Unit, are also occupied; however, these populations are currently being maintained by hatchery production. Additionally, LCT are stocked by California Department of Fish and Game in high mountain lakes to provide angling opportunities. These lakes are located throughout the Sierra Nevada Mountains and across multiple National Forests (Table 41).

## **Factors Affecting Species within the Action Area**

Factors affecting LCT are discussed in detail in the 5-year review (Service 2009); a summary is provided below. Lahontan cutthroat trout populations have been and continue to be impacted by nonnative species interactions, habitat fragmentation and isolation, degraded habitat conditions, drought, and fire (Rhymer and Simberloff 1996, Dunham *et al.* 1997, Dunham *et al.* 2002, Dunham *et al.* 2003, Fagan 2002). Nonnative fish co-occur with LCT in 36.4 percent of currently occupied stream habitat and all currently occupied historical lake habitat except for Walker Lake. Most LCT populations which co-occur with nonnative species are decreasing and the majority of population extinctions which have occurred since the mid 1990's have been caused by nonnative species. Additionally, nonnative fish occupy habitat in nearly all unoccupied LCT historical stream and lake habitat, making repatriation of LCT extremely difficult. The majority of LCT populations are isolated and confined to small habitats (width) and short stream lengths. These factors reduce gene flow between populations, and reduce the ability of populations to recover from catastrophic events thus threatening their long-term



persistence and viability (Frankham 2005). The literature suggests that to ensure long-term persistence, populations should consist of more than 2,500 individuals, occupy at least 8 km (5

**Table 38. Stream length km (mi) of currently occupied habitat by land ownership separated by watershed (Service 2009)**

HUC Number	Watershed Name	Land Ownership					
		BLM	USFS	Private	State	BIA	BOR
<b>Eastern Lahontan Basin</b>							
16040101	Upper Humboldt River	81.0 (50.4)	49.3 (30.7)	60.0 (37.3)	9.5 (5.9)		
16040102	N.F. Humboldt River	0.7 (0.4)	16.3 (10.1)	28.7 (17.8)	1.3 (0.8)		
16040103	S.F. Humboldt River	4.5 (2.8)	53.2 (33.0)	6.5 (4.1)			
16040104	Pine Creek	8.5 (5.3)					
16040106	Rock Creek	11.7 (7.2)		45.0 (27.9)	5.6 (3.5)		
16040107	Reese River		22.8 (14.2)	1.8 (1.1)			
16040109	Little Humboldt River	35.4 (22.0)	17.0 (10.6)	1.0 (0.6)	19.0 (11.8)		
<b>Northwest Lahontan Basin</b>							
16040201	Upper Quinn River	44.5 (27.6)	13.6 (8.5)	15.0 (9.4)			
16040202	Lower Quinn River	31.4 (19.5)		7.9 (4.9)			
17120009	Coyote Lake Basin, OR	98.5 (61.2)		19.6 (12.2)			
<b>Western Lahontan Basin</b>							
16050101	Lake Tahoe		9.7 (6.0)				
16050102	Truckee River	2.7 (1.7)	13.9	73.3		4.2	3.1



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			(8.6)	(45.5)		(2.6)	(1.9)
16050103	Pyramid Lake			4.8 (3.0)		44.0 (27.3)	
16050201	Upper Carson	0.1 (0.1)	25.7 (15.9)		1.4 (0.9)		
16050301	E.F. Walker River		11.8 (7.3)	0.3 (0.2)	1.8 (1.1)		
16050302	W.F. Walker River	0.6 (0.4)	18.8 (11.7)	1.4 (0.9)	14.8 (9.2)		
<b>Out-of Basin</b>							
16020308	N. Great Salt Lake Desert, UT	1.6 (1.0)		3.3 (2.1)	0.6 (0.4)		
16060001	Dixie Valley, NV	15.3 (9.5)		4.5 (2.8)			
16060004	Big Smoky Valley, NV		8.4 (5.2)				
16060005	Diamond-Monitor Valley, NV		3.5 (2.2)				
16060007	Long-Ruby Valley, NV		2.2 (1.4)				
17120009	Coyote Lake Basin, OR	15.0 (9.3)		7.2 (4.5)			
18020125	Upper Yuba River, CA		3.1 (1.9)	3.9 (2.4)			
18030010	Upper King River, CA		3.5 (2.2)				
18040006	Upper San Joaquin River, CA		2.5 (1.5)				
18040010	Upper Stanislaus River, CA		1.6 (1.0)				
18040012	Upper Mokelumne River, CA		7.0 (4.4)				
18090102	Crowley Lake, CA		1.4 (0.9)				

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<b>Total</b>	351.4 (218.4)	285.3 (177.3)	284.4 (176.7)	54.1 (33.6)	51.5 (32.0)	3.1 (1.9)
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**Table 39. Stream length km (mi) of currently occupied stream habitat by Forest separated by watershed (Service 2009)**

HUC Number	Watershed Name	Forest					
		HTNF	Tahoe	LTBMU	Stanislaus	Sierra	Inyo
<b>Eastern Lahontan Basin</b>							
16040101	Upper Humboldt River	49.3 (30.7)					
16040102	N.F. Humboldt River	16.3 (10.1)					
16040103	S.F. Humboldt River	53.2 (33.0)					
16040107	Reese River	22.8 (14.2)					
16040109	Little Humboldt River	17.0 (10.6)					
<b>Northwest Lahontan Basin</b>							
16040201	Upper Quinn River	13.6 (8.5)					
<b>Western Lahontan Basin</b>							
16050101	Lake Tahoe			9.7 (6.0)			
16050102	Truckee River		13.9 (8.6)				
16050201	Upper Carson	25.7 (15.9)					
16050301	E.F. Walker River	11.8 (7.3)					
16050302	W.F. Walker River	18.8 (11.7)					
<b>Out-of Basin</b>							
16060004	Big Smoky Valley, NV	8.4 (5.2)					
16060005	Diamond-Monitor Valley, NV	3.5 (2.2)					

16060007	Long-Ruby Valley, NV	2.2 (1.4)					
18020125	Upper Yuba River, CA		3.1 (1.9)				
18030010	Upper King River, CA					3.5 (2.2)	
18040006	Upper San Joaquin River, CA					2.5 (1.5)	
18040010	Upper Stanislaus River, CA				1.6 (1.0)		
18040012	Upper Mokelumne River, CA				7.0 (4.4)		
18090102	Crowley Lake, CA						1.4 (0.9)
<b>Total</b>		242.6 (150.7)	17 (10.6)	9.7 (6.0)	8.6 (5.3)	6.0 (3.7)	1.4 (0.9)

mi) of habitat, and have no nonnative species present (Hilderbrand and Kershner 2000). Currently, only 28.2 percent of LCT conservation populations occupy habitat greater than 8 km (5 mi) in length and over 83 percent of currently occupied streams have fewer than 94 fish/km (150 fish/mi). Pyramid and Walker Lakes are important habitat for the lacustrine form of LCT. Conditions in these lakes have deteriorated over the past 100 years and continue to decline, most dramatically in Walker Lake. The present or threatened destruction, modification, or curtailment of LCT’s habitat and range continues to be a significant threat and in some instances is increasing in magnitude and severity.

Recreational fishing for LCT in popular fishing waters is regulated and augmented by hatcheries; however, harvest from recreational fishing in the Western Lahontan Basin does appear to pose a threat to LCT recovery because it impedes our ability to establish recovery populations, to understand the life history needs of lacustrine LCT, and to identify the actions needed to achieve

**Table 40. High mountain lakes on Forest Service lands regularly stocked with Lahontan cutthroat trout by the California Department of Fish and Game (CDFG 2010)**

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<b>County</b>	<b>Forest</b>	<b>Waterbody Name</b>
Alpine	El Dorado	Upper Blue Lake
Alpine	El Dorado	Granite Lake
Alpine	El Dorado	Twin Lake
Alpine	El Dorado	Meadow Lake
Alpine	El Dorado	Evergreen Lake
Alpine	HTNF	Tamarack Lake
Alpine	HTNF	Sunset Lake
Mono	HTNF	Bridgeport Reservoir
Mono	HTNF	Kirmen Lake
Mono	HTNF	Lane Lake
Mono	HTNF	Roosevelt Lake
El Dorado	LTBMU	Upper Angora Lake
El Dorado	LTBMU	Upper Echo Lake
El Dorado	LTBMU	Lower Echo Lake
El Dorado	LTBMU	Lost Lake
El Dorado	LTBMU	Round Lake
El Dorado	LTBMU	Shower Lake
Inyo	Inyo	Baker Lake
Inyo	Inyo	Birch Lake
Mono	Inyo	Gull Lake
Mono	Inyo	June Lake
Mono	Inyo	McCleod Lake
Mono	Inyo	Silver Lake
Mono	Inyo	Steelhead Lake
Nevada	Tahoe	Meadow Lake

Nevada	Tahoe	Penner Lake
Sierra	Tahoe	Deadman Lake
Sierra	Tahoe	Saxonia Lake

recovery. Other occupied waters are either closed to fishing or have catch and release regulations. While LCT in small streams may be vulnerable to overharvest, most occupied habitats are in remote areas and receive little fishing pressure. Scientific and educational sampling is controlled by State and Tribal permitting processes and new, non-lethal techniques have been developed for genetic analyses. Overutilization for commercial, recreational, scientific, or education purposes is not believed to be a significant threat at this time except for priority recovery waters in the Western Lahontan Basin.

Whirling disease is currently not a threat to LCT; however, it has the potential to become more widespread due to warmer waters that could result from climate change (Rahel *et al.* 2008). Brown and brook trout are known piscivores; however, the extent to which these nonnative species prey on LCT is unknown. Most historical waters in the western portion of LCT’s range, including lakes, and to a more limited extent in the Quinn River watershed and North Fork Little Humboldt River sub-watershed, are occupied by brown trout. Brook trout are the most common nonnative salmonid which co-occur with LCT and are found in nearly every major historical LCT watershed. Lake trout (*Salvelinus namaycush*) are known to prey on LCT in lake environments. Efforts to manage the impacts from lake trout to reintroduced LCT are ongoing in Fallen Leaf Lake and strategies have been identified to abate these impacts. These strategies will be used in the other large historical lakes within the Western Lahontan Basin where lake trout are found to increase the success of reintroductions into these lakes. Disease is not believed to be a significant threat at this time. Predation from nonnative fish continues to be a threat where their distribution overlaps with LCT. The presence of nonnative predatory fish within unoccupied historical LCT habitat continues to impede recovery efforts in these waters.

The impacts to LCT from climate change are not known with certainty. Predicted outcomes of climate change imply that negative impacts will occur through increased stream temperatures, decreased stream flow, changes in the hydrograph, and increased frequency of extreme events such as drought and fire (Haak *et al.* 2010). These impacts will likely increase the magnitude and severity of other existing threats to LCT. Adding stressors predicted by climate change may exacerbate the current threats to LCT populations throughout its range, many of which already have multiple stressors affecting their persistence.

Effects of the Action

Fire has been one of the dominant factors shaping ecosystems for millennia (Skinner and Chang 1996, Van Wagtenonk and Fites-Kaufman 2006). Median fire return intervals in eastside Sierra Nevada forests where LCT reside are believed to be 8-16 years with a range of 5-47 years (Skinner and Chang 1996, Van Wagtenonk and Fites-Kaufman 2006, North *et al.* 2009, Van de Water and North 2010). In this fire regime type the following effects occur: (1) fire controls plant species composition by favoring species that require sunlight (*e.g.*, Jeffrey pine (*Pinus jeffreyi*) over shade-tolerant forms such as white fir (*Abies concolor*)), and by favoring fire-resistant and fire-dependent species over non-fire dependent species; (2) fire consumes understory vegetation without damaging the overstory; (3) crown fires are rare and patchy; and (4) small patches of intense surface burning often result in openings (Chang 1996).

Fire regimes in the Great Basin differ in the three main vegetation types: sagebrush shrublands, desert shrublands, and pinyon-juniper woodlands. Prior to European settlement, fire regimes in sagebrush shrublands of the Great Basin have been characterized as a combination of mixed-severity and stand-replacing fires with return intervals ranging anywhere from 10 to 70 years (Rice *et al.* 2008). Desert shrubland vegetation types are characterized by infrequent, stand-replacement fires with fire return intervals between 35 years to several centuries (Rice *et al.* 2008). Pinyon-juniper woodlands are characterized as a mixed fire regime; however, fire histories in pinyon-juniper woodlands are difficult to reconstruct (Paysen *et al.* 2000). Return intervals in pinyon-juniper woodlands range from 10 to over 300 years depending on site productivity and plant community structure (Rice *et al.* 2008).

Changes in historical fire regimes are well documented in the western United States (McKelvey *et al.* 1996, Arno 2000, Paysen *et al.* 2000, Stephens and Sugihara 2006, Richardson *et al.* 2007, Brooks 2008, Van de Water and North 2011). Around the late 1800's, high-frequency, low-intensity fire regimes associated with dry forest types, as found in the eastern Sierra Nevada, began having longer fire return intervals due to: (1) relocation of Native Americans which disrupted their historical burning practices; (2) loss of fine fuels, which carried low-intensity ground fires, due to extensive overgrazing; (3) disruption of fuel continuity on the landscape due to irrigation, agriculture, and development; and (4) fire exclusion management policies (Arno 2000, Paysen *et al.* 2000, Keane *et al.* 2002). Effects from the post-Euroamerican settlement influence on fire regimes include longer fire return intervals which allow fuel loads to increase. In return, relatively small, low-intensity ground fires have become uncharacteristically large, stand-replacing fires (Arno 2000, Miller *et al.* 2009). In contrast, fire regimes in the Great Basin have become more frequent due to wildfire exclusion, historical grazing practices, and the introduction of invasive nonnative plant species (Rice *et al.* 2008). More frequent fires favor the establishment of nonnative plants (*e.g.*, cheatgrass (*Bromus tectorum*)), which results in the loss of sagebrush and other native plant species (Rice *et al.* 2008).

Changing climate has affected summer temperatures and the timing of spring snowmelt, which have contributed to increasing the length of the wildfire season, wildfire frequency, and the size of wildfires (McKenzie *et al.* 2004, Westerling *et al.* 2006, Miller *et al.* 2009). Westerling *et al.* (2006) conclude that there are robust statistical associations between wildfire and climate in the western United States and that increased fire activity over recent decades reflects responses to climate change. Miller *et al.* (2009) studied the frequency, severity, and size of fires in the Sierra



Nevada Mountains and found that all three parameters are increasing. Although LCT evolved in a fire-prone environment, increases in wildfire frequency, size, and severity due to increased fuel loads and effects from climate change (Westerling *et al.* 2006, Miller *et al.* 2009) have increased the threats due to wildfire. Numerous LCT streams have been burned in the last decade alone (Service 2009). One population extirpation has been recorded and individual mortalities, reduction in population size, and poor recruitment have been documented in several other stream populations due to fire impacts (HTNF 2004, Neville and DeGraaf 2006). With increasing wildfire frequency, size, and severity, fire suppression activities will also increase, including the use of aerially delivered fire retardant.

Direct and indirect effects of long-term fire retardants are described in the BA. To summarize, long-term fire retardants are known to be toxic to aquatic species (Norris and Webb 1989; Gaikowski *et al.* 1996a, b; McDonald *et al.* 1996, 1997; Buhl and Hamilton 1998, 2000; Adams and Simmons 1999; Calfee and Little 2003; Wells *et al.* 2004). The toxic component of long-term retardant chemicals in aquatic systems is ammonia (McDonald *et al.* 1996). If ammonia concentrations are high enough, they could inhibit growth of juvenile LCT, cause tissue damage, or cause direct mortality. For example, high concentrations of ammonia can inhibit growth and cause mortality of rainbow trout (Burkhalter and Kaya 1977). Thurston *et al.* (1978) found that high concentrations of ammonia can result in tissue damage to cutthroat trout. Although tests of the effects of ammonia on LCT have not been conducted, it is highly likely results would be similar as for other salmonids. Indirect effects could occur to LCT from the retardant adversely affecting the aquatic and terrestrial macroinvertebrates that comprise their diet.

When fire retardants initially enter a stream, there is an immediate spike in ammonia concentration and toxic concentrations can extend up to 10 km (6.2 mi) downstream from where retardant enters the water (Norris and Webb 1989). The peak of the spike and area affected depends on many factors, such as volume of retardant to hit the water, volume of water to dilute the retardant, and turbulence of the stream. In simulations of only 1,011 L (267 gallons) (a normal load being approximately 5,678 L (1,500 gallons)) of fire retardants entering the surface of a stream, peak ammonia concentrations reached 5,026 mg/l (Buhl and Hamilton 1998). When the volume of retardant entering the stream is doubled, the zone of mortality is extended 10 times farther downstream (Norris *et al.* 1991). This ammonia concentration was caused by fire retardant alone, whereas in a natural situation during a fire, ammonia levels would also be elevated due to smoke adsorption (Gresswell 1999). In 2002, the Cannon Fire burned 5.9 km (3.7 mi) of occupied habitat in Mill Creek (West Walker River watershed). A retardant drop crossed the stream and all LCT downstream from the drop were extirpated (Mellison 2002). While the population rebounded by 2004 from upstream sources (HTNF 2004), it is unknown what the effects of genetic loss will be on the population. Studies on the toxicity of fire fighting chemicals can be summarized by: 1) long-term fire retardants are toxic to aquatic species, mainly due to ammonia; 2) long-term fire retardants are less toxic than most foaming and water-enhancing agents; 3) toxicity is likely to persist on the ground and may be released into streams in rainwater runoff; 4) high organic soils rapidly decrease chemical persistence; 5) combustion appears to remove the toxicity of the chemicals; and 6) fish are capable of avoiding exposure if an avenue of escape is available (Little and Calfee 2002).

Whenever practical, as determined by the fire incident, the Forest Service will use water or less toxic fire retardants in areas occupied by or designated critical habitat for threatened, endangered and proposed species. Incident Commanders and pilots are required to avoid aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 91 m (300 ft) of waterways (including perennial, ephemeral, and intermittent streams as well as lakes, ponds, identified springs, and reservoirs). The only exception to this is when human life or safety is threatened and the use of retardant can be reasonably expected to alleviate the threat. Any aerial application of fire retardant on the occupied habitat would have negative effects. Additionally, because of the isolated nature of the LCT populations, any effects to LCT or their habitat may be especially deleterious because extirpated populations will not be able to recolonize.

## **Effects by Forest**

### ***Humboldt-Toiyabe National Forest***

LCT occupy approximately 242.6 km (150.7 mi) of stream habitat on the HTNF. The HTNF provides habitat in all three Basins (including several out-of-basin populations) and all age classes of LCT within these streams would be expected to occur. Assuming a width of 2 m (6.6 ft) for occupied streams, LCT occupy approximately 120 acres of habitat. This represents roughly 0.005 percent of the HTNF.

### ***Tahoe National Forest***

LCT occupy approximately 17 km (10.6 mi) of stream habitat on the Tahoe National Forest. The Tahoe National Forest provides habitat in the Western Lahontan Basin and all age classes of LCT within these streams would be expected to occur. Assuming a width of 2 m (6.6 ft) for occupied streams, LCT occupy approximately 8.4 acres of habitat. This represents roughly 0.0007 percent of the Tahoe National Forest.

### ***Lake Tahoe Basin Management Unit***

LCT occupy approximately 9.7 km (6 mi) of stream habitat on the LTBMU. The LTBMU provides habitat in the Western Lahontan Basin and all age classes of LCT within these streams would be expected to occur. Assuming a width of 2 m (6.6 ft) for occupied streams, LCT occupy approximately 4.8 acres of habitat. This represents roughly 0.003 percent of the LTBMU.

### ***Stanislaus National Forest***

LCT occupy approximately 8.6 km (5.3 mi) of stream habitat on the Stanislaus National Forest. The Stanislaus National Forest provides habitat in an out-of-basin watershed and all age classes of LCT within these streams would be expected to occur. Assuming a width of 2 m (6.6 ft) for occupied streams, LCT occupy approximately 4.3 acres of habitat. This represents roughly 0.0004 percent of the Stanislaus National Forest.

### ***Sierra National Forest***

LCT occupy approximately 6 km (3.7 mi) of stream habitat on the Sierra National Forest. The Sierra National Forest provides habitat in an out-of-basin watershed and all age classes of LCT within these streams would be expected to occur. Assuming a width of 2 m (6.6 ft) for occupied streams, LCT occupy approximately 3.0 acres of habitat. This represents roughly 0.0002 percent of the Sierra National Forest.

### ***Inyo National Forest***

LCT occupy approximately 1.4 km (0.9 mi) of stream habitat on the Inyo National Forest. The Inyo National Forest provides habitat in an out-of-basin watershed and all age classes of LCT within these streams would be expected to occur. Assuming a width of 2 m (6.6 ft) for occupied streams, LCT occupy approximately 0.7 acres of habitat. This represents roughly 0.00003 percent of the Inyo National Forest.

The HTNF, Tahoe, LTBMU, Inyo, and El Dorado National Forest all have occupied lake habitat (Table 41). No data was presented in the BA regarding misapplication of fire retardant into high mountain lakes. However, the probability of an accidental drop in a lake is extremely low since lakes are easily seen from the air. Many of the lakes are located near the Sierra Nevada Crest with little fuel load to carry fires. Additionally, the volume of water in a lake is much greater compared to a small stream; consequently, if fire retardant were introduced into a lake, it should dilute quickly. Fish are capable of avoiding exposure if an avenue of escape is available (Calfee and Little 2002), LCT can swim to another part of the lake. Lahontan cutthroat trout are obligate stream spawners so breeding would not be impacted. For these reasons an accidental retardant drop into a lake is highly unlikely to occur and would have insignificant and discountable impacts to LCT in the unlikely event that a misapplication into a lake occurs. Therefore, no exemption from take for LCT in lake habitat is authorized in this biological opinion.

To estimate the probability that retardants would enter occupied LCT habitat, we calculated the area that was potentially covered by retardants during the 2000-2010 period by Forest. To do this we assumed retardant drops did not overlap and were dropped randomly. The BA states (page 14) that typical retardant drops are 15-23 m (50-75 ft) wide by 244 m (800 ft) long, which is approximately 1.4 acres. By multiplying 1.4 acres x number of drops during 2000-2010, the total area directly affected by retardant drops can be calculated. Dividing the area affected by the total area of each Forest, the probability of a drop affecting each acre of Forest can be estimated using the following table:

<b>National Forest</b>	<b>Area (million acres)</b>	<b>Retardant Drops 2000-2010</b>	<b>Acres Affected /10 Years</b>	<b>Probability of Retardant Drop in Each Acre</b>
HTNF	2.62	385	539	0.0002
Tahoe	1.24	235	329	0.0003
LTBMU	0.15	31	43.4	0.0003
Stanislaus	1.09	393	550.2	0.0005
Sierra	1.41	237	331.8	0.0002
Inyo	2.05	108	151.2	0.0001
El Dorado	0.89	30	42	0.00005

Next, to estimate the probability of retardants getting into occupied LCT habitat we multiplied the acres of occupied habitat by the probability of retardants affecting each acre of Forest from the table above. This results in a probability of 2.4 percent for the HTNF, 0.3 percent for the Tahoe National Forest, 0.1 percent for the LTBMU, 0.2 percent for the Stanislaus National Forest, 0.1 percent for the Sierra National Forest, 0.01 percent for the Inyo National Forest that a drop will enter occupied habitat.

Tables used for misapplication Effects Analysis:

<b>Forest</b>	<b>Expected total number of retardant drops 10 years<sup>1</sup></b>	<b>Number of drops expected to enter water ways (.42%- multiply by .0042 and round up)</b>
HTNF	350	2
Tahoe	214	1
LTBMU	28	0.1
Stanislaus	357	2
Sierra	215	1
Inyo	98	0.4
El Dorado	27	0.1

<sup>1</sup>The expected number of retardant drops is based on taking the total number of drops per forest as presented in the BA on pages 238-241 and dividing that number by 11 and multiplying by 10. The data presented in the BA is based on 11 years and the timeframe for this consultation is 10 years, therefore we must account for this difference in magnitude.

**Table 41. Lahontan cutthroat trout**

Forest name <sup>3</sup>	Miles of perennial stream on Forest	Miles of occupied streams on Forest <sup>1</sup>	% of total perennial streams which are occupied	Number of drops expected to hit stream	Total stream miles affected by retardant (6.2 miles per drop to water <sup>2</sup> )	% LCT occupied streams affected by retardant	Extent of take
HTNF	4,364	150.7	3.8%	2	2*6.2=12.4	(.038*12.4=0.5 mi)/ 150.7= 0.3%	0.5 mi
Tahoe	1,954	10.6	0.5%	1	1*6.2=6.2	(.005*6.2=0.03 mi)/ 10.6= 0.3%	0.03 mi
LTBMU	402	6.0	1.5%	0.1	0.1*6.2=0.6	(.015*6.2=0.1 mi)/ 6.0= 1.5%	0.1 mi
Stanislaus	1,598	5.3	0.3%	2	2*6.2=12.4	(.003*12.4=0.04 mi)/ 5.3= 0.7%	0.04 mi
Sierra	2,446	3.7	0.2%	1	1*6.2=6.2	(.002*6.2=0.01 mi)/ 3.7= 0.3%	0.01 mi
Inyo	2,749	0.9	0.03%	0.1	0.1*6.2=0.6	(.0003*0.6=0.0002 mi)/ 0.9= 0.02%	0.0002 mi

<sup>1</sup>Based on occupied habitat. Data available at the Nevada Fish & Wildlife Office.

<sup>2</sup>The BA states that lethal effects extend 10 km (6.2 mi) and sublethal may occur much further downstream. For purposed here, we will use the 10 km (6.2 mi) as the furthest extent of downstream effects.

<sup>3</sup>The El Dorado NF only has lake habitat.

Lahontan cutthroat trout may be resilient to stochastic events, particularly if their populations contain diverse life histories that are able to naturally recolonize extirpated local populations (Neville *et al.* 2006, Dunham *et al.* 2003). However, the majority of LCT populations are isolated, which places them at a much higher risk of extinction because they cannot recolonize after a large disturbance (Rinne 1996, Dunham *et al.* 1997, Dunham *et al.* 2003, Burton 2005, Dunham *et al.* 2007, Williams *et al.* 2009). Additionally, effects on small headwater streams are more severe because entire drainages are burned at these smaller spatial scales, in contrast to larger stream orders where relatively small proportions of the drainage burn (Sestrich *et al.* 2011).

### Conclusion

After reviewing the current status of LCT, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of LCT. The Service bases this conclusion on the following: 1) The probability of a retardant drop entering an occupied stream is small; and 2) LCT are widely dispersed across their historical range and out-of-basin populations on Forest Service lands which substantially lessens the impact of a misapplication. No critical habitat has been designated for LCT; therefore, none will be affected.

## **Layne's Butterweed (*Senecio layneae*)**

### Environmental Baseline

*Senecio laynea* is found growing in chaparral and woodland communities within four localities on National Forest System Lands. Two occurrences totaling 59 acres are located on the Eldorado National Forest (CNDDDB 2011), one occurrence totaling 5 acres on the Plumas National Forest (CNDDDB 2011), and one occurrence totaling 12 acres on the Tahoe National Forest (VanZuuk 2010). *Senecio layneae* occupies areas that are currently affected by off-highway vehicle use, invasion of nonnative plant species (VanZuuk 2010), and prescribed fire (Wenk and Merriam 2010).

### Effects of the Action

*Senecio layneae* flowers from April to July, thus the plant is active during times when fire retardant may be used. However, there is no specific information available to determine whether the application of fire retardant will directly affect this species. If retardant were to be applied directly to *S. layneae* it is anticipated that the individual plant may senesce prior to seed set, but since *S. layneae* is a perennial herb that sprouts from a rootstock, we do not anticipate the loss of individual plants as a direct result on the aerial application of fire retardant. However, since *S. layneae* is an early successional species that occupies temporary openings and is eliminated as vegetation grows up around it invasion and competition from nonnative plants poses a threat.

Retardant formulations in use today are primarily inorganic fertilizers (USDA 2011) and based on the general effects of the action, nonnative plants could be enhanced by fire retardant application. Since *Senecio layneae* is known to occur in areas occupied by nonnative plant species if retardant were dropped on *S. layneae*, we would expect increased competition from non-native plants that may reduce population numbers and reproductive efforts of *S. layneae* in that area. Given the total area occupied by the individual occurrence of *S. layneae*, we do not anticipate the proposed action would result in extirpation of the *S. layneae* populations on the National Forest System Lands.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, it is the Service's biological opinion that the proposed actions are not likely to jeopardize the continued existence of *Senecio layneae*.

Our conclusion is based on the following reasons: (1) the spatial extent of the anticipated effects is small in comparison to the species' current distribution; and (2) the Service does not anticipate the loss of plant populations within the action area.

## **Little Kern golden trout (*Oncorhynchus mykiss whitei*)**

### Environmental Baseline

The Sequoia National Forest is known to contain approximately 90 stream miles that are occupied by Little Kern golden trout, located within the Little Kern River drainage. Of these streams, a large majority of the Little Kern golden trout exhibit some degree of introgression with rainbow trout, with the exception of six genetically-pure subpopulations. These genetically pure subpopulations include fish in Soda Springs Creek, Deadman Creek, lower Wet Meadows



Creek, Willow Creek (including Sheep Creek), and Fish Creek. Within the Little Kern River drainage, portions of the area occupied by Little Kern golden trout are subject to cattle grazing, which may negatively affect water quality and habitat for the Little Kern golden trout (Service 2011). Additionally, in July of 2011 the Lion Fire burned approximately 21,000 acres of the Little Kern River drainage, burning with high severity in the headwaters of Willow Creek, creating a high potential for the extirpation of one significant genetic lineage of Little Kern golden trout.

### Effects of the Action

Although all aquatic features will be buffered by a minimum of 300 feet, there is the possibility of accidental application of retardant (misapplication) or application by exception to protect human life. While there is no way to predict when an exception to protect human life would occur, in the case of misapplication, 3 years of data from 2008 to 2010 indicate that misapplications do not occur often, i.e. less than 0.1 percent of all fire retardant applications (USFS 2011). Fire retardants and suppressant foams have been demonstrated to be highly toxic to trout species (Poulton et al. 1997). The toxic component of retardant chemicals in aquatic systems is ammonia (McDonald et al. 1996). When fire retardants initially enter a stream, there is an immediate spike in ammonia concentration in the receiving stream. For instance, when the fire retardant Phos Chek 259-F hits the surface of the water, it is 22.9% ammonia (Buhl and Hamilton 2000), resulting in mortality to fish species (Poulton et al. 1997).

The Forest Service suggests that the toxic effects to fish can extend up to 6.2 miles downstream from where retardant enters the water (USFS 2011), and depends on the volume of water to dilute the retardant, and turbulence of the stream. Given that the streams inhabited by Little Kern golden trout are of limited size and flow, it is likely that the toxic effects of the retardant on fish will extend a large distance downstream. Because fire retardant has been demonstrated to be extremely toxic to trout species (Poulton et al. 1997), and no research has been conducted on the specific effects of fire retardant in the Little Kern River drainage, the Service anticipates the mortality of all Little Kern golden trout adults and juveniles for a distance of 6.2 miles downstream of the point of application of fire retardant.

There are only six genetically pure subpopulations of Little Kern golden trout, five of which are located entirely on Forest Service lands, while the sixth is located in Soda Spring creek and extends into Sequoia National Park (S. Stephens, pers. comm.). Since none of these subpopulations occupy a section of stream greater than 3 miles in length (Christenson 1984), we anticipate that if fire retardant were to be applied to any one of the locations, it is likely to lead to the loss of the entire subpopulation. However, the Forest Service is proposing to avoid the application of fire retardant within the subwatersheds occupied by Little Kern golden trout, therefore we do not anticipate effects to the genetically-pure subpopulations.

The recovery of Little Kern Golden Trout is dependant on the removal of all rainbow trout and hybridized Little Kern Golden Trout within the Little Kern River drainage, and the recolonization of historically occupied habitat by self-sustaining, genetically pure Little Kern Golden Trout (Christenson 1984). Since 1983, the California Department of Fish and Game has taken part in the restoration and restocking of the historical Little Kern golden trout habitat within the Little Kern River drainage. As of 1996, 100 miles of stream had been restored as habitat for Little Kern golden trout (USFWS 2003). Although stocking efforts by the California Department of Fish and Game appeared to be successful in restoring trout, recent genetic testing determined that the fish used in the stocking program were not genetically pure leading to hybridized trout occupying over 50 miles of habitat (B. Beal pers. comm.).

Of the remaining habitat, approximately 35 miles are known to contain Little Kern golden trout with some rainbow trout ingression (Stephens 2007) and the six subpopulations occupy the additional 15 miles of streams. The genetic study conducted by Stephens (2007) showed that the majority of the extant Little Kern golden trout population contains a restricted genetic structure and low diversity that is likely a signature of restocking. Therefore the remaining genetically pure subpopulations provide the basis for genetically pure fish stock as well as genetic variation (B Beal pers. comm.). Given the potential for application of fire retardant to streams occupied by Little Kern golden trout, we anticipate that if retardant were to be applied to occupied streams, lethal and sublethal effects are anticipated for a distance of up to 6.2 miles downstream of the application site. However, given that the application is extremely unlikely to occur in areas occupied by genetically pure sub-populations, the potential loss of the Little Kern golden trout in the 6.2 miles of stream will not affect the viability of the populations as a whole, nor prevent recolonization of the area by Little Kern golden trout.

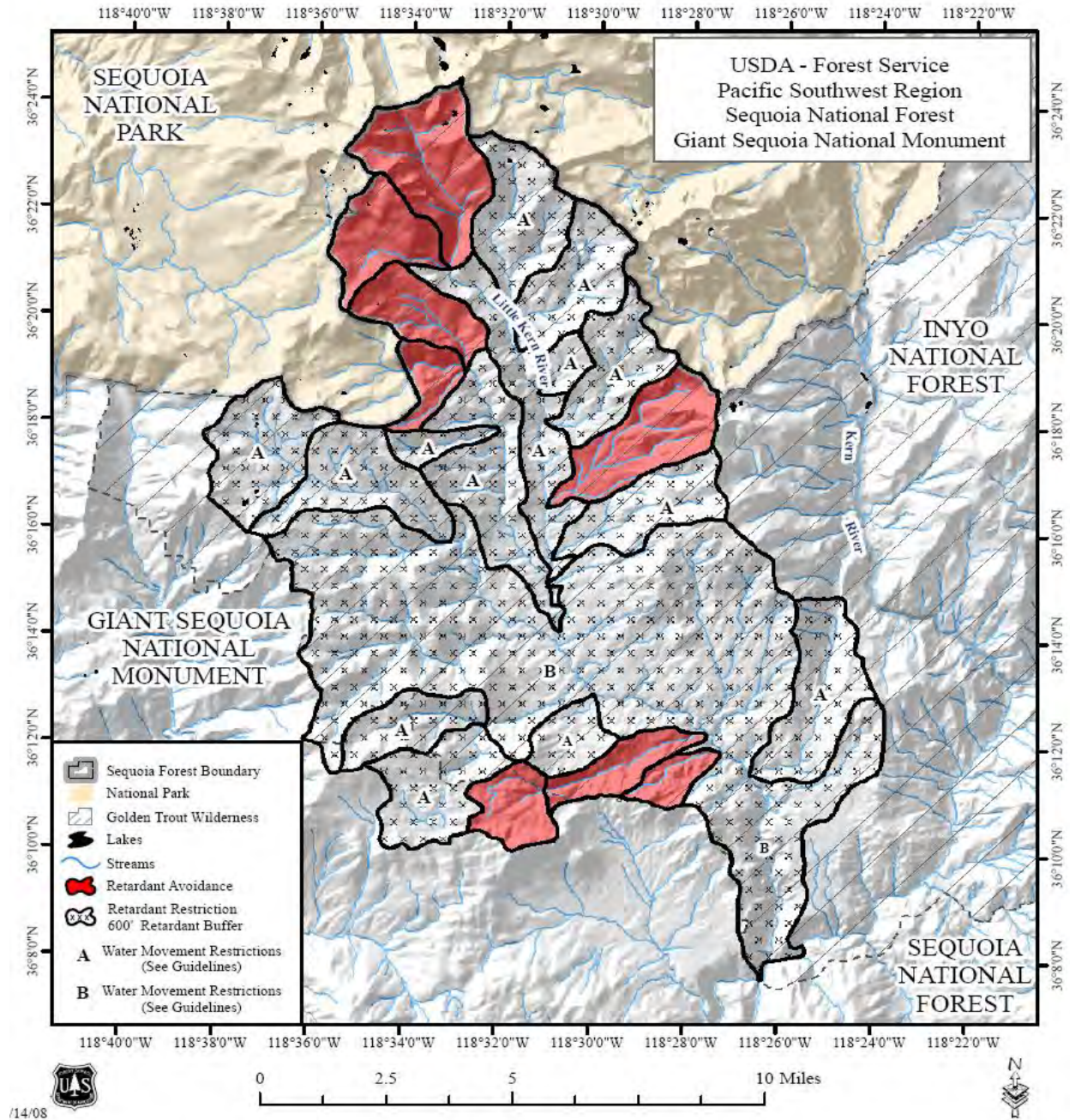
### Conclusion

After reviewing the current status of the Little Kern golden trout, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant Project is not likely to jeopardize the continued existence of Little Kern golden trout.

Our conclusion is based on the following: (1) the likelihood of retardant use within the occupied Little Kern golden trout habitat is low due to recent wildfire; (2) effects of a retardant drop would be short term; and (3) retardant would not be used in areas occupied by genetically pure subpopulations, thereby allowing for recolonization of areas affected, and preserving genetic lineages necessary for restoration and recovery of the species.

Fire retardant is not anticipated to adversely affect designated critical habitat due to potential effects on PCE's and essential features being considered short-term and/or insignificant.

Attachment: Little Kern Golden Trout Fire Retardant Use Avoidance Areas



**Shortnose sucker (*Chasmistes brevirostris*) & Lost River sucker (*Deltistes luxatus*)**



## Environmental Baseline

Historically, LRS and SNS occupied four lakes: Clear Lake, Tule Lake, Upper Klamath Lake, and Lower Klamath Lake and their associated tributaries in the Upper Klamath Basin (USBR 2002; see Figure 3-1, above). Watershed development, including construction of the Klamath Project, associated agriculture and refuge development, and construction of dams on the Klamath River for hydroelectric power, substantially changed sucker habitat. New sucker habitat was created as a result of construction of Gerber, J.C. Boyle, Copco No.1, and Iron Gate Dams and reservoirs, and sucker habitat in Clear Lake has expanded as a result of construction of the dam. In contrast, major reductions in habitat at Tule Lake (75 to 90 percent reduction from pre-development levels) and Lower Klamath Lake (97 percent reduction) occurred as a result of Reclamation projects (USBR 2002). Moderate reductions (66 percent) in sucker habitat have occurred in UKL as a result of diking and draining projects unrelated to those on the Klamath Project (Geiger 2001; Aquatic Scientific Resources 2005). Most of this loss was related to private diking and draining of emergent wetlands. However, approximately 18,000 acres of open water and wetland habitat around UKL is currently being restored and reconnected to the lake.

Changes in lake size resulted in changes in available sucker habitat. In the late 1800s, prior to most watershed development, 223,000 to 330,000 acres (276,000 average) of shallow lake and associated wetland habitat existed (Akins 1970; USBR 2002) compared to 76,000 to 122,000 acres (99,000 average) currently. Overall, suckers' lake and wetland habitat has decreased approximately 64 percent (177,000 acres) over the last century (USBR 2002a). A concurrent, substantial decline in sucker populations over this time period was related in part to the large loss of lake and wetland habitat areas, but was also attributable to suckers' blocked access to spawning and rearing areas, low instream flows, entrainment losses resulting from diversions, and other factors (USFWS 2002).

Construction of the Gerber Reservoir resulted in the expansion of SNS populations in the Lost River watershed. A relatively large population of SNS became established in the reservoir where a small population likely existed before the reservoir was built (USBR 2002). The Lost River historically flowed 80 miles from Clear Lake to Tule Lake (USBR 2000a) and was connected with the Klamath River by the Lost River Slough originating near Klamath Falls (Perry et al. 2005). In the Langell Valley, water moved through a marsh without a defined channel. This low gradient river was primary spawning habitat for LRS and SNS migrating upstream from Tule Lake. During summer and fall, flows were likely low, particularly in the upper Lost River above Bonanza (USFWS 2002). Small SNS populations have become established in impounded areas of the Lost River including one Project reservoir, Wilson Reservoir, and two non-Project impoundments, Harpold and Big Springs (Shively et al. 2000b; USBR 2001a; ISRP 2005).

Lake habitats that support sucker populations were developed along the Klamath River as part of the PacifiCorp Hydroelectric Project. Four reservoirs were constructed, including J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate, which are 420, 1000, 40, and 944 acres, respectively.

No lake habitat existed historically in the Klamath River below the Keno Reef. Sucker populations (mostly SNS) have expanded into these created lake habitats. It is believed these populations are maintained by vagrants from UKL (Desjardins and Markle 2000). Populations are small compared to those in UKL, Gerber Reservoir and Clear Lake (USFWS 2002, 2007a). Factors affecting sucker populations in the Klamath River reservoirs are discussed in detail in the FERC biological opinion for the proposed relicensing of the Klamath Hydroelectric Project (USFWS 2007a).

### Effects of the Action

For most of the analysis below, effects to Lost River sucker (LRS) and shortnose sucker (SNS) will be combined because their status, ecology, life history, distribution, and conservation needs are similar. Where known, species-specific differences in effects to the LRS and SNS will be described.

The effects to LRS and SNS from fire retardant applications on National Forest lands depend on many factors that are poorly or totally unquantified. However, the primary factors include 1) likelihood of the retardant entering occupied LRS/SNS habitat, (i.e., exposure), and 2) sensitivity of LRS and SNS to the retardant (i.e., toxicological hazard). These factors are discussed below.

### *Exposure Analysis*

#### Probability of Direct Entry of Fire Retardants into Occupied Sucker Habitat:

Effects to LRS and SNS from fire retardant drops will depend in part on the likelihood that suckers would be directly or indirectly exposed to fire retardants. At its most basic level, exposure risk is proportional to the probability of retardant entering occupied sucker habitat.

To estimate the probability that retardants would enter LRS and SNS habitat, we calculated the area that was potentially covered by retardants during the 2000-2010 period in the two National Forests that have occupied habitat, i.e., Fremont/Winema NF, and Modoc NF. Klamath National Forest has no known occupied LRS or SNS habitat, so we did not include that Forest in this analysis.

For this analysis, we assumed retardant drops did not overlap and that each acre of Forest had an equal probability of receiving a drop. The BA states (page 14) that typical retardant drops are 50-75 feet wide by 800 feet long, or approximately 1.4 acres in size. By multiplying 1.4 acres x number of drops during 2000-2010 (11 years total), the total area in each Forest directly affected by retardant drops can be calculated. Then by dividing the area affected by retardant drops by the total area of each Forest, the probability of a drop affecting each acre of Forest can be estimated (Table 43).

Probability of retardants affecting each acre of Forest = area covered by typical retardant drop (~1.4 acres) x 11-year total of retardant drops per Forest/ total area of each

Forest in acres.

$$P_{\text{drop}} = 1.4 \text{ acre per drop} \times 11 \text{ year total drops} / \text{Forest area (acres)}$$

**Table 42. Data on forest area, retardant drop statistics, and estimate of probability of retardant drops affecting each acre of Forest (adjusted to a 10 year period), assuming each drop affects 1.4 Acres**

<b>National Forest</b>	<b>Area (million acres)</b>	<b>Retardant Drops 2000-2010</b>	<b>Acres Affected /10 Years</b>	<b>Probability of Retardant Drop in Each Acre</b>
Fremont/Winema	1.71	1,218	1550	0.0009
Modoc	1.98	224	285	0.0001

Next, we estimated the amount of occupied LRS and SNS habitat because the more habitat in each Forest that is occupied, the greater the probability would be that retardants could enter the habitat and adversely affect LRS or SNS (Table 44). To do this, we needed to know the area of occupied habitat; however, the available data only quantifies habitat as stream miles, which is a linear measure. Therefore, we converted the linear distance of occupied to an area by multiplying it by an assumed stream width of 50 feet. For most of the LRS and SNS habitat, we believe this is likely an over estimate because during the summer fire season (July to October) the occupied streams are much smaller than earlier in the season. In fact, some of the streams in the Gerber Reservoir of Fremont/Winema NF and Willow Creek drainage of Modoc NF are less than from 3-20 feet in width and additionally are a series of isolated pools by mid-summer. Furthermore, this assumes all of the stream reach is occupied, which is unlikely the case because during the fire season most LRS and SNS are in the lakes and reservoirs; although, SNS do occupy streams and small reservoirs in the Gerber Reservoir watershed and the Willow Creek.

$$\text{Area of occupied LRS \& SNS habitat (acres)} = (\text{occupied stream miles} \times 5,280 \text{ feet/mile} \times 50 \text{ feet width}) / 4.36 \times 10^4 \text{ square feet/acre}$$

**Table 43. Miles of Occupied Sucker Habitat and Estimated Acres of Habitat (assuming that the streams are 50 feet wide)**

<b>National Forest</b>	<b>Water Body</b>	<b>Species</b>	<b>Occupied Stream Miles <sup>*1</sup></b>	<b>Area of Occupied Habitat (Acres)</b>
Fremont/Winema	East side of Upper Klamath Lake	LRS and SNS	6	<b>36</b>
Fremont/Winema	West side of Upper Klamath Lake	LRS and SNS	18	<b>109</b>
Fremont/Winema	Sprague River near Braymill and S'Ochollis Canyon	LRS and SNS	10	<b>60</b>
Fremont/Winema	Gerber Reservoir Drainage	SNS	14	85
Fremont/Winema	All above except Gerber Reservoir Drainage	LRS	Total = 34	205
Fremont/Winema	All listed above	SNS	Total = 48	290
Modoc	Willow Creek and Tributaries	LRS	23	139
Modoc	Willow Creek and Tributaries	SNS	72	436

\*1 Data on amount of occupied habitat is from draft proposed critical habitat rule (USFWS 2011).

Next, to estimate the probability of retardants getting into occupied LRS and SNS habitat during the 10-year term of the proposed action, we multiplied the acres of occupied habitat by the probability of retardants affecting each acre of Forest from Table 43. The result is shown below in Table 45. Based on this analysis the probability of fire retardant being dropped into occupied sucker habitat for both Forests ranges from 0.02 to 0.3, and is lowest for the Modoc National Forest, which has more acres of occupied habitat but had fewer retardant drops during the 2000-2010 periods.



Probability of retardants entering occupied LRS and SNS habitat = area of occupied habitat (acres) x probability of each retardants affecting Forest acre ( $P_{\text{drop/acre}}$ ).

$$P_{\text{retardants in habitat}} = \text{occupied habitat (acres)} \times P_{\text{drop/acre}}$$

**Table 44. Probability of fire retardant being dropped into occupied sucker habitat over the 10 year period term of the proposed action**

Forest	Species	Probability
Fremont-Winema	LRS	0.2
Fremont-Winema	SNS	0.3
Modoc	LRS	0.02
Modoc	SNS	0.06

*Site Specific Exposure Risk – Modoc Rim Area, Fremont/Winema NF.* Based on the above analysis, the 10-year probability of a retardant drop directly affecting occupied habitat both species and for both Forests varied from as low as 0.02 for LRS on the Modoc NF to a high of 0.3 for SNS on the Fremont/Winema NF. Consequently the risk of retardant drops occurring in sucker habitat is low, forest-wide. However, based on communications with John Giller, Fremont/Winema NF, Fire Management Officer (pers. comm. 2011) we learned that there was one area in particular where the risk of a retardant drop into sucker habitat is high and that area is known as Modoc Rim. Modoc Rim is located along the eastern shore of Upper Klamath Lake. The rim is a steep fault scarp that rises over 1,000 feet from the lake. A major north-south rail line and highway are located at the base of the rim and consequently the numbers of wild fires is greatly elevated. Since 1980, there have been over 40 fires in this area for a fire frequency of about 1.3/year (John Giller, Fremont/Winema NF fire management officer, pers. comm. 2011). Most of the fires in the Modoc Rim area were quite small being less than an acre in size (Table 46), and therefore likely did not require use of retardants, but five fires were over 100 acres in size and three were greater than 400 acres in size, and fires of that size are more likely to require retardants. Further because of the steep terrain and proximity to the lake, it is more likely that retardant drops into water would occur as a result of fire-fighting efforts in the Modoc Rim area, and that is one area where drops into water have occurred (John Giller, Fremont/Winema NF, pers. comm. 2011). Based on this, it is probable that over the next 10 years there will be one retardant drop into Upper Klamath Lake, which is occupied sucker habitat.

**Table 45. Summary of Modoc Rim area fires 1980-2009. Source: John Giller, Fremont/Winema NF**

<b>Time Period</b>	<b>Total Number of Fires</b>	<b>Number Fires 0.1-1 Acre</b>	<b>Number Fires 1-100 Acre</b>	<b>Number Fires &gt;100 Acre</b>
1980-1989	10	7	2	1
1990-1999	18	15	1	2
2000-2009	13	9	2	2

*Conclusion: LRS and SNS Exposure Risk*

Based on the above analysis, the risk of a retardant drop into LRS and SNS habitat is low on a Forest-wide basis for both Fremont-Winema and Modoc Forests, but based on unique conditions at one area, i.e., Modoc Rim on Fremont-Winema NF, there is a high probability of one retardant drop being accidentally made into sucker habitat in Upper Klamath Lake.

*Toxicological Hazard Posed by Fire Retardants*

Because the toxic component to fish of the Phos-Chek family of fire retardants is primarily ammonia, we review LRS/SNS tolerance to ammonia to help determine how much of a risk it poses. Phos Chek 259-F is 23 percent ammonia (Buhl and Hamilton 2000, cited in BA), so about one-fourth of the volume of the retardant is ammonia.

When fire retardant enters water it causes the initial spike in ammonia. The peak of the spike and area affected depends on many factors, such as volume of retardant to hit the water, volume of water to dilute the retardant, and turbulence of the stream. Also, the ammonia that is released immediately begins to form a chemical equilibrium between ionized ammonia (or the ammonia ion  $\text{NH}_4^+$ ) and un-ionized ammonia ( $\text{NH}_3$ ). Un-ionized ammonia is approximately 100 times more toxic than the ammonium ion. The chemical balance between these two forms of ammonia is determined by pH, temperature, and total ammonia concentration (USEPA 1999). In most streams, the pH of the stream is sufficiently low that the less toxic ionized ammonia predominates. However, in highly alkaline waters, like Upper Klamath Lake, which is part of the action area, un-ionized ammonia concentrations increase and can reach toxic levels. The freshwater aquatic life chronic criterion for fish set by the Environmental Protection Agency (USEPA) at pH 7.5 is 8 mg/L at 0° C, but goes down to 1 mg/L at 25° C (USEPA 1999).

Laboratory studies on effects of water quality on suckers can be divided into two exposure categories, acute and chronic. Acute studies are designed to determine short-term tolerance, for example over 96 hours, whereas chronic studies focus on longer term effects. Toxicity data are usually presented as the median lethal concentration necessary to kill 50% of the test organisms

(abbreviated as LC-50). LC-50 values for LRS and SNS larvae and juveniles exposed to un-ionized ammonia based on studies by Saiki et al. (1999) are summarized below in Table 47.

**Table 46. 96-hour LC-50 for un-ionized ammonia as NH<sub>3</sub>-N mg/L (mean and 95% confidence limits).**  
Source: Saiki et al. (1999)

<b>Sucker Species</b>	<b>Life Stage</b>	<b>Un-ionized Ammonia (mg/L) ( 95% Confidence Limits)</b>
Lost River	larvae	0.5 (0.44-0.52)
Lost River	juveniles	0.8 (0.70-0.86)
Shortnose	larvae	1.1 (0.73-1.53)
Shortnose	juveniles	0.5 (0.34-0.82)

Another study addressed chronic effects of water quality on suckers. Meyer et al. (2002) examined 14- and 30-day chronic effects of low dissolved oxygen (DO), and elevated pH and ammonia on larval and juvenile LRS. Mortality thresholds were found to range from 1.5-2.0 mg/L DO, >10 pH, and 0.37-0.69 mg/L un-ionized ammonia. These levels correspond well with those obtained in previous studies by Saiki and others but are higher. Contrary to expectation for fish chronically exposed to toxicants, LRS generally did not display sub-lethal responses to low DO concentrations, elevated pH, or elevated ammonia concentrations based on the three traditional chronic-toxicity endpoints used (growth, whole-body ion content, and swimming performance). In the 14-day sub-lethal ammonia/sub-lethal DO test, mortality did not decrease significantly and no sub-lethal effects were observed and there was a slight but significant decrease in sodium content at pH 10 levels held for 30 days.

In the above-mentioned study by Meyer et al., gill histopathology was sometimes more sensitive than the three traditional chronic endpoints, i.e., growth, whole-body ion content, and swimming performance (Lease et al. 2003). In the ammonia test, statistically significant structural changes occurred in gills of LRS larvae exposed continuously to un-ionized ammonia concentrations 3.5 times lower than the lowest concentration at which significant mortality and growth effects occurred. Changes in gill structure that were quantified included significantly increased oxygen diffusion distance and increased thickness of secondary lamellae—the primary site for respiratory and ion regulation. Additionally, qualitative structural changes were observed, including increased number of chloride and mucous cells, the appearance of mitotic figures, and infiltration of white blood cells into the lymphatic space (Lease et al. 2003). However, no statistically significant structural changes were detected in gills of fish exposed to the highest pH of 10.0. Histopathology of the juvenile LRS exposed to sub-lethal ammonia concentrations was also studied by Foott et al. (2000). They found three abnormalities: gill epithelium separation and swelling, and clear droplets in kidney tubular cells at the lowest ammonia concentrations of

6 µg NH<sub>3</sub>-N/L, but these were believed to be a result of the high pH of the water rather than the ammonia (Scott Foott, California Nevada Fish Health Center, pers. comm. 2011).

#### *Conclusions: Toxicology of Retardant Applications*

Laboratory and in situ studies show that suckers, although relatively tolerant of adverse water quality including ammonia, are nonetheless killed when ammonia concentrations reach critically high levels. Mortality could occur if suckers are exposed to un-ionized ammonia at concentrations at or above 0.5 mg/L.

#### *Indirect Effects of Fire Retardants to LRS and SNS*

##### *Effects of Downstream Drift of Retardants into LRS and SNS Habitat*

In the BA, the Forest Service noted that trout had been adversely affected by retardant drifting downstream from an accidental drop or spill. If the exposure analysis was to incorporate areas upstream of occupied habitat, the risk of exposure could increase. It's not clear how much risk this poses because for most of the occupied stream habitat, such as in the Gerber Reservoir and Willow Creek watersheds, there is little or no flow during the primary July-September fire season, especially during the latter part of the season when these systems are mostly isolated pools. Perhaps this is mostly an issue for tributaries, such as Fourmile, Cherry, and Sevenmile creeks, flowing into sucker habitat along the west side of Upper Klamath Lake. However, if retardants were dropped in one of these creeks, which is unlikely because of the 300-foot wide exclusion zone, the concentration of ammonia would be substantially diluted by the time it reached sucker habitat in the lake. Likewise, we assume that if retardants were dropped in the tributaries to the Klamath River on the Klamath NF, ammonia concentrations would be extremely low before they reached sucker habitat in the mainstem or reservoirs.

##### *Surface Runoff and Leaching*

Surface run-off occurs after the retardant is applied to the ground outside of the 300-foot waterway buffer and is carried into a waterway by storm water runoff. Retardant applied outside of the 300-foot waterway buffer may have adverse effects to aquatic organisms; however, the level of toxicity depends on the surface or soil type (rock, sand, soils with high or low organic matter, etc.), persistence in the environment, timing of a rainfall event, and the amount of retardant on the ground. In one study, 1,000 gallons of mixed fire retardant was applied parallel to and within three meters of one stream in Oregon. Results showed no immediate increase in ammonia concentrations where retardant were applied parallel to the stream (Norris et al 1978, cited in BA). During a year of monitoring after application of the retardant to near-stream ground, soluble nitrogen forms and phosphorus levels in stream water were similar to the untreated, control watersheds (Norris et al. 1978 and Norris et al. 1991, as cited in the BA). In

another study, post fire water quality monitoring for streams near four wildfires showed that application of fire retardant near streams but not into the stream had minimal effects on surface water quality (Crouch et al. 2005, cited in BA). Ammonia and phosphorus were found in streams in burned areas where retardant was not used from burning of wood and other organics, at concentrations similar to those found in areas where retardant was applied due to direct effects from the fire. Furthermore, during the fire season there is little precipitation in the Fremont/Winema and Modoc Forests so runoff is unlikely to occur until winter and by that time the amount of available ammonia is likely to be much less. Based on this information and the fact that suckers are relatively tolerant of ammonia, we do not anticipate adverse effects to LRS and SNS from retardant surface runoff or leaching.

### *Effects of Retardant Misapplications*

Misapplications occur when retardants do not hit their intended targets. This could have serious implications if the retardants are dropped accidentally into aquatic environments, as discussed above. Since about 1990, there have been at least four known misapplications on the Fremont/Winema NF that have entered streams or lakes, one in Honey Creek, another in Larkin Creek, and two in Upper Klamath Lake (James, Price, Bureau of Land Management, pers. comm. 2011).

### *Effects of Retardants on Aquatic Macroinvertebrates*

Because macroinvertebrates are a key food source for fish, the loss of numbers and the population will affect the viability of the food web. According to the BA, when fire retardant hits the water and ammonia concentrations increase quickly, the affected macroinvertebrates will exhibit highly variable responses depending on their tolerance to ammonia and their mobility. Macroinvertebrates that react similarly to small amounts of ammonia have up to a four-fold difference in their resistance to acute toxicity (Williams et al. 1986, cited in BA). If a retardant drop occurs in a stream, almost all macroinvertebrates will drift downstream away from areas of elevated ammonia, but many will die, and it can take years for them to recolonize a stretch of stream that is negatively impacted (Minshall et al. 1997, cited in BA). As long as there is depressed individual and species abundance of prey, fish that depend on those macroinvertebrates as a food source will not recolonize.

How the food supply of suckers would be affected by a retardant drop is unknown, but it would depend in part on the ammonia tolerance of the prey. In the stream environment, the diets of suckers are unknown, but in lake environments suckers are known to feed on larval midges known as chironomids (Buettner and Scopettone 1990). At least some of these chironomids are highly tolerant of water quality conditions, including ammonia, because they are abundant in Upper Klamath Lake (Kuwabara et al. 2010) where water quality is seasonally poor and includes relatively high levels of ammonia (Meyer et al. 2002). If these water-quality tolerant chironomids also occur in streams, then we would anticipate that they would be tolerant of ammonia resulting from a retardant drop, as long as concentrations were not too high. If less

tolerant chironomids occur in stream habitats with suckers than the impact of a retardant drop would be greater.

#### *Effects of Increased Primary Production Resulting from Use of Fire Retardants*

Because fire retardants are nitrogen based they eventually become nitrogenous nutrients if present in water and thus could increase primary production. This is most likely to be a problem for LRS and SNS in areas such as the Miller Creek drainage in the Fremont/Winema and the Willow Creek drainage of Modoc National Forests where SNS are confined to pools or small reservoirs during the summer-fall fire season. However, the results of the exposure analysis suggest that there is a small probability of retardants getting into the water and affecting primary production (see Table 45). Additionally, suckers are tolerant of low dissolved oxygen levels that might result from increased primary production if a small amount of retardant got into sucker habitat. Therefore, if small amounts of retardant get into streams occupied by suckers they are unlikely to be harmed.

#### *Summary of Effects*

We agree with the Forest Service that there is risk to LRS and SNS associated with misapplication of retardant drops that enter fish habitat. Our analysis indicated that the risk was low to LRS and SNS on a Forest-wide basis, but was greater at Modoc Rim on the Fremont-Winema NF. The minimization measures in the proposed action will likely reduce risk to LRS and SNS in most situations; however, at Modoc Rim where there is steep terrain and fires are likely to start near the water where the rail line and highway are located, there is a greater risk of retardant entering LRS and SNS habitat, and in fact over the past several decades there have been two accidental retardant drops that have affected Upper Klamath Lake where the LRS and SNS occur.

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### Conclusion

After reviewing the current status of the LRS and SNS, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's opinion that the proposed action is not likely to jeopardize the continued existence of the LRS or SNS, and is not likely to destroy or adversely modify proposed critical habitat for these species. The Service reached these conclusions because the likelihood of retardants entering sucker habitat is low except in one area because of the relatively small amount of habitat on the Forests, the relatively low use of retardants, and the minimization measures included in the proposed action will reduce risk. In the incidental take statement below, we estimate that no more than 100 juvenile suckers would be killed and 1.4 acres of habitat would temporarily be made toxic if retardant was

accidentally dropped into Upper Klamath Lake. This represents a very small fraction of the juvenile sucker population which probably numbers in the hundreds of thousands each year, and the 1.4 acres is a small fraction of the total habitat that is in the thousands of acres.

## **Mariposa pussypaws (*Calyptridium pulchellum*)**

### Environmental Baseline

The Sierra National Forest is known to contain two occurrences of *Calyptridium pulchellum* occupying less than 2 acres, located on granite outcrops in openings within the chaparral and foothill woodland plant communities (CNDDDB 2011). Of the two occurrences, one has been fenced to exclude cattle (USFWS 2007) while the other is currently affected by trampling as the result of cattle grazing. Both occurrences of *C. pulchellum* are currently threatened by nonnative grass intrusion and shading from other plant species (USFWS 2007, CNDDDB 2011).

### Effects of the Action

*Calyptridium pulchellum* flowers from May to August therefore it is anticipated that fire retardant applications in habitat for this species may occur before seed-set and before plant senescence. While there is no specific information available to determine whether the application of fire retardant will directly affect *C. pulchellum*, if retardant were to be applied directly to *C. pulchellum* it is anticipated that the individual plant may senesce prior to seed set. Since *C. pulchellum* is an annual herb we anticipate the potential loss of individual plants as a direct result on the aerial application of fire retardant.

*Calyptridium pulchellum* tends to grow in open, relatively unvegetated areas, presumably because it competes poorly with other species on more fertile soils (USFWS 2004). Retardant formulations in use today are primarily inorganic fertilizers (USDA 2011). Since plants that are poor competitors are typically outcompeted by other plants in nutrient rich environments (Ricklefs 2006), the addition of nutrients is expected to adversely affect *C. pulchellum*. The increased level of nutrients, due to the application of fire retardant, will allow for the increased growth of both native and non-native plant species (Larson and Duncan 1982) in the current *C. pulchellum* habitat. However, because the Forest Service is proposing to monitor plant populations that are subjected to the aerial application of fire retardant and remove any nonnative or non-compatible plant species, the Service does not anticipate the loss of the *C. pulchellum* populations resulting from competition with other plants. Additionally, while the fire retardant may result in the loss of individual plants, we anticipate recruitment of subsequent *C. pulchellum* plants within the area from the seed bank.

### Conclusion



After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, it is the Service's biological opinion that the proposed actions are not likely to jeopardize the continued existence of *Calyptridium pulchellum*.

Our conclusion is based on the following; (1) the direct effects of a retardant drop would be short term (single season); and (2) implementation of the proposed action, including the proposed conservation measures, is not anticipated to result in the loss of plant populations within the action area

## **Modoc sucker (*Catostomus microps*)**

### Environmental Baseline

Modoc sucker are primarily found in relatively small (second- to fourth-order), perennial streams. They occupy an intermediate zone between the high-gradient and higher elevation, coldwater trout zone and the low-gradient and low elevation, warm-water fish zone. Most streams inhabited by Modoc sucker are characterized by moderate gradient (15-50 feet drop per mile), low summer flow (1-4 cubic feet per second), and relatively cool (59-72° F) summer temperatures (Moyle and Daniels 1982).

In the Pit River system, Modoc sucker occupy stream reaches above the Sacramento sucker/pikeminnow/hardhead zone of the main-stem Pit River and the lower reaches of its primary tributaries (Moyle and Marciochi 1975; Moyle and Daniels 1982). The known elevation range of Modoc sucker is from about 4,200 to 5,000 feet in the upper Pit River drainage (Ash and Turner Creeks) and from about 4,700 to 5,800 feet in the Goose Lake subbasin (Heck et al. 2008; Reid 2007, 2008). However, most known populations are constrained by the effective upstream limit of permanent stream habitat. Only Rush and Thomas creeks extend substantially above the elevations occupied by Modoc sucker.

The pool habitat occupied by Modoc sucker generally includes fine sediments to small cobble bottoms, substantial detritus, and abundant in-water cover. Cover can be provided by overhanging banks, larger rocks, woody debris, and aquatic rooted vegetation or filamentous algae. Larvae occupy shallow vegetated margins and juveniles tend to remain free-swimming in the shallows of large pools, particularly near vegetated areas, while larger juveniles and adults remain mostly on, or close to, the bottom (Martin 1967, 1972; Moyle and Marciochi 1975; Reid 2008).

Modoc sucker often segregate themselves along the length of a stream by size with larger individuals being more common in lower reaches of streams. This may indicate a temperature-growth relationship or that larger Modoc sucker move downstream into larger, deeper, warmer pool habitats as they outgrow the relatively limited habitat in upper stream reaches. Spawning

often occurs in the lower end of the pools over gravel-dominated substrates containing gravels, sand, silt and detritus (Reid 2007, 2008).

Because spawning and rearing habitats are relatively non-specific and common, suitable habitat is not considered limiting except during severe droughts. There are approximately 40 miles of suitable habitat within their range and most of that is occupied (Reid 2008a; USFWS 2009).

### *Habitat Modification*

The 1985 listing rule stated that land management activities had: 1) dramatically degraded Modoc sucker habitat, 2) removed natural passage barriers allowing hybridization with Sacramento suckers and providing exposure to predaceous fishes, and 3) decreased the distribution of the Modoc sucker to only four streams (USFWS 1985).

Since listing, the majority of Modoc sucker streams on public land have been fenced to exclude or actively manage cattle grazing (Reid 2008). In 2001, California Department of Fish and Game, in cooperation with the Modoc National Forest and the Service, carried out extensive habitat surveys of all known occupied stream reaches on public land and all private lands in the Turner Creek drainage and lower Johnson Creek to determine Proper Functioning Condition. Proper Functioning Condition is a method of assessing the physical functioning of riparian and wetland areas. The team found that all streams reaches of designated Critical Habitat on public lands were in ~~“proper functioning condition”~~ (i.e., Turner, Coffee Mill, Hulbert, Washington, Johnson Creeks) and that Dutch Flat and Garden Gulch, two occupied streams not originally listed as Critical Habitat, were ~~“functional-at risk”~~ with ~~“upward trends,”~~ which is a positive condition just below proper functioning condition. On private lands surveyed in Critical Habitat, most habitat was assessed to be ~~“functional-at risk;”~~ however, all habitat also showed upward trends.

Extensive landowner outreach and improved land stewardship in Modoc and Lassen Counties in California have also resulted in improved protection of riparian corridors on private lands. Cattle are currently excluded from all private land Critical Habitat on Rush Creek and Johnson Creek below Higgins Flat (Modoc National Forest), allowing continued upward trends in habitat condition (Reid 2008).

### *Movement Barriers*

The 1985 listing rule assumed that natural passage barriers in streams occupied by Modoc suckers had been eliminated by human activities, allowing hybridization between the Modoc and Sacramento suckers, as well as providing access to Modoc sucker streams by non-native predatory fishes. However, review of all streams where Modoc suckers occur indicates no evidence for historical natural barriers that would have physically separated the two species in

the past, particularly during higher springtime flows when Sacramento suckers make their upstream spawning migrations (Reid 2008). In addition, there is no evidence showing the historical range of the Modoc sucker, or its distribution within that range, has been substantially reduced in the recent past. To the contrary, continued field surveys have resulted in recent expansions of our understanding of the species' range and distribution. Furthermore, the distribution of Modoc suckers within the stream populations recognized in 1985 has either remained stable over the past 22 years, or slightly expanded, and the ten populations appear to occupy all available and suitable habitat.

### Effects of the Action

#### **A. Location: Spatial extent of retardant compared to species distribution in the forest**

*Proximity of the action:* Within the Modoc National Forest, Modoc sucker are found in Cedar Creek, Hulbert Creek, Turner Creek, Coffee Mill Gulch, Washington Creek, Garden Gulch (Turner Creek sub-basin streams) as well as Dutch Flat Creek, Ash Creek, Rush Creek, Johnson Creek, and two unnamed creeks (Figure 1; Ash Creek sub-basin streams). At the time of listing, Modoc sucker were only known to occur in California. Critical habitat was designated at the time of listing (50 FR 24526) and includes the following streams: Turner Creek (4.5 miles), Washington Creek (4.0 miles), Hulbert Creek (3.5), Johnson Creek (4.0), and Rush Creek (5.0). Within the Fremont-Winema National Forests, Modoc sucker occur in Thomas Creek, a tributary of Goose Lake, in Lake County, Oregon (Figure 1). Most of the range of Modoc sucker within Oregon occurs on the Fremont-Winema National Forests, save portions at the up- and downstream ends of Thomas Creek where they occur on private property. Critical habitat has not been designated for Modoc sucker within Oregon.

*Distribution:* The current distribution of the Modoc sucker within its natural range includes populations in twelve streams in three sub-drainages (Reid 2008). At the time of listing in

1985, the distribution of the Modoc sucker was considered to be restricted to the Turner and Ash Creek sub-drainages of the Pit River (i.e., Turner, Hulbert, and Washington creeks [all tributaries to Turner Creek], and Johnson Creek [a tributary of Rush Creek]). The original listing also recognized four additional creeks (Ash, Dutch Flat, Rush, and Willow creeks) as having been occupied historically. However, these populations were presumed lost due to hybridization with

Sacramento suckers (*Catostomus occidentalis*). Although there was no genetic corroboration of hybridization available at that time (Ford 1977; Mills 1980; USFWS 1985), hybridization was suspected because of overlapping occurrences. New information is available that documents the occurrence of three additional populations not considered in the original listing (i.e., Coffee Mill and Garden Gulch creeks in the Turner sub-drainage and Thomas Creek in the Goose sub-basin). New genetic information also is available on the four populations considered lost to hybridization in 1985. The Thomas Creek population is in the Goose Lake sub-basin of Oregon; all of the other populations are in the Pit River sub-basin in Modoc and Lassen counties, California. Examination of the Oregon State University fish collection revealed several lots of

Modoc sucker collected in Thomas Creek that were originally misidentified as Sacramento sucker. Modoc sucker specimens were found in collections from five sites on Thomas Creek taken in 1954, 1974, 1993 (two collections), and 1997. Surveys conducted in 2007 confirmed Modoc suckers were present throughout 14 miles of upper Thomas Creek (Reid 2007, 2008; Heck 2008).

**B. Timing: Species life-cycle activity during fire season and times of retardant drops**

Moyle and Marciochi (1975) indicated that Modoc suckers are most successful in small, relatively undisturbed, pool-dominated streams. Modoc sucker habitat is characterized by high water flows in winter and spring months, but by mid-summer, large reaches of habitat dry up (Studinski 1993). During these times, fish populations are confined to relatively small, permanent pools, which is when they are most sensitive. This is coincident with the Modoc National Forest peak fire season, which runs from August through October, and the Fremont-Winema National Forests fire season that runs from June through October (USDA 2011).

**C. Likelihood of exposure to retardant**

Several characteristics of the application site determine the initial concentration of retardant in the stream. Narrow, deep streams have a much lower initial concentration (therefore a shorter mortality zone for aquatic species) than shallow, wide streams, assuming equivalent flow properties (Norris and Web in USDA Forest Service Gen. Tech.Rep. PSW-109. 1989). Streams with dense overstory vegetation are less affected by retardant because the vegetation intercepts much of the retardant (Norris et al. 1978). Where less overstory vegetation exists, more retardant gets directly in the water.

Tests using 1000 gallons of fire retardant applied across four of the streams occurred in Idaho, Oregon and California. A result showed no immediate increase in NH<sub>3</sub> concentrations where retardant was applied parallel to the stream (Norris et al. 1978). Results directly into water showed maximum concentrations of un-ionized ammonia ranging from 0.02 to 0.32 mg/l, approximately 150 feet downstream from the application point at time intervals between 2 and 22 minutes after application (Norris et al. 1978).

Time to dilution to 1 percent of maximum concentration, at 150 feet downstream, ranged between 10 minutes to almost 4 hours. Sampling over all the sites at various time intervals from 10 minutes to four hours after application showed a reduction in concentration from 4 to 29 percent at 650 feet downstream of the application points, and 1 to 3 percent at 2,600 feet downstream. The differences in concentrations were due to factors of velocity and mixing turbulence of the stream flows. Retardant that was applied to the ground on either side of the streams was effectively mitigated by untreated strips of ground as narrow as 3 meters wide from the stream banks and contributed little or not at all to the streams (Norris et al. 1978).

Simulations run by Norris and Webb (1989) showed ammonia concentrations could remain at

lethal levels between 0 and 6.2 miles downstream, depending on stream characteristics and the size of the retardant load. Thus, we use 6.2 miles for amount of stream affected by a retardant drop. First, we calculated the number of retardant drops expected to enter streams from a misapplication (Table 48) and then determined the amount of take from the misapplication (Table 49).

**Table 47. Number of retardant drops expected to enter streams used for misapplication effects analyses**

<b>Forest</b>	<b>Expected total number of retardant drops 10 years<sup>1</sup></b>	<b>Number of drops expected to enter water ways (.42%- multiply by .0042 and round up)<sup>2</sup></b>
Fremont-Winema National Forests	1218	5
Modoc National Forest	224	1

<sup>1</sup>The expected number of retardant drops is based on taking the total number of drops per forest as presented in the BA on pages 238-241 and dividing that number by 11 and multiplying by 10. The data presented in the BA is based on 11 years and the timeframe for this consultation is 10 years, therefore we must account for this difference in magnitude.

<sup>2</sup>The BA assumes that .42% of all retardant drops will result in misapplication to a waterway. Therefore, the Service expects that over the life of the consultation, .42% of all drops on each Forest will result in delivery to a waterway with potential adverse effects to Modoc sucker, if the stream is occupied or designated critical habitat.

**Table 48. Extent of take in occupied habitat due to misapplication of fire retardant by National Forest**

<b>Forest name</b>	<b>Miles of perennial stream on Forest</b>	<b>Miles of occupied streams on Forest<sup>1</sup></b>	<b>% of total perennial streams which are occupied</b>	<b>Number of drops expected to hit stream</b>	<b>Total stream miles affected by retardant (6.2 miles per drop to water<sup>2</sup>)</b>	<b>% Modoc sucker occupied steams affected by retardant</b>	<b>Extent of take</b>
Fremont-Winema National Forests	1,315	14	1.1	5	5*6.2=31.0	.011*31.0=0.7 miles	0.3 miles
Modoc National	1,795	18	1.0	1	1*6.2=6.2	.01*6.2=	0.06 miles

Forest							
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<sup>1</sup>Based on occupied habitat. Data available at the Klamath Falls Fish & Wildlife Office.

<sup>2</sup>The BA states that lethal effects extend 6.2 miles and sublethal may occur much further downstream. For purposes here, we will use the 6.2 miles as the furthest extent of downstream effects.

Approximately 18 miles (28,968 m) of occupied habitat occur on the Modoc National Forest, which, when assuming a width of 3 m in Modoc sucker occupied habitat, equals approximately 21 acres occupied habitat. This represents roughly 0.0012% of occupied habitat on the Modoc National Forest lands. Approximately 14 miles (22,531 m) of occupied habitat occur on the Fremont-Winema National Forests, which, when using the above information, equals approximately 17 acres occupied habitat. This represents roughly 0.0007% of occupied habitat on the Fremont-Winema National Forests lands.

To estimate the probability that retardants would enter occupied Modoc sucker habitat, we calculated the area that was potentially covered by retardants during the 2000-2010 period in the Modoc National Forest and the Fremont-Winema National Forests. To do this we assumed retardant drops did not overlap and were dropped randomly. The BA states (page 14) that typical retardant drops are 50-75 feet wide by 800 feet long, which is approximately 1.4 acres. By multiplying 1.4 acres x number of drops during 2000-2010, the total area in each Forest directly affected by retardant drops can be calculated. Dividing the area affected by the total area of each Forest, the probability of a drop affecting each acre of Forest can be estimated (Table 50).

**Table 49. Data on National Forest area, retardant drop statistics, and estimate of probability of retardant drops affecting each acre of forest, assuming each drop affects 1.4 acres**

<b>National Forest</b>	<b>Area (million acres)</b>	<b>Retardant Drops 2000-2010</b>	<b>Acres Affected /10 Years</b>	<b>Probability of Retardant Drop in Each Acre</b>
Fremont/Winema	1.71	1,218	1705	0.001
Modoc	1.98	224	314	0.0002

Next, to estimate the probability of retardants getting into occupied Modoc sucker habitat, we multiplied the acres of occupied habitat by the probability of retardants affecting each acre of Forest (Table 3). This results in a probability of 0.017% and 0.0042% that a drop will enter occupied habitat on the Fremont-Winema National Forests and Modoc National Forest,

respectively. Because the Forest Service will be implementing 300 foot exclusions from identified water bodies, the risk of a drop occurring in any year in occupied habitat is substantially reduced.

Assuming a width of 3 m in Modoc sucker occupied streams, and using the extent of take of 0.3 miles (from Table 49 above), then 1449 m<sup>2</sup> of habitat on the Fremont-Winema National Forests would be affected. Similarly, 291 m<sup>2</sup> of habitat on the Modoc National Forest would be affected. Using an assumption of 1.46 Modoc sucker per 100 m<sup>2</sup> of habitat (following data on occupied habitat presented in Reid (2009)), this would equate to approximately 21 Modoc sucker on the Fremont-Winema National Forests and 4 Modoc sucker (of all life stages) on the Modoc National Forest in an individual stream that could be exposed to a misapplication of retardant.

#### **D. Toxicity of fire retardant to various life stages**

*Nature of the effect:* The primary effect on Modoc sucker would be from toxic ammonia compounds coming into contact with occupied habitat as the retardant is applied or very soon after application. If these effects are severe enough, they could inhibit growth of Modoc sucker, cause tissue damage, or cause direct mortality. For example, high concentrations of ammonia can inhibit growth and cause mortality of rainbow trout (*Oncorhynchus mykiss*; Burkhalter and Kaya 1977). Thurston et al. (1978) found that high concentrations of ammonia can result in tissue damage to cutthroat trout (*Oncorhynchus clarkii*). Tissue damage also has been observed in Lost River sucker (*Deltistes luxatus*) at high ammonia concentrations (Lease et al. 2003). Although tests of the effects of ammonia on Modoc sucker have not been conducted, it is highly likely results would be similar as for other fishes. Indirect effects could occur to Modoc sucker from the retardant adversely affecting the aquatic macroinvertebrates that comprise their diet.

*Duration:* The effects of the proposed action would be considered a short-term event whose effects are relaxed almost immediately (pulse effect). However, depending on stream conditions (e.g., rainfall or flow) the duration could extend over a greater extent of stream length.

*Disturbance frequency:* The Service is not able to make a precise assessment regarding disturbance frequency for Modoc sucker. However, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. From 2000 to 2010, the Modoc National Forest had a total of 224 fire retardant drops for an average of 20 drops per year (USDA 2011). During that same time period, the Fremont-Winema National Forests had a total of 1218 fire retardant drops for an average of 111 drops per year.

*Disturbance intensity:* The Service is not able to make a precise assessment regarding disturbance intensity for this species. However, it is likely the intensity of fire retardant



application would be dependent on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

*Disturbance severity:* The Service is not able to make a precise assessment regarding disturbance severity for this species. However, it is likely the intensity of fire retardant application would be dependent on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

**E. For critical habitat effects, percentage affected compared to overall CH**

We completed the same effects analysis for critical habitat as for occupied habitat.

**Table 50. Extent of take in critical habitat due to misapplication of fire retardant by National Forest**

Forest name	Miles of perennial stream on Forest	Miles of critical habitat on Forest <sup>1</sup>	% of total perennial streams which are critical habitat	Number of drops expected to hit streams	Total stream miles affected by retardant (6.2 miles per drop to water <sup>2</sup> )	% Modoc sucker CH steams affected by retardant	Extent of take
Fremont-Winema National Forests	1,315	0	0	5	5*6.2=31.0	0.0*31.0=0 miles	0 miles
Modoc National Forest	1,795	27	1.5	1	1*6.2=6.2 miles	.015*6.2=	0.09 miles

<sup>1</sup>No critical habitat has been proposed or designated on the Fremont-Winema National Forests

<sup>2</sup>The BA states that lethal effects extend 6.2 miles and sublethal may occur much further downstream. For purposed here, we will use the 6.2 miles as the furthest extent of downstream effects.

**F. Misapplication effects**

*Beneficial effects:* The Service does not believe the effects of the action would be wholly positive to Modoc sucker.

*Direct effects:* A direct effect to Modoc sucker would be from toxic ammonia compounds coming into contact with an occupied stream as the fire retardant is applied or very soon thereafter. If these effects are severe enough, they could inhibit growth of Modoc sucker, cause tissue damage, or cause direct mortality (as discussed in *Nature of the effect* above). Whenever practical, as determined by the fire incident, the Forest Service will use water or less toxic fire retardants in areas occupied by or designated critical habitat for threatened, endangered and proposed species. Incident Commanders and pilots are required to avoid aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways (including perennial, ephemeral, and intermittent streams as well as lakes, ponds, identified springs, and reservoirs). The only exception to this is when human life or safety is threatened and the use of retardant can be reasonably expected to alleviate the threat. However, very few private structures are located adjacent to occupied habitat that would require retardant drops to protect human life or safety. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application or receive less precise placement of the fire retardant relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams. However, Modoc sucker are not known to occur in ephemeral or intermittent streams. Because of the isolated nature of the local Modoc sucker populations during the fire season when streams are at low flow or consist of isolated pools, any local effects may be especially deleterious. However, many of the occupied creeks will have very low flow or no surface flow at all in late summer, when fire activity is highest. This will greatly reduce the likelihood that a retardant misapplication would be carried downstream for any great distance.

*Interrelated and interdependent actions:* Based on the information provided, the Service has not identified any interrelated or interdependent actions applicable to Modoc sucker regarding this proposed aerial application of fire retardant.

*Indirect effects:* Indirect effects could occur to Modoc sucker from the retardant adversely affecting the aquatic macroinvertebrates that comprise their diet.

#### Species' response to a proposed action

*Numbers of individuals/populations in the action area affected:* The exact number of individual Modoc sucker in the action area is not known. There have been five attempts to estimate the population sizes of the Modoc sucker (Table 52). All of these estimates were for populations in the Pit River drainage of California. No population size estimates are available from the Oregon portion of the range.

**Table 51. Comparison of Pit River drainage Modoc Sucker population estimates**

Stream Drainage	Estimated Population Size				
	Moyle 1974	Ford 1977	White 1989	Scoppettone et al. 1992	Reid 2008
<b>Turner Creek Drainage</b>	100	-	-	640+	552+
Turner	-	100	-	249+	265+
Washington	-	50	-	230	100+
Coffee Mill	-	-	-	50	106+
Hulbert	-	500	-	106	31+
Garden Gulch	-	-	-	-	~50
			-		
<b>Ash Creek Drainage</b>	-	-	-	-	-
Johnson	3,163	700	-	653	128+
Rush	535	1,000		-	-
Dutch Flat	-	40	133-358	1,300+	101+
Ash	300	200	-	-	-
Willow	-	15 <sup>1</sup>	-	-	0

<sup>1</sup> These 15 suckers are most likely Sacramento suckers based on their morphology (Reid 2007, 2008).

Although the population estimates presented above are subject to error, they do suggest that the populations have been relatively stable over the 35 years that the species has been monitored.

Additionally, the species has occupied most of the available habitat. These data suggest that the populations are resilient to threats such as drought and non-native predators that affect survival and reproduction.

*Sensitivity to change:* The 1985 listing rule identified threats to the Modoc sucker which include habitat modification, range reduction, presence of movement barriers, predation and

hybridization. Reexamination of natural barriers, morphological characters, and new genetic information that were unavailable at the time of listing indicate that hybridization with Sacramento suckers is not a substantial threat to the Modoc sucker and may be part of its natural evolutionary history. Most threats to the Modoc sucker that were considered in the 1985 listing rule (e.g., habitat modification, range reduction, and hybridization) have undergone substantial improvements or been ameliorated by new information and improved technology such that they no longer threaten the continued existence of the species. The principal remaining threat to the Modoc sucker is predation by non-native fishes, particularly brown trout (*Salmo trutta*) in the Ash Creek sub-basin and largemouth bass (*Micropterus salmoides*) in the Turner sub-basin.

*Resilience:* The listing rule did not identify drought or climate change as threats to the continued existence of the Modoc sucker. However, the northwestern corner of the Great Basin is naturally subject to extended droughts, during which even the larger water-bodies such as Goose Lake have dried up (Laird 1971). Regional droughts have occurred every 10 to 20 years in the last century (Reid 2008). The “dustbowl” drought of the 1920’s to 1930’s appears to have been the most extreme regional drought in at least the last 270 years and probably the last 700 years (Keen 1937; Knapp et al. 2004). There is no doubt that reaches of habitat did stop flowing in the past because some reaches dry up (or flow goes through the gravel instead of over the surface) nearly every summer under current climatic conditions (Reid 2008). They also take refuge in natural spring-fed reaches and in deeper pools that receive sub-surface flow even when most of the stream channel is dry (Reid 2008). Collections of Modoc sucker from Rush Creek and Thomas Creek near the end of that drought (Hubbs and Miller 1934; Merriman and Soutter 1933), and the continued persistence of Modoc sucker throughout its known range through substantial local drought years since 1985 without active management, demonstrate the resiliency of the population given availability of suitable refuge habitat.

*Recovery rate:* Since listing, the majority of Modoc sucker streams on public land have been fenced to exclude or actively manage cattle grazing (Reid 2008). The original listing noted the improvements seen over the recent past and continued protection over the last 23 years has allowed substantial improvements in riparian vegetative corridors, in-stream cover, and channel morphology. In 2001, CDFG, in cooperation with the Modoc National Forest and the Service, carried out extensive habitat surveys of all known occupied stream reaches on public land and all private lands in the Turner Creek drainage and lower Johnson Creek (Rossi 2001). All stream habitat was characterized and mapped using GIS, and pool characteristics (e.g., area, depth, substrate, cover, etc.) were recorded and photographs were taken at each pool. Subsequent to stream mapping, the principal team members carried out a Proper Functioning Condition (PFC; Prichard et al. 1998) assessment for occupied reaches of each stream (CDFG 2002). Proper Functioning Condition is a method of assessing the physical functioning of riparian and wetland areas. The term PFC is used to describe both the assessment process, and a defined, on-the-ground condition of a riparian-wetland area. The team found that all streams reaches of designated critical habitat on public lands were in “proper functioning condition” (i.e., Turner, Coffee Mill, Hulbert, Washington, Johnson Creeks) and that Dutch Flat and Garden Gulch, two occupied streams not originally listed as critical habitat, were “functional-at risk” with “upward trends,” which is a positive condition just below proper functioning condition. On private lands

surveyed in critical habitat, most habitat was assessed to be ~~functional-at risk;~~” however, all habitat also showed upward trends. Extensive landowner outreach and improved land stewardship in Modoc and Lassen counties have also resulted in improved protection of riparian corridors on private lands. Cattle are currently excluded from all private land critical habitat on Rush Creek and Johnson Creek below Higgins Flat (Modoc National Forest), allowing continued upward trends in habitat condition (Reid 2008). At this time, the Service has no indication that land management practices on public and private lands adjacent to Modoc sucker habitat will not continue. Upward habitat trends are expected to continue as a result.

The majority of the upper Thomas Creek watershed and the stream reach containing Modoc suckers are managed by Fremont-Winema National Forests. Prior to the recognition that there were Modoc suckers in Thomas Creek, the Forest Service in 1986 established the Thomas Creek Riparian Recovery Project with the objective to halt erosion, stabilize stream banks, and reduce water temperatures for the benefit of native fishes. As part of this project, there have been numerous riparian restoration and channel improvement projects to promote deeper pool development and water retention, as well as improved grazing management.

There are two privately-owned meadow reaches of Thomas Creek upstream of the lower Forest boundary that are characterized by low gradient and large open pools. Both are managed for grazing by the Forest Service permittee. The lower parcel, which is unfenced and grazed with neighboring Forest Service allotments, contains substantial populations of Modoc sucker (Reid 2007). The upper parcel is fenced and has not been surveyed; however, Modoc suckers are abundant in pools at its boundaries and therefore the suckers are likely to occur on the unsurveyed stream reach. At this time, the Service has no indication that current land management practices on public and private lands on Thomas Creek are incompatible with the conservation of the species, and therefore upward habitat trends are expected to continue.

### *Cumulative Effects*

The implementing regulations for section 7 define cumulative effects to include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Service is not aware any projects that are ongoing or proposed on State, tribal, or private lands that has the capability of impacting Modoc sucker. Therefore, the cumulative effects to this species from the implementation of the proposed action are not expected to be additive to any foreseeable future project in the action area.

## Conclusion

After reviewing the current status of Modoc sucker and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely to neither jeopardize the continued existence of Modoc sucker nor adversely modify critical habitat. This proposed action is not likely to jeopardize the continued existence of Modoc sucker because (1) very few private structures are located adjacent to occupied habitat that would require retardant drops to protect human life or safety; (2) most of the streams have very low flows or no surface flow at all in late summer, when fire activity is highest, which will greatly reduce the likelihood that a retardant misapplication would be carried downstream for an extended distance; (3) there is an extremely low probability of a retardant drop occurring in occupied habitat; and (4) there has been some success containing retardant chemicals in an isolated stream segment if retardant does get into a small stream. Further, the Forest Service will use water or less toxic fire retardants in areas occupied by or designated critical habitat for threatened, endangered and proposed species. As well, Incident Commanders and pilots are required to avoid aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 300 feet of waterways (including perennial, ephemeral, and intermittent streams as well as lakes, ponds, identified springs, and reservoirs).



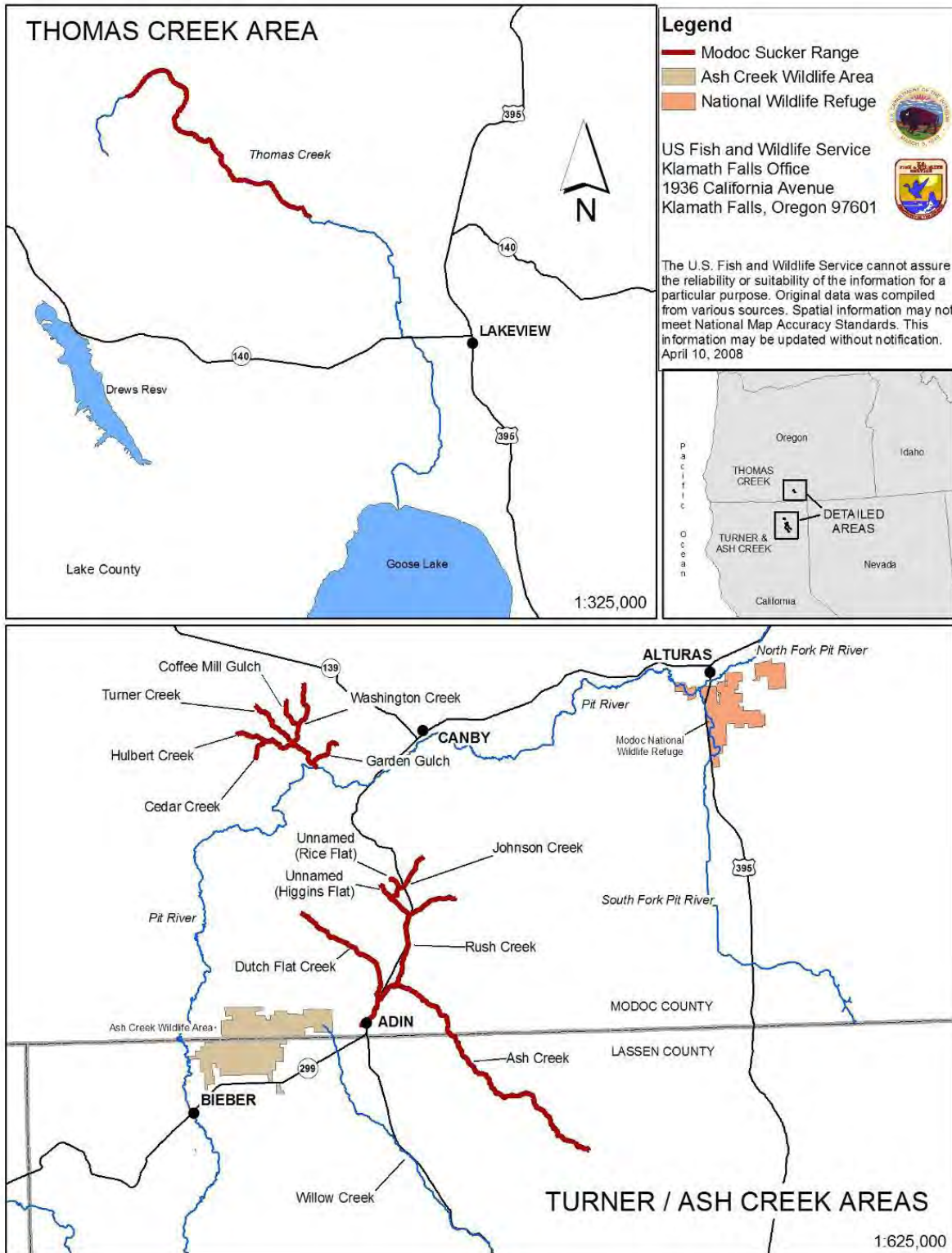




Figure 1. Map showing detailed distribution of the Modoc sucker in the Thomas Creek drainage, Oregon, of the Goose Lake sub-basin and the Turner/Ash Creek drainages, California, in the upper Pit River sub-basin.

**Mountain Meadow Plants (Pedate Checkermallow [*Sidalcea pedata*], Slender-petaled mustard [*Thelypodium stenopetalum*], California Taraxacum [*Taraxacum californicum*], San Bernardino bluegrass [*Poa atropurpurea*])**

Environmental Baseline

*Pedate Checkermallow*

Six of the sixteen extant pedate checkermallow (–checkermallow”) populations are at least partially on the San Bernardino National Forest. The six populations are at northwest Baldwin Lake (two populations), Pan Hot Springs, Lodgepole Meadow, south of Metcalf Bay, and Old Ski Beach. About 9 ac (3.6 ha) of occupied habitat occurs on the San Bernardino National Forest (USFS 2005).

The smallest occurrence is at Old Ski Beach which occurs over 0.1 ac (0.04 ha) (USFWS 2011a). This occurrence is estimated to include between 450 and 1800 individual plants depending on precipitation and habitat conditions.

Checkermallow within the action area is threatened by off-highway vehicle use, alteration of hydrology, recreation, fire suppression activities, and small population size (USFWS 2011a). Nonnative plants are a threat to four of the six populations, including the northwest Baldwin Lake, the Pan Hot Springs, and south of Metcalf Bay populations. In particular, intermediate wheatgrass (*Thinopyrum intermedium*) has been identified as a threat to several populations and burning and mowing of intermediate wheatgrass has not been effective in controlling this species.

In 2002, the San Bernardino National Forest completed the Meadow Habitat Management Guide (USFS 2002). This guide updates the status of checkermallow on the forest and on private lands and describes specific management strategies to promote the recovery of this species.

*Slender-petaled Mustard*

One of the six extant slender-petaled mustard (–mustard”) populations is on the San Bernardino National Forest, at Belleville Meadow. The Belleville Meadow population occurs over 6.9 ac (2.8 ha) (USFWS 1998). Monitoring at Belleville Meadow over 10 years showed that numbers of flowering plants fluctuate considerably relative to soil moisture and precipitation (between 500 and 75,000 individuals) (USFWS 2011b). The average density of mustard was estimated at 5.94 plants per square meter (USFWS 2011b).

Water withdrawals/altered hydrology are a threat to this species due to the dependence of this species on moist meadows. Nonnative plants are also a threat, especially intermediate wheatgrass. Burning and mowing of intermediate wheatgrass has not been effective in controlling this species (USFWS 2011b).

In 2002, the San Bernardino National Forest completed the Meadow Habitat Management Guide (USFS 2002). This guide updates the status of slender-petaled mustard on the forest and on private lands and describes specific management strategies to promote the recovery of this species.

### *California Taraxacum*

Eighteen of the twenty-four remaining populations of California taraxacum (~~taraxacum~~) occur at least partially on the San Bernardino National Forest (USFWS 2008a). Little information exists regarding the abundance and population trends of taraxacum. In 2000, about 925 plants were found across the sixteen populations surveyed. Some populations consist of few individuals. In surveys from 1999-2002, five populations surveyed were never found to have more than 36 plants and another five populations were never found to have more than 10 plants (USFWS 2008a). The Forest Service indicates that this species occurs over 194 ac (78 ha) (USFS 2005).

Taraxacum within the action area is threatened by off-highway vehicle use, alteration of hydrology, recreation, fire suppression activities, and small population size. Nonnative plants are a threat to taraxacum, especially the common dandelion (*Taraxacum officinale*), which potentially hybridizes with taraxacum and is present at all known taraxacum populations (USFWS 2008a). Other nonnative plants near taraxacum include Kentucky bluegrass (*Poa pratensis*), cheatgrass (*Bromus tectorum*), red-stemmed filaree (*Erodium cicutarium*), quackgrass (*Elytrigia repens*), and sweet clover (*Melilotus albus*) (USFWS 2008a).

In 2002, the San Bernardino National Forest completed the Meadow Habitat Management Guide (USFS 2002). This guide updates the status of bluegrass on the forest and on private lands and defines locality-specific management strategies to promote the recovery of this species.

### *San Bernardino Bluegrass*

Seven populations of San Bernardino bluegrass (~~bluegrass~~) occur within the San Bernardino Mountains. Five of these occur on the San Bernardino National Forest including at Belleville, Hitchcock, North Baldwin Lake, Bluff, and Cienaga meadows (USFWS 2008b). The San Bernardino National Forest indicates that San Bernardino bluegrass occurs over 69 ac (28 ha) (USFS 2005). In addition, three populations occur on the Cleveland National Forest at Laguna Meadow, Bear Valley and Mendenhall Valley. The Cleveland National Forest indicates that bluegrass occurs over 59 ac (24 ha) (USFS 2005). Bluegrass populations within the action area are threatened by recreational activities, altered hydrology, small population size (USFWS 2008b) and nonnative plants (73 FR 47706).

The Cleveland National Forest livestock grazing non-jeopardy biological opinion (1-6-01-F-1694) addressed the impacts of livestock grazing on bluegrass (USFWS 2001c). The

occurrences within the Laguna Mountains and Mendenhall Valley are in grazed areas. Grazing is deferred until after seed-set.

In 2002, the San Bernardino National Forest completed the Meadow Habitat Management Guide (USFS 2002). This guide updates the status of bluegrass on the forest and on private lands and defines locality-specific management strategies to promote the recovery of this species.

### Effects of the Action

Fire retardant application in occupied habitat for these species should occur rarely. Only a small portion of the Cleveland or San Bernardino National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, these forests combined averaged 376 ac (152 ha) of fire retardant applications per year over 1,346,355 ac (544,850 ha) of Forest Service land (USFS 2011). Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area occupied by these species is generally low. Also, since the Forest Service proposes to avoid fire retardant application in occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

### Direct Effects

Fire retardant applications could impact mountain meadow plant species via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)].

However, fire retardant application within the range of these species is most likely to occur during the primary fire season in southern California, which is August to October. Since the flowering season for checkermallow is May to August (USFWS 2011a), the flowering season for mustard is May to July (USFWS 2011b), the flowering season for taraxacum is May to August (USFWS 2008a), and the flowering season for bluegrass is April to July (USFWS 2008b), most fire retardant applications in habitat for this species would occur after seed-set.

Also, while the average fire retardant application covers about 1-1.5 ac (0.4-0.6 ha), applications are linear, so only a small portion of a given application would be expected to occur in occupied habitat. Thus, it would be unlikely for a population to be completely covered by fire retardant and the portions of a population affected could re-establish from adjacent individuals, as necessary.

### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact these species. Nonnative plants could decrease water availability via competition and create a thatch from dead grasses that prevents seedling establishment. Also, nonnative plants could shade these species and reduce access to sunlight and photosynthesis (52 FR 36265). Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties, resulting in alterations in plant community composition (Ehrenfeld et al. 2001). Finally, enhanced nonnative plants could help attract additional grazing animals, which may trample or consume these species.

Nonnative plants have been identified as a threat to the majority of checkermallow populations (USFWS 2011a) and could be enhanced by fire retardant. Specifically, intermediate wheatgrass has been identified as a threat to a number of populations and appears to have resulted in the extirpation of one population (USFWS 2011a). Intermediate wheatgrass is also a threat to mustard (USFWS 2011b). Nonnative plants have been identified as a threat to taraxacum and all populations are located proximal to nonnative plants (specifically common dandelion) (USFWS 2008a) that could be enhanced by fire retardant and increase hybridization with taraxacum. Nonnative plants have been identified as a threat to bluegrass (USFWS 2008b) and could be enhanced by fire retardant. Finally, burro grazing could occur on two populations of bluegrass on the San Bernardino National Forest (USFWS 2008b) and could be enhanced by fire retardant application.

While fire retardant could enhance nonnative plants, it could also enhance native plant growth. Fire retardants contain nitrogen and phosphorus that could act as nutrients. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on these federally listed mountain meadow species.

Regardless, if fire retardant is applied to occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

### Effect on Recovery

#### *Pedate Checkermallow*

In 1998, the Service completed the Recovery Plan for the Pedate Checkermallow (*Sidalcea pedata*) and the Slender-Petaled Mustard (*Thelypodium stenopetalum*) (USFWS 1998). This plan indicated that checkermallow could be downlisted based upon achieving the following criteria:

1. Thirteen populations of checkermallow and adjacent suitable habitat are fully protected through land management agreements, land ownership by a resource agency or conservation organization, conservation easement or other permanent means of protection.
2. Populations are stable or increasing with allowances for natural fluctuations.

In order to achieve delisting, the following additional criteria must be met:

1. Any necessary protection, restoration and enhancement recommended as a result of prescribed research or management contingency plans are successfully completed.
2. Current and potential threats to populations of checkermallow at all sites with high or moderate protection priorities have been eliminated.
3. Natural populations of checkermallow at all protected sites show positive trends for establishment and recruitment for a minimum of five consecutive generations (at least fifteen consecutive years).
4. Populations of checkermallow are representative of the current genetic and geographical range of each species and occur in habitats that collectively represent the full range of parameters observed during prescribed research and monitoring efforts.

Regardless, based on the discussion above, fire retardant application in checkermallow occupied habitat should occur rarely, especially during the flowering season. If fire retardant application does occur in checkermallow occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to checkermallow populations or habitat conditions are not likely to occur and meeting the delisting criteria should not be impeded. Thus, the ability of this species to recover should not be affected.

#### *Slender-petaled Mustard*

In 1998, the Service completed the Recovery Plan for the Pedate Checkermallow (*Sidalcea pedata*) and the Slender-Petaled Mustard (*Thelypodium stenopetalum*) (USFWS 1998). This plan indicated that mustard could be downlisted based upon achieving the following criteria:

1. Six populations of mustard and adjacent suitable habitat are fully protected through land management agreements, land ownership by a resource agency or conservation organization, conservation easement or other permanent means of protection.
2. Populations are stable or increasing with allowances for natural fluctuations.

In order to achieve delisting, the following additional criteria must be met:

1. Any necessary protection, restoration and enhancement recommended as a result of prescribed research or management contingency plans are successfully completed.

2. Current and potential threats to populations of mustard at all sites with high or moderate protection priorities have been eliminated.
3. Natural populations of mustard at all protected sites show positive trends for establishment and recruitment for a minimum of five consecutive generations (ten consecutive years).
4. Populations of mustard are representative of the current genetic and geographical range of each species and occur in habitats that collectively represent the full range of parameters observed during prescribed research and monitoring efforts.

Regardless, based on the discussion above, fire retardant application in mustard occupied habitat should occur rarely, especially during the flowering season. If fire retardant application does occur in mustard occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to mustard populations or habitat conditions are not likely to occur and meeting the delisting criteria should not be impeded. Thus, the ability of this species to recover should not be affected.

#### *California Taraxacum and San Bernardino Bluegrass*

No recovery plan exists for taraxacum, but a 5-year review was completed on March 31, 2008, which provided management recommendations for the next five years for this species (USFWS 2008a). Likewise, no recovery plan exists for bluegrass, but a 5-year review was completed on September 30, 2008, which provided management recommendations for the next five years for this species (USFWS 2008b). Based on the discussion above, fire retardant application in occupied habitat for these species should occur rarely, especially during the flowering season. If fire retardant application does occur in occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to populations or habitat conditions are not likely to occur and implementation of the recommendations for these species in the 5-year review should not be impeded. Thus, the ability of these species to recover should not be affected.

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the



proposed action is not likely to jeopardize the continued existence of checkermallow, mustard, taraxacum or bluegrass. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Direct impacts should be effectively avoided or minimized due to the application of fire retardant in occupied habitat primarily outside the flowering season and the size and linear nature of fire retardant applications.
3. Due to the proposal to conduct monitoring after a fire retardant application in occupied habitat and remove nonnative plants, as appropriate, impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary.
4. Meeting the recovery criteria in the recovery plan for checkermallow and mustard and implementing the recommendations from the 5-year reviews for taraxacum and bluegrass should not be impeded due to the expected short term and temporary nature of the potential impacts.

We concur that these designated or proposed critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the Forest Service will map and avoid application of fire retardant to these areas, to the extent feasible; and 3) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated or proposed critical habitats. Finally, the potential impact to the primary constituent elements of these critical habitats would occur from nonnative plants. However, the Forest Service will monitor areas of fire retardant application within critical habitats and remove nonnative plants, as appropriate. Thus, any potential enhancement of nonnative plants would be short term and temporary.

## **Munz's Onion (*Alium munzii*)**

### Environmental Baseline

There is one population of Munz's onion ("onion") near Elsinore Peak on the Trabuco Ranger District, Cleveland National Forest. The Forest Service estimates that 26 ac (10 ha) of occupied habitat occurs here (USFS 2005). A low probability exists of detecting additional populations on the national forests, as extensive surveys of the Trabuco Ranger District were conducted in 1991 (Boyd and Mistretta 1991).

### Effects of the Action



Fire retardant application in onion occupied habitat should occur rarely. Only a small portion of the Cleveland National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, the Cleveland National Forest averaged 61 ac (25 ha) of fire retardant applications per year over 439,035 ac (177,671 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area of onion occupied habitat is generally low. Also, since the Forest Service proposes to avoid fire retardant application in onion occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in onion occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in onion occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

#### Direct Effects

Fire retardant applications could impact onion via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)].

However, fire retardant application within the range of onion is most likely to occur during the primary fire season in southern California, which is August to October. Since the flowering season for onion is generally March to May (USFWS 2009f), most fire retardant applications in habitat for this species would occur after seed-set.

Also, while the average fire retardant application covers about 1-1.5 ac (0.4-0.6 ha), applications are linear, so only a small portion of a given application would be expected to occur in onion occupied habitat. Thus, a fire retardant application is not likely to completely cover a population of this species and the portions of a population impacted could re-establish from adjacent individuals, if necessary.

#### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact onion. Nonnative plants could decrease water availability for onion via competition and create a thatch from dead grasses that prevents onion seedling establishment. Also, nonnative plants could shade onion and reduce access to sunlight and photosynthesis. Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties, resulting in alterations in plant community composition (Ehrenfeld et al. 2001).

While fire retardant could enhance nonnative plants, it could also enhance growth. Fire retardants contain nitrogen and phosphorus that could act as nutrients to onion. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to

native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on onion.

Regardless, if fire retardant is applied to onion occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts to onion due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

#### Effect on Recovery

No recovery plan exists for the onion, but a 5-year review was completed on June 17, 2009, which provided management recommendations for the next five years for this species (USFWS 2009f). Regardless, based on the discussion above, fire retardant application in onion occupied habitat should occur rarely, especially during the flowering season. If fire retardant application does occur in onion occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to onion populations or habitat conditions are not likely to occur. Thus, the ability of this species to recover should not be affected.

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of onion. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in onion occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Direct impacts should be effectively avoided or minimized due to the application of fire retardant in onion occupied habitat primarily outside the flowering season and the size and linear nature of fire retardant applications.
3. Due to the proposal to conduct monitoring after a fire retardant application in onion occupied habitat and remove nonnative plants, as appropriate, impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary.

4. Due to the expected short term and temporary nature of the potential impacts and size of potential impacts, we do not expect that the proposed action will impact the ability of this species to recover.

We concur that these designated or proposed critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the Forest Service will map and avoid application of fire retardant to these areas, to the extent feasible; and 3) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated or proposed critical habitats. Finally, the potential impact to the primary constituent elements of these critical habitats would occur from nonnative plants. However, the Forest Service will monitor areas of fire retardant application within critical habitats and remove nonnative plants, as appropriate. Thus, any potential enhancement of nonnative plants would be short term and temporary.

## **Nevin's Barberry (*Berberis nevinsii*)**

### Environmental Baseline

Nevin's barberry (~~barberry~~) occurs on the Angeles National Forest on approximately 141 ac (57 ha) in San Francisquito and Lopez canyons (USFWS 2009g). In 2002, a fire burned the entire barberry population in San Francisquito Canyon (USFWS 2005). The occurrence in San Francisquito Canyon consists of 91 plants based on recent surveys after the fires (USFWS 2005), and the occurrence in Lopez Canyon consists of a single plant. The San Francisquito occurrence appears to have been planted in 1929 and is now considered nonnative (73 FR 8412, USFWS 2009g). The plant in Lopez Canyon has not shown reproduction recently and is not considered essential to the conservation of the species (73 FR 8412).

Barberry occurs on the Cleveland National Forest over approximately 7 ac (2.8 ha) near the Agua Tibia Wilderness Area (USFWS 2005). The barberry population on the Cleveland National Forest consists of seven plants (USFWS 2009g).

### Effects of the Action

Fire retardant application in barberry occupied habitat should occur rarely. Only a small portion of the Angeles and Cleveland national forests will be subject to fire retardant applications annually. Based on data from 2000-2010, the Angeles and Cleveland national forests averaged 307 ac (124 ha) of fire retardant applications per year over 1,107,762 ac (448,295 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area of occupied habitat for barberry is generally low. Also, since the Forest Service proposes to avoid fire retardant application in barberry occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in barberry occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would

fire retardant be applied in barberry occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

### Direct Effects

Fire retardant applications could impact barberry via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)].

However, fire retardant application within the range of barberry is most likely to occur during the primary fire season in southern California, which is August to October. Since the flowering season for barberry is generally March to April (USFWS 2009g), most fire retardant applications in habitat for this species would occur after seed-set.

Also, while the average fire retardant application covers about 1-1.5 ac (0.4-0.6 ha), applications are linear, so only a small portion of a given application would be expected to occur in barberry occupied habitat. Thus, a fire retardant application is not likely to completely cover the barberry occurrences in San Francisquito Canyon or the Agua Tibia Wilderness. The Lopez Canyon plant could be completely covered by fire retardant, but while it may be damaged by fire retardant, as a shrub species, it is less likely to be extirpated by fire retardant application. Regardless, the Lopez Canyon plant has not shown evidence of reproduction recently and is not considered essential to the conservation of the species (73 FR 8412).

### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact barberry. Nonnative plants could decrease water availability for barberry via competition and create a thatch from dead grasses that prevents barberry seedling establishment. Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties, resulting in alterations in plant community composition (Ehrenfeld et al. 2001).

While fire retardant could enhance nonnative plants, it could also enhance growth. Fire retardants contain nitrogen and phosphorus that could act as nutrients to barberry. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on barberry.

Regardless, if fire retardant is applied to barberry occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts to barberry due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

### Effect on Recovery

No recovery plan exists for barberry, but a 5-year review was completed on August 14, 2009, which provided management recommendations for the next five years for this species (USFWS 2009g). Regardless, based on the discussion above, fire retardant application in barberry occupied habitat should occur rarely, especially during the flowering season. If fire retardant application does occur in barberry occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to barberry populations or habitat conditions are not likely to occur. Thus, the ability of this species to recover should not be affected.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of barberry. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in barberry occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Direct impacts should be effectively avoided or minimized due to the application of fire retardant in barberry occupied habitat primarily outside the flowering season, the size and linear nature of fire retardant applications, and the shrub nature of this species.
3. Due to the proposal to conduct monitoring after a fire retardant application in barberry occupied habitat and remove nonnative plants, as appropriate, impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary.
4. Due to the expected short term and temporary nature of the potential impacts, we do not expect that the proposed action will impact the implementation of the recommendations from the 5-year review or the ability of this species to recover.

We concur that these designated or proposed critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the Forest Service will map and avoid application of fire retardant to these areas, to the extent feasible; and

3) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated or proposed critical habitats. Finally, the potential impact to the primary constituent elements of these critical habitats would occur from nonnative plants. However, the Forest Service will monitor areas of fire retardant application within critical habitats and remove nonnative plants, as appropriate. Thus, any potential enhancement of nonnative plants would be short term and temporary.

### **Owens tui chub (*Siphateles bicolor snyderi*)**

#### Environmental Baseline

##### ***Inyo National Forest***

Two locations of Owens tui chub are present in the Inyo National Forest: Owens Gorge and Little Hot Creek. Another population in Sotcher Lake was likely introduced from the Hot Creek Fish Hatchery during trout planting, and is not considered necessary for the species' recovery (according to the Recovery Plan for the Owen's tui chub).

Hot Creek Headwaters (AB and CD Springs): Both springs are the headwaters for Hot Creek, a tributary of the Owens River. The habitat for the AB Spring subpopulation has four spring discharge locations along its 123-meter (m) (400-foot (ft)) long, flowing channel (McEwan 1991). The habitat for the CD Spring population has five spring discharge locations and is about 178 m (600 ft) long (McEwan 1990, 1991). Both springs are similar in width, 6.3 m (20.5 ft), and depth, 0.15 to 0.77 m (0.5 to 2.5 ft) (McEwan 1990, 1991). Both springs have a profuse growth of emergent and submergent vegetation (McEwan 1990). Rainbow trout (*Oncorhynchus mykiss*), a competitor with the Owens tui chub for food and a predator of its eggs and fry, are present. We do know that the population at the headwaters of Hot Creek (AB and CD Springs) does move downstream from the springs and was found in the waterways of the hatchery. We have no information that sampling efforts have been conducted for the Owens tui chub farther downstream in Hot Creek.

Little Hot Creek Pond: This population occupies a man-made pond constructed by the U.S. Forest Service in 1986 to enhance waterfowl habitat. The stream channel was impounded about 0.4 kilometer (km) (0.25 mi) downstream from the thermal headsprings of Little Hot Creek (Moskowitz 1989). The pond is shallow; covered with muskgrass (*Chara* sp.), an invasive alga which provides cover for the chubs; and cattail (*Typha* sp.) is abundant. Mosquitofish (*Gambusia affinis*) are also present. Mosquitofish prey on the eggs and fry of Owens tui chubs and compete for aquatic insects. We have no information on population size or monitoring efforts at Little Hot Creek Pond.



Owens River Gorge: This portion of the Owens River, which supports the Upper Owens River Gorge population, is located below Crowley Lake and Long Valley Dam. The water source for the upper gorge is seepage through the Long Valley Dam. Owens tui chubs are located downstream of the dam and upstream of a weir (a low dam built across a stream to raise water level or divert water), which is 1,610 m (5,232 ft) below the dam. The dam and weir function as barriers to movement of non-native fish species from Crowley Lake above the dam and the Owens River below the weir.

The aquatic habitat in the Upper Owens River Gorge consists of narrow, heavily silted channels (Bogan et al. 2002). Lacustrine habitat for the chub is confined to a long pond created by a beaver dam. The banks of the pond and channel are heavily vegetated with willow (*Salix* sp.), cattail, grasses, stinging nettle (*Urtica* sp.), and wild rose (*Rosa californica*). Pondweed (*Potamogeton* sp.) is abundant along the banks (Bogan et al. 2002). Non-native fish present in the Owens Gorge include brown trout (*Salmo trutta*), which prey on Owens tui chubs, and Lahontan tui chub, which hybridize with Owens tui chubs (Malengo 1998).

#### *Critical Habitat*

Lands adjacent to the streams and springs are included for the protection of the riparian habitat that is important to the maintenance of aquatic ecosystems. The areas designated as critical habitat include the entire range of the subspecies as known at the time of listing. Known 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.

The designated critical habitat includes:

- 1) Owens River and 50 feet on each side of the river from Long Valley Dam downstream for a distance of 8 stream miles.

This occupied critical habitat unit in the Owens Gorge is within LADWP land but is bordered on both sides of the Gorge by lands managed by Inyo National Forest. The primary constituent elements vary in quality seasonally and depend upon the amount of seepage through the Long Valley Dam and evaporation.

- 2) A portion of Hot Creek and outflows, and those areas of land within 50 feet of all sides of the springs, their outflows, and the portion of Hot Creek. This area .about 0.25 miles of stream and springs, and about 5 acres of fronting land.



This occupied critical habitat unit at Hot Creek is located on LADWP land but Inyo National Forest land is within 0.15 to 0.3 mile to the south, east, and north. The primary constituent elements are present and of excellent quality. Access to the critical habitat is ~~managed~~ by the California Department of Fish and Game’s Hot Creek Hatchery.

Effects of the Action

The Forest Service proposes to avoid fire retardant application in Owens tui chub occupied habitat by providing maps and guidance to aerial fire-fighting personnel so that the potential for an application to occur in occupied habitat is minimized. However, there is the possibility of accidental application of retardant (misapplication) or application by exception to protect human life. While there is no way to predict when an exception to protect human life would occur, in the case of misapplication, 3 years of data from 2008 to 2010 indicate that misapplications do not occur often (i.e., less than 0.1 percent of all fire retardant applications) (USFS 2011). The Forest Service has indicated that retardant applications to protect property is a lower priority than listed species management, so as long as the threat to people has been ameliorated, the Forest Service would avoid application within the 600-foot buffer (P. Krueger pers. comm. 2011d). In the event of a fire within or that may encroach on the 600-foot buffer, an evacuation will be attempted to remove people from the structures within the buffer to further reduce the likelihood that fire retardant will need to be applied to protect human life (P. Krueger pers. comm. 2011d).

The Inyo National Forest has had 568 fires and 108 retardant drops in the same 11-year period. As opposed to only 3 years of misapplication of retardant data, the historical fire data provided in the biological assessment covers 11 years. However, the timeframe for this consultation is 10 years; assuming that national forests will continue to drop retardant at the same rate in the future, we extrapolated those numbers over the next 10 years. Table 53 shows this difference in magnitude of retardant drops for each Forest. The biological assessment also assumes that 0.42 percent of all retardant drops will result in misapplication to a waterway. Based on this assumption, we expect that over the life of the consultation, 0.42 percent (0.0042) of all drops on each Forest will result in delivery to a waterway with potential adverse effects to Owens tui chub if the stream is occupied, as shown in Table 53 below.

**Table 52. Number of Applications of Retardant Expected to Enter Waterways**

Forest	Total number of fires in 2000-2010 (11 years)	Total number of retardant drops in 2000-2010	Expected total number of retardant drops over 10 years	Number of drops expected to enter water ways (multiplied by 0.42 percent (0.0042) and rounded up)

Inyo	568	108	98	0.4
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To capture the extent of exposure risk for Owens tui chub, we calculated the number of miles of perennial streams within the Forest and how many miles of Owens tui chub occupied habitat in those perennial streams are within the Forest, as shown in Table 54. Finally, Table 55 presents the total percentage of occupied Owens tui chub habitat that may be adversely affected by retardant in the next 10 years. Our calculations show the potential for loss or degradation of occupied habitat for Little Hot Creek and Owens Gorge populations from misapplications of retardant to be less than 1 percent in a 10 year period.

**Table 53. Miles of Owens Tui Chub Occupied Habitat on the Inyo National Forest**

Forest	Miles of perennial streams on Forest	Miles of Owens tui chub occupied streams
Inyo	1,611	9

**Table 54. Percentage of Occupied Owens Tui Chub (OTC) Habitat That May Be Adversely Affected**

Forest name	Miles of perennial stream on Forest	Miles of OTC occupied streams on Forest	% of total perennial streams which are occupied	Number of drops expected to hit stream	Total stream miles affected by retardant (6.2 miles per drop to water <sup>1</sup> )	% OTC occupied streams affected by retardant
Inyo	1,611	9	0.3%	0.4	0.003 x 6.2 = 0.02 miles	0.4 x 0.02 = 0.008 miles (0.08%)

<sup>1</sup>The BA states that lethal effects extend 6.2 miles and sublethal effects may occur much further downstream. For our purpose here, we will use the 6.2 miles as the furthest extent of downstream effects.

Because the possibility exists of an application by exception to protect human life, the most direct adverse effect of the action would be if retardant was dropped directly into a waterbody containing Owens tui chub. The biological assessment also states that lethal effects of retardant could extend at least 6.2 miles downstream and sublethal effects may occur much farther downstream (USFS 2011). Owens tui chub may be directly affected if retardant is applied within or upstream of occupied habitat from exposure to the toxic chemicals in retardant or by

eutrophication processes that would degrade occupied habitat resulting from the fertilizer effects of retardant. Most fire retardants are chemicals composed mostly of ammonia and phosphate. Of all the water quality parameters that affect fish, ammonia is the most important after oxygen (Francis-Floyd et al. 2009). Ammonia causes stress and damages gills and other tissues, even in small amounts. Fish exposed to low levels of ammonia over time are more susceptible to bacterial infections and have poor growth. Ammonia kills fish when present in higher concentrations (Francis-Floyd et al. 2009). Eutrophication is the excessive growth of aquatic vegetation resulting from the input of nutrients, particularly phosphate and nitrate (Ricklefs 1990). Oxygen depletion occurs as a result of eutrophication and can also cause fish kills. This is because oxygen reduction is usually associated with abundant growth of rooted vegetation, heavy algal blooms, or high concentration of organic matter (e.g., fertilizers, sewage, livestock feces). The oxygen required during the decay of plants and breakdown of organic matter by bacterial flora, coupled with consumption by fish and other biota, may exceed the oxygen available in the water and Owens tui chub would suffocate from lack of sufficient oxygen in the water.

If a fire retardant drop does occur over Little Hot Creek, the Owens tui chub population there could be extirpated. This is especially true because the water in Little Hot Creek is alkaline (pH of approximately 9, per Steve Parmenter, CDFG biologist, pers. comm. Jan. 24, 2008), as is much of the water in the upper Owens Basin. Owens tui chub would be more likely to experience injury or death from exposure to retardant because the greater the alkalinity of the water, the greater the likelihood of toxic forms of ammonia being present in the water (Hargreaves and Tucker 2004). While the species is found in several other areas, most other populations are affected by hybridization with other species of tui chub; only five pure populations are known, including the Little Hot Creek population. This population is unique in that it is the largest, most robust, and genetically-diverse population of Owens' tui chub in existence, and it is not currently threatened by hybridization because it is the most isolated population from other tui chub populations. Lastly, the Little Hot Creek Owens tui chub population inhabits an area approximately 250 feet by 300 feet in size and it is highly susceptible to water problems both within its pond and from upstream. We would expect that a retardant drop on or upstream of the Little Hot Creek population of Owens tui chub would result in extirpation of this population, and thus would reduce appreciably the likelihood of the species' survival and recovery in the wild. The Little Hot Creek population is identified in the Recovery Plan as the population with the highest priority for protection to achieve downlisting and delisting.

The significance of the Owens Gorge population of Owens tui chub lies in the fact that it is one of two "relictual" populations of Owens tui chub in existence (i.e., a remnant of the original distribution). This population has not been subjected to hybridization and is one of the populations identified as needing protection to achieve downlisting and delisting of the Owens tui chub (per the Recovery Plan). The potential for impacts to this population are the same as those discussed above for the Little Hot Creek population (e.g. alkaline water, higher levels of toxic ammonia, potential extirpation). Loss of this population due to a fire retardant drop would similarly reduce appreciably the likelihood of the species' survival and recovery in the wild.

We also expect that any retardant dropped either directly or indirectly into Little Hot Creek would adversely affect the constituent elements of Owens tui chub critical habitat (i.e. high quality, cool water with adequate cover in the form of rocks, undercut banks, or aquatic vegetation, and a sufficient insect food base) to such an extent that this essential habitat would be appreciably diminished in its role of supporting both the survival and recovery of Owens tui chub.

To reduce the risk of retardant misapplication exposing Owens tui chub to the toxic chemicals in fire retardant, and the risk of those chemicals degrading occupied habitat by eutrophication, the Forest Service will establish a 600-ft fire retardant exclusion zone on occupied habitat for the Little Hot Creek and Owens Gorge populations of Owens tui chub on the Inyo National Forest (Krueger, pers. comm. 2011c).

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the Owens tui chub, environmental baseline for the action area, effects of potential misapplication of retardant on occupied Owens tui chub habitat, and cumulative effects, it is our biological opinion that the use of aerially-applied fire retardant on National Forest System lands is not likely to jeopardize the continued existence of the Owens tui chub or adversely modify critical habitat. We base our conclusion on a written statement from the Forest Service that a 600-ft fire retardant exclusion zone will be established on occupied habitat of the Little Hot Creek and Owens Gorge populations and because less than 1 percent of Owens tui chub occupied habitat may be affected by a misapplication of retardant on the Inyo National Forest in the next 10 years.

## **Paiute cutthroat trout (*Oncorhynchus clarkii seleniris*)**

### Environmental Baseline

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem, within the action area. The environmental baseline is a snapshot of a species' health at a specified point in time. It does not include the effects of the action under review in this consultation.

Paiute cutthroat trout occupy habitat in five widely separated watersheds. Factors that historically influenced the decline in the species include: 1) Hybridization, predation, and competition with introduced non-native species; 2) small isolated populations; and 3) degradation of habitat due to logging and grazing management. The effects of many of these actions continue today.

#### *Status of PCT within the Action Area*

The historical distribution of PCT was limited to 14.7 kilometers (km) (9.1 miles (mi)) of habitat in Silver King Creek 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 (Service 2004).

Paiute cutthroat trout occupy approximately 33.2 km (20.6 mi) of habitat in five widely distributed drainages outside of their historical range, all of which occur on National Forest System lands. They were first established in the upper reaches of the Silver King Creek drainage, located on the Humboldt-Toiyabe National Forest, in 1912 when local livestock operators transplanted fish above Llewellyn Falls (Service 2004). The progeny of these early day transplants were then introduced into several other lakes and streams in California. Four self-sustaining populations are now established outside the historical drainage in the North Fork of Cottonwood Creek and Cabin Creek, Inyo National Forest, Mono County, California; Sharktooth Creek, Sierra National Forest, Fresno County, California; and Stairway Creek, Sierra National Forest, Madera County, California. Currently, no PCT occur within its historical range.

Paiute cutthroat trout occupy approximately 9.1 km (5.6 mi) in the upper reaches of Silver King Creek and its tributaries (Four Mile Canyon Creek and Fly Valley Creek) above Llewellyn Falls. Two other occupied tributaries are located below Llewellyn Falls, Corral Valley (3.6 km, 2.2 mi) and Coyote Valley (4.9 km, 3.0 mi) Creeks. This area is considered to be the best currently occupied habitat and largest, most genetically diverse population (Cordes *et al.* 2004, Service 2004). The trout present in the historical range are a genetic mixture of rainbow trout (*O. mykiss*), golden trout (*O. m. aguabonita*), and cutthroat trout (*O. clarkii*) (Finger *et al.* 2008). Effective fish barriers prevent other trout from invading PCT waters; however, even with effective barriers, there is an ever-present risk that nonnative trout will be illegally introduced above the barriers by humans (Rahel 2004).

Paiute cutthroat trout were first established in North Fork Cottonwood Creek in 1946 and currently occupy approximately 5.5 km (3.4 mi). The Cabin Creek population was established in 1968 and 2.4 stream km (1.5 mi) are occupied. The Sharktooth Creek population was established in 1968 with 3.2 stream km (2 mi) occupied and the Stairway Creek population was established in 1972 with approximately 3.5 stream km (2 mi) occupied (Service 2008). The long-term survival of these out-of-basin populations is uncertain due to their small size, limited genetic diversity (Cordes *et al.* 2004, Moyle *et al.* 2008), and no hydrologic connections to other PCT populations. The Recovery Plan (Service 2004) provides that these out-of-basin populations will serve an important role in the recovery of PCT, mainly to protect against a catastrophic event within the Silver King Creek drainage, but also for restocking purposes within the subspecies' historical range once other threats have been addressed.

It is difficult to fully characterize the abundance of the PCT. Like most animal populations, numbers of PCT fluctuate annually due to biotic and abiotic factors. Further, population estimation methods vary by location and occur at differing frequencies, which means only general comparisons among the populations can be made. Overall, the population estimates that have been made suggest that PCT are stable in all populations. Please see the Service's 5-year review for further details on population estimates (Service 2008).

### ***Factors Affecting Species***

#### ***Population Isolation***

Isolated populations are vulnerable to extinction through demographic stochasticity (random fluctuations in birth and death rates); environmental stochasticity (random variation in environmental attributes) and catastrophes; loss of genetic heterozygosity (genetic diversity) and rare alleles (inherited forms of a genetic trait); and human disturbance (Hedrick and Kalinowski 2000, Lande 2002, Reed and Frankham 2003, Noss *et al.* 2006, Pringle 2006). Completely isolated populations are the most severe form of fragmentation because gene flow among populations does not occur, thereby inflicting inbreeding depression dynamics on the population and reducing fitness (Hedrick and Kalinowski 2000, Reed and Frankham 2003, Frankham 2005, Scribner *et al.* 2006, Pritchard *et al.* 2007, Guy *et al.* 2008). Past fisheries management included deliberately placing PCT into isolated streams to protect them from competing and hybridizing species. While the current populations have maintained their purity, evidence of loss of genetic diversity has been found in PCT populations (Cordes *et al.* 2004). As such, the long-term persistence of these isolated populations is in doubt (Moyle *et al.* 2008).

#### ***Habitat Availability/Population Size***

Several studies found that population viability of cutthroat trout is correlated with stream length or habitat size (Hilderbrand and Kershner 2000, Harig and Fausch 2002, Young *et al.* 2005). Stream length is important because trout move throughout stream networks searching for a variety of habitats necessary to complete their life cycle (*i.e.*, spawning, rearing, migration corridors, refugium) (Fausch and Young 1995, Young 1996, Schmetterling 2001, Hilderbrand and Kershner 2004, Schrank and Rahel 2004, Colyer *et al.* 2005, Neville *et al.* 2006, Umek 2007). Longer stream reaches have more complexity and have a higher probability that no particular habitat type limits the population (Horan *et al.* 2000, Harig and Fausch 2002, Dunham *et al.* 2003, Huusko *et al.* 2007).

To ensure long-term persistence, Hilderbrand and Kershner (2000) estimated that a population should consist of at least 2,500 cutthroat trout, and that to maintain a population of that size (accounting for emigration and mortality), for streams with smaller population densities (100 fish/km, 160 fish/mi), required a stream length of 25 km (15.5 mi). In a similar study, Young *et al.* (2005) found that to maintain a population of 2,500 cutthroat trout, 8.8 km (5.5 mi) of stream was needed.



As mentioned previously, all PCT populations are isolated and confined to narrow and short lengths of stream. This factor eliminates gene flow between populations, and reduces the ability of PCT populations to recover from catastrophic events thus threatening their long-term persistence and viability. All populations, except for upper Silver King Creek and associated tributaries, do not provide adequate habitat size for long-term persistence as described in the literature.

### *Climate Change*

Research has shown that the annual mean temperature in North America has increased from 1955 to 2005; however, the magnitude varies spatially across the continent, is most pronounced during spring and winter months, and has affected daily minimum temperatures more than daily maximum temperatures (Field *et al.* 2007). Other effects of climate change include, but are not limited to, changes in types and amounts of precipitation (Knowles *et al.* 2006, Seager *et al.* 2007), reduced snowpack (Pierce *et al.* 2008), earlier spring run-off (Stewart *et al.* 2005), longer and more intense fire seasons (Brown *et al.* 2004, Westerling *et al.* 2006, Bachelet *et al.* 2007), and more frequent extreme weather events (Diffenbaugh *et al.* 2005, Rosenzweig *et al.* 2007, Kunkel *et al.* 2009). Climate change is predicted to have several effects on cold water habitat including: (1) increased water temperature; (2) decreased stream flow; (3) change in the hydrograph; (4) increased frequency and severity of extreme events such as drought and floods; and (5) changing biotic interactions between native and nonnative species (Stewart *et al.* 2005, Ficke *et al.* 2007, Bates *et al.* 2008, Webb *et al.* 2008, Kaushal *et al.* 2010, Wenger *et al.* 2011). These changes in climate and subsequent effects can be attributed to the combined effects of greenhouse gases, sulphate aerosols, and natural external forcing (Karoly *et al.* 2003, Barnett *et al.* 2008, Serreze 2010).

Warming trends seen over the past 50 years are predicted to continue (Field *et al.* 2007). The Intergovernmental Panel on Climate Change states that of all ecosystems, freshwater ecosystems will have the highest proportion of species threatened with extinction due to climate change (Kundzewicz *et al.* 2007). Species with narrow temperature tolerances and cold-water species (*e.g.*, salmonids) will likely experience the greatest effects from climate change, and it is anticipated that populations located at the margins of the species' hydrologic and geographic distributions will be affected first (Meisner 1990, Dunham *et al.* 2003b, Bates *et al.* 2008, Rieman and Isaak 2010). Several studies have modeled the effects of increased water temperatures on North American salmonids (Meisner 1990, Keleher and Rahel 1996, Jager *et al.* 1999, Rahel 2002, Mohseni *et al.* 2003, Flebbe *et al.* 2006, Preston 2006, Rieman *et al.* 2007, Kennedy *et al.* 2009). The extent of habitat predicted to become unsuitable for salmonids ranges from 17 to 97 percent, depending on various factors such as the magnitude of the temperature increase and the region of North America in which the species exists (Rahel 2002, Flebbe *et al.* 2006, Preston 2006, Rieman *et al.* 2007).



In response to increasing temperatures, PCT will likely shift their distribution to higher elevations to find adequate cooler stream temperatures if possible (Keleher and Rahel 1996, Poff *et al.* 2002). This will likely shrink the currently occupied habitat and coupled with increases in stochastic events, will increase the probability of extinction (Dunham *et al.* 1997, Fagan 2002, Opdam and Wascher 2004, Frankham 2005, Wilcox *et al.* 2006). Restoring physical connections among aquatic habitats may be the most effective and efficient step in restoring or maintaining the productivity and resilience of many aquatic populations (Bisson *et al.* 2003, Dunham *et al.* 2003a, Rieman *et al.* 2003, Dunham *et al.* 2007). The focus should be to protect aquatic communities in areas where they remain robust and restore habitat structure and life history complexity of native species where aquatic ecosystems have been degraded (Gresswell 1999).

Stream temperatures in occupied habitat are not likely to increase above the thermal tolerance levels of PCT due to the high elevation in which PCT occur. However, predicted increases in extreme events (*i.e.*, flooding, fire, and drought), type and amount of precipitation, and changing hydrology, as described above, could negatively impact the PCT populations. Coupled with the small amount of habitat available, the small population size, and its isolation from other occupied streams, PCT populations may be susceptible to the effects of climate change.

#### Effects of the Action

Endangered and threatened species are among the many things the Forest Service must consider when making decisions under their fire suppression program. Consequently, while the buffers may help prevent exposure in some cases, they cannot prevent PCT from being exposed in all instances. As the number of fires increases along the eastern front of the Sierra Nevada Mountain Range, we expect that the number of times PCT are likely to be exposed to fire retardants will likely increase in the future. We believe it is also reasonable to expect that the exposure risk is likely to increase commensurate with the Forest Service's increasing use of fire retardants.

Fire has been one of the dominant factors shaping ecosystems for millennia (Skinner and Chang 1996, Van Wagtenonk and Fites-Kaufman 2006). Median fire return intervals in eastside Sierra Nevada forests where PCT reside are believed to be 8-16 years with a range of 5-47 years (Skinner and Chang 1996, Van Wagtenonk and Fites-Kaufman 2006, North *et al.* 2009, Van de Water and North 2010). In this fire regime type the following effects occur: (1) fire controls plant species composition by favoring species that require sunlight (*e.g.*, Jeffrey pine (*Pinus jeffreyi*) over shade-tolerant forms such as white fir (*Abies concolor*)), and by favoring fire-resistant and fire-dependent species over non-fire dependent species; (2) fire consumes understory vegetation without damaging the overstory; (3) crown fires are rare and patchy; and (4) small patches of intense surface burning often result in openings (Chang 1996).

Changes in historical fire regimes are well documented in the western United States (McKelvey *et al.* 1996, Arno 2000, Stephens and Sugihara 2006, Richardson *et al.* 2007, Brooks 2008, Van de Water and North 2011). Around the late 1800's, high-frequency, low-intensity fire regimes associated with dry forest types, as found in the eastern Sierra Nevada, began having longer fire return intervals due to: (1) relocation of Native Americans which disrupted their historical burning practices; (2) loss of fine fuels, which carried low-intensity ground fires, due to extensive overgrazing; (3) disruption of fuel continuity on the landscape due to irrigation, agriculture, and development; and (4) fire exclusion management policies (Arno 2000, Keane *et*

*al.* 2002). Effects from the post-Euroamerican settlement influence on fire regimes include longer fire return intervals which allow fuel loads to increase. In return, relatively small, low-intensity ground fires have become uncharacteristically large, stand-replacing fires (Arno 2000, Miller *et al.* 2009).

Changing climate has affected summer temperatures and the timing of spring snowmelt, which have contributed to increasing the length of the wildfire season, wildfire frequency, and the size of wildfires (McKenzie *et al.* 2004, Westerling *et al.* 2006, Miller *et al.* 2009). Westerling *et al.* (2006) conclude that there are robust statistical associations between wildfire and climate in the western United States and that increased fire activity over recent decades reflects responses to climate change. Miller *et al.* (2009) studied the frequency, severity, and size of fires in the Sierra Nevada Mountains and found that all three parameters are increasing. Although PCT evolved in a fire-prone environment, increases in wildfire frequency, size, and severity due to increased fuel loads and effects from climate change (Westerling *et al.* 2006, Miller *et al.* 2009) have increased the threats due to wildfire.

With increasing wildfire frequency, size, and severity, fire suppression activities will also increase, including the use of aerially delivered fire retardant. Long-term fire retardants are known to be toxic to aquatic species (Norris and Webb 1989; Gaikowski *et al.* 1996a, b; McDonald *et al.* 1996, 1997; Buhl and Hamilton 1998, 2000; Adams and Simmons 1999; Calfee and Little 2003; Wells *et al.* 2004). The toxic component of long-term retardant chemicals in aquatic systems is ammonia (McDonald *et al.* 1996). If ammonia concentrations are high enough, they could inhibit growth of juvenile PCT, cause tissue damage, or cause direct mortality. For example, high concentrations of ammonia can inhibit growth and cause mortality of rainbow trout (Burkhalter and Kaya 1977). Thurston *et al.* (1978) found that high concentrations of ammonia can result in tissue damage to cutthroat trout. Although tests of the effects of ammonia on PCT have not been conducted, it is highly likely results would be similar as for other salmonids. Indirect effects could occur to PCT from the retardant adversely affecting the aquatic and terrestrial macroinvertebrates that comprise their diet.

When fire retardants initially enter a stream, there is an immediate spike in ammonia concentration and toxic concentrations can extend up to 10 km (6.2 mi) downstream from where retardant enters the water (Norris and Webb 1989). The peak of the spike and area affected depends on many factors, such as volume of retardant to hit the water, volume of water to dilute the retardant, and turbulence of the stream. In simulations of only 1,011 L (267 gallons) (a normal load being approximately 5,678 L (1,500 gallons)) of fire retardants entering the surface of a stream, peak ammonia concentrations reached 5,026 mg/l (Buhl and Hamilton 1998). When the volume of retardant entering the stream is doubled, the zone of mortality is extended 10 times farther downstream (Norris *et al.* 1991). This ammonia concentration was caused by fire retardant alone, whereas in a natural situation during a fire, ammonia levels would also be elevated due to smoke adsorption (Gresswell 1999). Studies on the toxicity of fire fighting chemicals can be summarized by: 1) long-term fire retardants are toxic to aquatic species, mainly due to ammonia; 2) long-term fire retardants are less toxic than most foaming and water-enhancing agents; 3) toxicity is likely to persist on the ground and may be released into streams in rainwater runoff; 4) high organic soils rapidly decrease chemical persistence; 5) combustion

appears to remove the toxicity of the chemicals; and 6) fish are capable of avoiding exposure if an avenue of escape is available (Little and Calfee 2002).

Whenever practical, as determined by the fire incident, the Forest Service will use water or less toxic fire retardants in areas occupied by or designated critical habitat for threatened, endangered and proposed species. Incident Commanders and pilots are required to avoid aerial application of retardant on mapped avoidance areas for threatened, endangered, or proposed species or within 91 m (300 ft) of waterways (including perennial, ephemeral, and intermittent streams as well as lakes, ponds, identified springs, and reservoirs). The only exception to this is when human life or safety is threatened and the use of retardant can be reasonably expected to alleviate the threat. Because PCT are extremely rare, the Forest Service has agreed to increase the buffer to 183 m (600 ft). Any aerial application of fire retardant on the occupied habitat would have negative effects. Additionally, because of the isolated nature of the PCT populations, any effects to PCT or their habitat may be especially deleterious because extirpated populations will not be able to recolonize.

## **Effects by Forest**

### ***Humboldt-Toiyabe National Forest***

Occurrence of PCT on the HTNF is in the Silver King watershed and associated tributaries. All age classes of PCT within these streams would be expected to occur on the HTNF. There is approximately 18.6 km (11.6 mi) of occupied habitat, which, when assuming a width of 2 m (6.6 ft) for occupied streams, equals approximately 9.2 acres of occupied habitat. This represents roughly 0.0004 percent of the HTNF.

### ***Sierra National Forest***

Occurrence of PCT on the Sierra National Forest is in Stairway and Sharktooth Creeks. All age classes of PCT within these streams would be expected to occur on the Sierra National Forest. There is approximately 6.7 km (4.0 mi) of occupied habitat, which, when assuming a width of 2 m (6.6 ft) for occupied streams, equals approximately 3.3 acres of occupied habitat. This represents roughly 0.0002 percent of the Sierra National Forest.

### ***Inyo National Forest***

Occurrence of PCT on the Inyo National Forest is in North Fork Cottonwood and Cabin Creeks. All age classes of PCT within these streams would be expected to occur on the Inyo National Forest. There is approximately 7.9 km (4.9 mi) of occupied habitat, which, when assuming a

width of 2 m (6.6 ft) for occupied streams, equals approximately 3.9 acres of occupied habitat. This represents roughly 0.0002 percent of the Inyo National Forest.

To estimate the probability that retardants would enter occupied PCT habitat, we calculated the area that was potentially covered by retardants during the 2000-2010 period by Forest. To do this we assumed retardant drops did not overlap and were dropped randomly. The BA states (page 14) that typical retardant drops are 15-23 m (50-75 ft) wide by 244 m (800 ft) long, which is approximately 1.4 acres. By multiplying 1.4 acres x number of drops during 2000-2010, the total area directly affected by retardant drops can be calculated. Dividing the area affected by the total area of each Forest, the probability of a drop affecting each acre of Forest can be estimated using the following table:

<b>National Forest</b>	<b>Area (million acres)</b>	<b>Retardant Drops 2000-2010</b>	<b>Acres Affected /10 Years</b>	<b>Probability of Retardant Drop in Each Acre</b>
HTNF	2.62	385	539	0.0002
Sierra	1.41	237	331.8	0.0002
Inyo	2.05	108	151.2	0.0001

Next, to estimate the probability of retardants getting into occupied PCT habitat we multiplied the acres of occupied habitat by the probability of retardants affecting each acre of Forest from the table above. This results in a probability of 0.2 percent for the HTNF, 0.07 percent for the Sierra National Forest, and 0.04 percent for the Inyo National Forest that a drop will enter occupied habitat.

**Table 55. Tables used for misapplication Effects Analysis**

<b>Forest</b>	<b>Expected total number of retardant drops 10 years<sup>1</sup></b>	<b>Number of drops expected to enter water ways (.42%- multiply by .0042 and round up)</b>
HTNF	350	2
Sierra	215	1
Inyo	98	0.4

<sup>1</sup>The expected number of retardant drops is based on taking the total number of drops per forest as presented in the BA on pages 238-241 and dividing that number by 11 and multiplying by 10. The data presented in the BA is based on 11 years and the timeframe for this consultation is 10 years, therefore we must account for this difference in magnitude.

For Species: Paiute cutthroat trout

Forest name	Miles of perennial stream on Forest	Miles of occupied streams on Forest <sup>1</sup>	% of total perennial streams which are occupied	Number of drops expected to hit stream	Total stream miles affected by retardant (6.2 miles per drop to water <sup>2</sup> )	% PCT occupied streams affected by retardant	Extent of take
HTNF	4,364	11.6	0.27	2	2*6.2=12.4	(.0027*12.4=0.03 mi)/11.6 =0.3%	0.03 miles
Sierra	2,446	4	0.16	1	1*6.2=6.2	(.0016*6.2=0.01 mi)/4 =0.3%	0.01 miles
Inyo	2,749	4.9	0.18	0.4	0.4*6.2=0.6	(.0018*2.5=0.005 mi)/4.9 =0.1%	0.005 miles

<sup>1</sup>Based on occupied habitat. Data available at the Nevada Fish & Wildlife Office.

<sup>2</sup>The BA states that lethal effects extend 10 km (6.2 mi) and sublethal may occur much further downstream. For purposed here, we will use the 10 km (6.2 mi) as the furthest extent of downstream effects.

### Conclusion

After reviewing the current status of the PCT, the environmental baseline for the action area, and the effects of the proposed action, it is the Service’s biological opinion that the proposed action is not likely to jeopardize the continued existence of PCT. The Service bases this conclusion on the following: 1) The probability of a retardant drop entering an occupied stream is small; and 2) increasing the buffer from 91 to 183 m (300 to 600 ft). No critical habitat has been designated for PCT; therefore, none will be affected.

## **Pebble Plains Species (Southern Mountain Buckwheat [*Eriogonum kennedyi* var. *austromontanum*], Ash-grey Paintbrush [*Castilleja cinerea*], and Bear Valley Sandwort [*Arenaria ursine*])**

### Environmental Baseline

Southern mountain buckwheat is known to occur in nine pebble plain complexes, including Arrastre/Union Flat, Big Bear Lake, Broom Flat, Fawnskin, Gold Mountain, Holcomb Valley, North Baldwin Lake, Sawmill, and South Baldwin Ridge/Erwin Lake (72 FR 73092, USFWS 2005a). There are about 1,388 ac (562 ha) of southern mountain buckwheat occupied habitat remaining, with 1,026 ac (415 ha), or about 74 percent, on San Bernardino National Forest lands (USFWS 2008c).

Ash-grey paintbrush (–paintbrush”) is known to occur in eleven pebble plain complexes and several non-pebble plain habitat areas. The pebble plain complexes supporting paintbrush include Arrastre/Union Flat, Big Bear Lake, Broom Flat, Fawnskin, Gold Mountain, Holcomb Valley, North Baldwin Lake, Sawmill, Snow Valley, South Baldwin Ridge/Erwin Lake and Sugarloaf Ridge (72 FR 73092, USFWS 2005a). Paintbrush occurs in non-pebble plain habitat in pine forests near the Snow Forest Ski Area, along Sugarloaf Ridge, and in the vicinity of Lost Creek (71 FR 67712). There are about 1,622 ac (656.4 ha) of occupied habitat, or about 82 percent of the remaining habitat, on San Bernardino National Forest lands (USFWS 2008d).

Bear Valley sandwort is known to occur in ten pebble plain complexes, including Arrastre/Union Flat, Big Bear Lake, Broom Flat, Fawnskin, Gold Mountain, Holcomb Valley, North Baldwin Lake, Sawmill, South Baldwin Ridge/Erwin Lake, and Sugarloaf Ridge (71 FR 67712, USFWS 2005a). There are about 1,508 ac (610 ha) of occupied habitat, or about 78 percent of the remaining occupied habitat, on San Bernardino National Forest lands (USFWS 2008e).

In 2001, a non-jeopardy biological opinion (1-6-99-F-25) was issued addressing the impact of activities that were occurring in habitat for these species. Roads and utility corridors are the primary land use features that overlap with occurrences. However, dispersed recreation activities also have potential effects (USFWS 2001a).

Since the 2001 biological opinion on pebble plains species (1-6-99-F-25), the Forest Service has updated the Pebble Plain Habitat Management Guide (USFS 2005) and implemented several measures for pebble plains species. Special use events (Mountain Man gathering, motorcycle trials, mountain bike races, filming, etc.) previously located within habitat have been relocated to other sites (USFS 2005). The Forest Service has acquired 4 ac (1.6 ha) of southern mountain buckwheat occupied habitat, 23 ac (9 ha) of paintbrush occupied habitat and 4 ac (1.6 ha) of Bear Valley sandwort occupied habitat at Broom Flat (USFWS 2005a). The Snow Forest Ski Area, which supported a large number of pebble plains plants, has been closed (USFWS 2005a).

Threats to pebble plains species in the action area include nonnative plants and burro grazing at the Broom Flat complex (USFWS 2005a). Non-native plants are specifically identified as a concern in the Fawnskin, Arrastre/Union Flat, Sawmill, North Baldwin Lake, South Baldwin Ridge/Erwin Lake, and Broom Flat complexes (USFWS 2008c).



### Effects of the Action

Fire retardant application in pebble plains species occupied habitat should occur rarely. Only a small portion of the San Bernardino National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, the San Bernardino National Forest averaged 315 ac (127 ha) of fire retardant applications per year over 677,628 ac (274,226 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area of occupied habitat is generally low. Also, since the Forest Service proposes to avoid fire retardant application in occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

### Direct Effects

Fire retardant applications could impact pebble plains species via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m)] (USFS 2011).

However, fire retardant application within the range of these species is most likely to occur during the primary fire season in southern California, which is August to October. Since the flowering season for paintbrush is usually June-July (60 FR 39337), most fire retardant applications would likely occur outside the flowering season of this species. Fire retardant application would be more likely to occur within the flowering season for southern mountain buckwheat or Bear Valley sandwort, since the flowering season for southern mountain buckwheat is July to September and the flowering season for Bear Valley sandwort is May to August (63 FR 49006).

However, while the average fire retardant application covers about 1-1.5 ac (0.4-0.6 ha), applications are linear, so only a small portion of a given application would be expected to occur occupied habitat. Given the amount of occupied habitat for each species, it would be unlikely for a population to be completely covered by fire retardant or for a significant portion of habitat to be covered. Thus, the portions of a population subject to the direct impacts of a fire retardant application are likely to recover by re-establishment from directly adjacent individuals, as necessary.

### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact these species. Nonnative plants could decrease water availability for these species via competition and create a thatch from dead grasses that prevents seedling establishment. Also, nonnative plants could shade these species and reduce access to sunlight and photosynthesis (52 FR 36265). Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant



growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties resulting in alterations in plant community composition (Ehrenfeld et al. 2001). Finally, enhanced nonnative plants could help attract additional grazing animals, which may trample or consume these species. Burro grazing is a threat at the Broom Flat pebble plain complex and this impact could be enhanced by fire retardant application (USFWS 2008c).

While fire retardant could enhance nonnative plants, it could also enhance native plant growth. Fire retardants contain nitrogen and phosphorus that could act as nutrients. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on pebble plains species.

Regardless, if fire retardant is applied to occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

#### Effect on Recovery

No recovery plan exists for these species, but 5-year reviews were completed in 2008 which provided management recommendations for the next five years (USFWS 2008c, USFWS 2008d, USFWS 2008e). Based on the discussion above, fire retardant application in occupied habitat should occur rarely, especially during the flowering season. If fire retardant application does occur in occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications compared to the extent of occupied habitat and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to populations or habitat conditions are not likely to occur and implementation of the recommendations for this species in the 5-year review should not be impeded. Thus, the ability of these species to recover should not be affected.

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of southern mountain buckwheat, paintbrush, or Bear Valley sandwort. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Direct impacts should be effectively avoided or minimized due to the size and linear nature of fire retardant applications compared to the extent of occupied habitat.
3. Due to the proposal to conduct monitoring after a fire retardant application in occupied habitat and remove nonnative plants, as appropriate, impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary.
4. No recovery plan exists for these species. However, implementation of the management recommendations from the 5-year review should not be impeded. Due to the expected short term and temporary nature of the potential impacts, we do not expect that the proposed action will impact the ability of these species to recover.

We concur that these designated or proposed critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the Forest Service will map and avoid application of fire retardant to these areas, to the extent feasible; and 3) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated or proposed critical habitats. Finally, the potential impact to the primary constituent elements of these critical habitats would occur from nonnative plants. However, the Forest Service will monitor areas of fire retardant application within critical habitats and remove nonnative plants, as appropriate. Thus, any potential enhancement of nonnative plants would be short term and temporary.

## **Quino Checkerspot Butterfly (*Euphydryas editha quino*)**

### Environmental Baseline

The Quino checkerspot butterfly (“Quino”) occurs on the Cleveland National Forest along the northeastern side of the Palomar Ranger District and along the southern portion of the Descanso Ranger District. Based on the use of a one km (0.6 mi) buffer to estimate occupied habitat for a Quino observation (USFWS 2003), there are about 3,869 ac (1,566 ha) of Quino occupied habitat on the Cleveland National Forest.

In November 10, 2010, the Service issued a non-jeopardy biological opinion regarding the Sunrise Powerlink transmission line project (USFWS 2010). This project was expected to result in the loss of 32.7 ac (13.3 ha) of Quino occupied habitat during construction (15.2 ac (6.2 ha) of permanent loss and 17.5 ac (7.1 ha) of temporary loss), impacts to 4.7 ac (1.9 ha) of Quino occupied habitat annually during operations and maintenance activities and impacts to 52 ac (21 ha) due to fire prevention and management activities. Some portion of these impacts would be

likely to occur within the Cleveland National Forest along the southern portion of the Descanso Ranger District. These impacts would occur across a linear area, which should limit the impact to a given Quino population.

Quino have been located on the San Bernardino National Forest at a number of locations and are widely distributed across the San Jacinto Ranger District. They have been located along Garner Valley in many locations, on Rouse Ridge at the western end, north of Lake Hemet and in Bautista Canyon. It appears that Quino are likely to occur widely across the southwest and south central San Jacinto Ranger District, where suitable habitat occurs. Based on the use of a one km (0.6 mi) buffer to estimate occupied habitat for a Quino observation (USFWS 2003), there are about 9,117 ac (3,689 ha) of occupied habitat on the San Bernardino National Forest.

Several biological opinions have been issued to the San Bernardino National Forest regarding Quino, although only one involved the permanent loss of occupied habitat:

- In 2007, the Service issued a non-jeopardy biological opinion regarding the potential effects of the Thomas Mountain Fuels Reduction Project (USFWS 2007b). This project includes mechanical vegetation removal and prescribed burns across 10,365 ac (4,195 ha) on the San Jacinto Ranger District. Only portions of this area would be treated (about 50-70 percent), focused on areas of dense vegetation that don't contain suitable habitat for Quino. In areas of suitable habitat, host plants would be surveyed for and excluded from treatments. The flagging and avoidance of host plants should effectively minimize potential impacts. In addition, post-project monitoring will occur to identify the response of Quino host plants to treatments, in support of the actions recommended in the Recovery Plan for the Quino Checkerspot Butterfly (USFWS 2003).
- In 2010, the Service issued a non-jeopardy biological opinion regarding the Ramona Road paving project. This project involved the permanent loss of 0.15 ac (0.6 ha) of Quino occupied habitat and had the potential to increase vehicle speeds along Ramona Road, where high numbers of Quino have been located. About 6,700 ft (2,402 m) of this road occurs within the action area (USFWS 2010b).
- In 2011, the Service issued a non-jeopardy biological opinion on the Bonita Vista Fuel Break Project (USFWS 2011b). This project involves the removal of vegetation along a 185-ac (75-ha) fuel break. Host plant occurrences will be flagged and avoided during the Quino flight season. Only one host plant location has been found on this fuel break. This area is outside the recovery units for this species as identified in the Recovery Plan for the Quino Checkerspot Butterfly (USFWS 2003).
- In 2011, the Service issued a non-jeopardy biological opinion for the Garner Valley Fuels Reduction Project on the San Jacinto Ranger District (USFWS 2011c). This project involves prescribed burning over 1,056 ac (427 ha), including 182 ac (74 ha) of suitable habitat for Quino. Only portions of this area would be treated (between 30-70 percent), focused on areas of dense vegetation that don't contain suitable habitat for Quino. In addition, post-project monitoring will occur to identify the response of Quino host plants to treatments, in support of the actions recommended in the Recovery Plan for the Quino Checkerspot Butterfly (USFWS 2003).

- In 2011, the Service issued a non-jeopardy biological opinion regarding the 24-Hours of Adrenaline and Idyllwild Spring Challenge Mountain Bike Races on the San Jacinto Ranger District (USFWS 2011d). These races occur over 21.5 mi (34.6 km) of trails north of Lake Hemet and at the northern edge of the range of Quino. Potential impacts included the crushing of larvae on and around the trails. However, these races occur over a short duration (1-2 days) and are restricted to existing disturbed areas.

There are three recovery units for Quino which partially occur on Forest Service lands. The Northwest Riverside Unit includes about 3 ac (1.2 ha), the South Riverside Unit includes 27,126 ac (10,977 ha) and the South Riverside/Northern San Diego Unit includes 82,579 ac (33,418 ha) on Forest Service lands. According to the Recovery Plan for the Quino Checkerspot Butterfly, as much as possible of these areas should be conserved to recover the species (USFWS 2003).

### Effects of the Action

Due to the relatively large area on Forest Service lands where Quino occur, fire retardant applications could occur in occupied habitat more often than for other federally listed species. Regardless, only a small portion of the San Bernardino or Cleveland national forests will be subject to fire retardant applications annually. Based on data from 2000-2010, the San Bernardino National Forest averaged 315 ac (127 ha) of fire retardant applications per year over 677,628 ac (274,226 ha) of land and the Cleveland National Forest averaged 61 ac (25 ha) of fire retardant applications per year over 439,035 ac (177,671 ha) of land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), a low amount of fire retardant applications are expected to occur in Quino occupied habitat. Also, since the Forest Service proposes to avoid fire retardant application in Quino occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in these areas is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in Quino occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

### Direct Effects

Data on the potential toxicity of fire retardants to Quino are lacking. However, fire retardants do not appear to be acutely toxic to invertebrates that feed on vegetation with fire retardant applications. Also, fire retardant does not appear to render plants inedible. In one set of laboratory tests, Phos Chek G75 was found to be non-toxic to earthworms at the highest concentration tested (>1000 mg/kg soil), which is comparable to the concentration that might occur in the top inch of soil following a single application at 1 gallon/100 square ft (Beyer and Olson 1996). However, fire retardant applications could harm or kill adults, larvae, pupae, and eggs of Quino by covering and immobilizing or suffocating individuals.

In addition, fire retardant applications could impact Quino host and nectar plants via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)].

In order to estimate the extent of fire retardant application that would occur within Quino occupied habitat over the life of the project (10 years), we can use the data provided by the Forest Service regarding the acres of fire retardant applications per year by each forest. By multiplying the acres of fire retardant applications per year by 10 years, we can determine the total acreage of fire retardant that would be expected to be applied on a given forest over the life of the project. This can then be divided by the total acreage of a given forest to find the percentage of land on this forest that is expected to have a fire retardant application. Assuming that Quino occupied habitat will have the same percentage of land impacted as the rest of the forest, we can determine the acreage of Quino occupied habitat affected by multiplying the amount of Quino occupied habitat by the percentage of forest land that is expected to have fire retardant applications. This will likely overestimate the potential impact to Quino occupied habitat since the Forest Service proposes to avoid fire retardant applications in these areas, to the extent feasible.

Thus, based on the number of acres per year affected by fire retardant on the San Bernardino National Forest, about 3,150 ac (1,275 ha) on this forest will have fire retardant applications over the 10-year timeframe of the project. Further, 0.5 percent of the San Bernardino National Forest [3,150 ac (1,275 ha) divided by 677,628 ac (274,226 ha) of San Bernardino National Forest land] will have fire retardant applications. Considering that an estimated 9,117 ac (3,689 ha) of Quino occupied habitat occurs on the San Bernardino National Forest, about 46 ac (19 ha) of occupied habitat [0.5 percent multiplied by 9,117 ac (3,689 ha)] on this forest will have fire retardant applications.

Likewise, based on the number of acres per year affected by fire retardant on the Cleveland National Forest, about 610 ac (247 ha) on this forest will have fire retardant applications over the 10-year timeframe of the project. Thus, 0.1 percent of the Cleveland National Forest [610 ac (247 ha) divided by 439,035 ac (177,671 ha) of Cleveland National Forest land] will have fire retardant applications. Considering that an estimated 3,869 ac (1,566 ha) of Quino occupied habitat occurs on the Cleveland National Forest, about 4 ac (1.6 ha) of occupied habitat [0.1 percent multiplied by 3,869 ac (1,566 ha)] on this forest will have fire retardant applications.

Impacts due to fire retardant applications should be minimized due to the scope and diffuse nature of Quino populations on National Forest lands. Quino appear to occur across a broad area on the San Bernardino National Forest; thus, fire retardant applications are not likely to result in the loss of any occurrences either due to direct applications to individuals or host plants. Likewise, the expected impacts to 4 ac (1.6 ha) over 10 years on the Cleveland National Forest should be effectively minimized by the amount of occupied habitat on this forest, which should prevent any localized extirpations. Further, fire retardant applications are not expected to result in the permanent loss of occupied habitat. Finally, the primary fire season in southern California occurs from August to October, outside the flight season for this species. Thus, most fire retardant applications in Quino occupied habitat will only occur on diapausing individuals and after host plants have set seed.

#### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact Quino. Conversion of Quino habitat to nonnative grasslands is the greatest threat to Quino reserves (USFWS 2003).

Nonnative plants could degrade habitat quality for Quino by competing with and replacing host and nectar plants (USFWS 2003). Nonnative plants could decrease water availability for host and nectar plants via competition and create a thatch from dead grasses that prevents seedling establishment. Also, nonnative plants could shade host and nectar plants and reduce access to sunlight and photosynthesis. Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties, resulting in alterations in plant community composition (Ehrenfeld et al. 2001). Finally, enhanced nonnative plants could help attract additional grazing animals, which may trample or consume host or nectar plants and Quino individuals.

Impacts to Quino due to enhanced nonnative plants could extend beyond the impacts to host and nectar plants. Fire retardant application may have resulted in lower activity levels for some ant species in Australia due to increased nonnative plant species and litter accumulation (Seymour and Collett 2009) and similar impacts could occur to Quino larvae.

While fire retardant could enhance nonnative plants, it could also enhance the growth of host and nectar plants. Fire retardants contain nitrogen and phosphorus that could act as nutrients. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on Quino host plants.

Regardless, if fire retardant is applied to Quino occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts to Quino due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

#### *Effect on Recovery*

The Recovery Plan for the Quino Checkerspot Butterfly was issued on August 11, 2003 (USFWS 2003). The recovery plan recommends protection and management of the remaining suitable and restorable habitat within recovery units, as much as possible. If fire retardant application occurs in recovery units for Quino, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications, the extent of the annual fire retardant applications per year compared to the size of occupied habitat and recovery units and the proposed removal of nonnative plants, as appropriate. The expected applications over the next 10 years represent a small portion of the Northwest Riverside, South Riverside, and the South Riverside/Northern San Diego recovery units. With monitoring and appropriate nonnative plant removal, long term changes to Quino populations or habitat conditions are not likely to occur and implementation of the recommendations for this species in the recovery plan should not be impeded. Thus, the ability of this species to recover should not be affected.



### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of Quino Checkerspot Butterfly. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in Quino Checkerspot Butterfly occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.
2. Impacts should be effectively avoided or minimized due to the application of fire retardant in Quino Checkerspot Butterfly occupied habitat primarily outside the breeding season, the size and linear nature of fire retardant applications compared to the extent of Quino occupied habitat, and the temporary nature of the impacts to habitat.
3. Due to the expected short term and temporary nature of the potential impacts to habitat and the extent of fire retardant application compared to the extent of occupied habitat and the recovery units, we do not expect that the proposed action will impact the ability of this species to recover or impede implementation of the recovery plan for Quino Checkerspot Butterfly.

We concur that these designated or proposed critical habitats are not likely to be adversely affected by the proposed action for the following reasons: 1) low amounts of fire retardant are dropped annually compared to the extent of Forest Service land (USFS 2011); 2) the Forest Service will map and avoid application of fire retardant to these areas, to the extent feasible; and 3) the typical fire retardant application (about 1-1.5 ac ((0.4-0.6 ha)) would cover a small amount of any of these designated or proposed critical habitats. Finally, the potential impact to the primary constituent elements of these critical habitats would occur from nonnative plants. However, the Forest Service will monitor areas of fire retardant application within critical habitats and remove nonnative plants, as appropriate. Thus, any potential enhancement of nonnative plants would be short term and temporary.

## **Railroad Valley springfish (*Crenichthys nevadae*)**

### Environmental Baseline



Regulations implementing the ESA (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have already undergone section 7 consultations and the impacts of State and private actions which are contemporaneous with the consultation in progress. Such actions include, but are not limited to, diversions and other land management activities including livestock grazing. The environmental baseline is a snapshot of a species' health at a specified point in time. It does not include the effects of the action under review in this consultation.

#### *Status of the Species within the Action Area*

Two Railroad Valley springfish populations are located on the Humboldt-Toiyabe National Forest (HTNF) in Hot Creek Canyon just west of the Old Dugan Ranch, Nye County, Nevada. One population is located in Upper Warm springs and associated outflow which is entirely on Forest Service lands (T8N, R49E, section 21). The other population is located in an unnamed spring just to the east of Upper Warm spring (T8N, R49E, section 23) and the outflow flows south onto private lands (J. Harvey, Forest Service, pers. comm. 2011). Another thermal spring is located in Hot Creek Canyon completely on private property at the Old Dugan Ranch site (T8N, R49E, section 25) which is adjacent to Forest Service lands. Garside and Schilling (1979) reported that Upper Warm Spring had a temperature of 34° Celsius (C) (94° Fahrenheit (F)) and a flow rate of 121 liters per minute (lpm) (32 gallons per minute (gpm)). Temperature and flow for the Old Dugan Spring was measured twice in the 1960's with water temperature between 32 and 36°C (89 and 97° F) and flow rates between 1,632 and 2,250 lpm (359 and 495 gpm) (Garside and Schilling 1979). Temperature and flow at the unnamed spring have not been reported.

#### *Factors Affecting Species within the Action Area*

These self-sustaining populations were established as refugium for the species during the early to mid 1980's. Nonnative Australian red claw crayfish (*Cherax quadricarinatus*) and American bullfrogs (*Lithobates* (formerly *Rana*) *catesbeianus*) occur on the Old Dugan Ranch site but have not been found in the other two springs. These two nonnative species are known predators and vectors for disease which can negatively impact native fauna (Edgerton *et al.* 2002, Casper and Hendricks 2005). The three Hot Creek Canyon sites were visually surveyed in 2007, and Railroad Valley springfish numbered in the hundreds with multiple age classes present (B. Hobbs, pers. comm. 2007). Forest Service personnel visited the two sites on Forest Service land in 2011 and verified Railroad Valley springfish were still present (J. Harvey, pers. comm. 2011).

The increasing demand for water in Southern Nevada poses a new threat to the Railroad Valley springfish. Groundwater withdrawal and exportation has the potential of either modifying or destroying occupied Railroad Valley springfish designated critical habitat by reducing the total output of water from springs in Railroad Valley. Refugia habitat could be impacted as well.

While Southern Nevada Water Authority has not developed a formal plan for pumping groundwater from the Railroad Valley groundwater flow systems, they have already applied to the Nevada State Water Engineer for these water rights and it could affect the survival and potentially the recovery of the Railroad Valley springfish in the next decade.

The Intergovernmental Panel on Climate Change (IPCC) states that of all ecosystems, freshwater ecosystems will have the highest proportion of species threatened with extinction due to climate change (Kundzewicz *et al.* 2007). However, quantifying the potential site-specific effects to the Railroad Valley springfish, and the time scale at which they would occur, is problematic. The species is geographically isolated and dependent on groundwater discharge to maintain its spring system habitats. Despite its importance to surface water and aquatic species, little attention has been given to climate change impacts on groundwater (Bates *et al.* 2008). Difficulties remain in reliably simulating and attributing climate change effects at such small, localized scales. Natural climate variability is relatively larger-scaled, thus making it harder to distinguish changes expected due to external, human-related sources (IPCC 2007). Our concern with this threat is linked to the extent that climate change may affect the water supply of Railroad Valley springfish through lowering groundwater levels and increasing the frequency, intensity, and severity of wildfires in the area (Westerling *et al.* 2006).

### Effects of the Action

Endangered and threatened species are among the many things the Forest Service must consider when making decisions under their fire suppression program. Consequently, while the buffers may help prevent exposure in some cases, they cannot prevent Railroad Valley springfish from being exposed in all instances. As the number of fires increases in the Great Basin, we expect that the number of times Railroad Valley springfish are likely to be exposed to fire retardants will likely increase in the future. We believe it is also reasonable to expect that the exposure risk is likely to increase commensurate with the Forest Service's increasing use of fire retardants.

Fire regimes in the Great Basin differ in the three main vegetation types: sagebrush shrublands, desert shrublands, and pinyon-juniper woodlands. Prior to European settlement, fire regimes in sagebrush shrublands of the Great Basin have been characterized as a combination of mixed-severity and stand-replacing fires with return intervals ranging anywhere from 10 to 70 years (Rice *et al.* 2008). Desert shrubland vegetation types are characterized by infrequent, stand-replacement fires with fire return intervals between 35 years to several centuries (Rice *et al.* 2008). Pinyon-juniper woodlands are characterized as a mixed fire regime; however, fire histories in pinyon-juniper woodlands are difficult to reconstruct (Paysen *et al.* 2000). Return intervals in pinyon-juniper woodlands range from 10 to over 300 years depending on site productivity and plant community structure (Rice *et al.* 2008). Fire regimes in the Great Basin have become more frequent due to wildfire exclusion, historical grazing practices, and the introduction of invasive nonnative plant species (Rice *et al.* 2008). More frequent fires favor the establishment of nonnative plants (*e.g.*, cheatgrass (*Bromus tectorum*)), which results in the loss

of sagebrush and other native plant species (Rice *et al.* 2008).

Changing climate has affected summer temperatures and the timing of spring snowmelt, which have contributed to increasing the length of the wildfire season, wildfire frequency, and the size of wildfires (McKenzie *et al.* 2004, Westerling *et al.* 2006, Miller *et al.* 2009). Westerling *et al.* (2006) conclude that there are robust statistical associations between wildfire and climate in the western United States and that increased fire activity over recent decades reflects responses to climate change. With increasing wildfire frequency, size, and severity, fire suppression activities will also increase, including the use of long-term fire retardant.

Direct and indirect effects of long-term fire retardants are described in the BA. To summarize, long-term fire retardants are known to be toxic to aquatic species (Norris and Webb 1989; Gaikowski *et al.* 1996a, b; McDonald *et al.* 1996, 1997; Buhl and Hamilton 1998, 2000; Adams and Simmons 1999; Calfee and Little 2003; Wells *et al.* 2004). The toxic component of long-term retardant chemicals in aquatic systems is ammonia (McDonald *et al.* 1996). When fire retardants initially enter a stream, there is an immediate spike in ammonia concentration and toxic concentrations have been documented up to 10 km (6.2 mi) downstream from where retardant enters the water (Norris and Webb 1989). The peak of the spike and area affected depends on many factors, such as volume of retardant to hit the water, volume of water to dilute the retardant, and turbulence of the stream. In simulations of only 1,011 L (267 gallons) (a normal load being approximately 5,678 L (1,500 gallons)) of fire retardants entering the surface of a stream, peak ammonia concentrations reached 5,026 mg/l (Buhl and Hamilton 1998). When the volume of retardant entering the stream is doubled, the zone of mortality is extended 10 times farther downstream (Norris *et al.* 1991). This ammonia concentration was caused by fire retardant alone, whereas in a natural situation during a fire, ammonia levels would also be elevated due to smoke adsorption (Gresswell 1999). Studies on the toxicity of fire fighting chemicals can be summarized by: 1) long-term fire retardants are toxic to aquatic species, mainly due to ammonia; 2) long-term fire retardants are less toxic than most foaming and water-enhancing agents; 3) toxicity is likely to persist on the ground and may be released into streams in rainwater runoff; 4) high organic soils rapidly decrease chemical persistence; 5) combustion appears to remove the toxicity of the chemicals; and 6) fish are capable of avoiding exposure if an avenue of escape is available (Little and Calfee 2002).

Occurrence of Railroad Valley springfish on the HTNF is in two separate springs and another spring (Old Dugan Ranch spring) immediately adjacent to Forest Service lands within the Hot Creek Canyon/Old Dugan Ranch area. All age classes of Railroad Valley springfish within these spring systems would be expected to occur on the HTNF. There is approximately 0.4 km (0.25 mi) of occupied habitat, which, when assuming a width of 1 m (3.3 ft) for occupied streams, equals approximately 0.0001 acres of occupied habitat.

To estimate the probability that retardants would enter occupied Railroad Valley springfish habitat, we calculated the area that was potentially covered by retardants during the 2000-2010

period in the HTNF. To do this we assumed retardant drops did not overlap and were dropped randomly. The BA states (page 14) that typical retardant drops are 15-23 m (50-75 ft) wide by 244 m (800 ft) long, which is approximately 1.4 acres. By multiplying 1.4 acres x number of drops during 2000-2010, the total area directly affected by retardant drops can be calculated. Dividing the area affected by the total area of each Forest, the probability of a drop affecting each acre of Forest can be estimated using the following table:

**Table 56. Tables used for misapplication Effects Analysis**

<b>National Forest</b>	<b>Area (million acres)</b>	<b>Retardant Drops 2000-2010</b>	<b>Acres Affected /10 Years</b>	<b>Probability of Retardant Drop in Each Acre</b>
HTNF	2.62	385	539	0.0002

Next, to estimate the probability of retardants getting into occupied Railroad Valley springfish habitat, we multiplied the acres of occupied habitat by the probability of retardants affecting each acre of Forest from the table above. This results in a probability of 0.000002 percent that a drop will enter occupied habitat.

**Table 57. Expected total number of retardant drops 10 years**

<b>Forest</b>	<b>Expected total number of retardant drops 10 years<sup>1</sup></b>	<b>Number of drops expected to enter water ways (.42 percent- multiply by .0042 and round up)</b>
HTNF	350	2

<sup>1</sup>The expected number of retardant drops is based on taking the total number of drops per forest as presented in the BA on pages 238-241 and dividing that number by 11 and multiplying by 10. The data presented in the BA is based on 11 years and the timeframe for this consultation is 10 years, therefore we must account for this difference in magnitude.

Direct and indirect adverse effects to Railroad Valley springfish from the proposed action may occur in the form of harm and harassment, including mortality. There may be a high likelihood that retardant could enter the unnamed spring or Old Dugan Ranch spring because of the proximity of existing structures near the springs and the need for structure protection during a wildfire event. High mortality would be likely in all three spring systems because of the small size of the springs and no escape routes available for the springfish. All three springs are isolated from each other; therefore, recolonization could not occur without human intervention. Hot Creek Canyon/Old Dugan Ranch is one of only two refugia populations known to be currently self-sustaining. The Recovery Plan states that existing refugia populations such as Hot

Creek Canyon/Old Dugan Ranch should be maintained, but they are not required for recovery of the species (Service 1997).

#### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

#### Conclusion

After reviewing the current status of Railroad Valley springfish, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of Railroad Valley springfish. The Hot Creek Canyon/Old Dugan Ranch populations have been introduced outside the species' historic range, and the loss of this population would not jeopardize the continued existence of this species. There is no designated critical habitat for this species within the action area, therefore none will be affected.

### **San Bernardino Mountains Bladderpod (*Physaria kingie* ssp. *Bernardina*)**

#### Environmental Baseline

San Bernardino Mountains bladderpod ("bladderpod") occupies about 210 ac (85 ha) within the San Bernardino National Forest in two areas. One population is on the north side of Bear Valley towards the east end of Bertha Ridge. The other population is on the north-facing slope of Sugarlump Ridge to the south of the valley (USFWS 2009e). The San Bernardino National Forest has mapped 87 site-specific populations.

On January 26, 1995, the Service issued a biological opinion for the Bear Mountain Ski Resort Expansion Project. This project involved the loss of 0.55 ac (0.22 ha) of previously disturbed bladderpod habitat (USFWS 1995). On February 5, 2001, the Service issued a non-jeopardy biological opinion on the effects of ongoing activities, such as recreation and road use and maintenance, on five listed carbonate plant species (Cushenbury milk-vetch, Parish's daisy, Cushenbury buckwheat, oxytheca, and San Bernardino Mountains bladderpod) on the San Bernardino National Forest (1-6-99-F-26) (USFWS 2001b).

In 2003, a fuelbreak was created in bladderpod occupied habitat in emergency response to the Old Fire. The fuelbreak was created manually and brush piles were placed on bladderpod individuals. These piles were removed one month later, but the creation of the fuelbreak left an area more attractive to recreational activities (USFS 2005). Evidence of bicycle and motorcycle tracks was found in the area of the fuelbreak after clearing of vegetation (USFS 2005).

#### Effects of the Action

Fire retardant application in bladderpod occupied habitat should occur rarely. Only a small portion of the San Bernardino National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, the San Bernardino National Forest averaged 315 ac (127 ha) of fire retardant applications per year over 677,628 ac (274,226 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area of occupied habitat for bladderpod is generally low. Also, since the Forest Service proposes to avoid fire retardant application in bladderpod occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in bladderpod occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in bladderpod occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

#### Direct Effects

Fire retardant applications could impact bladderpod via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant application [*i.e.*, the average fire retardant application covers about 800 ft (244 m) by 50-75 ft (15-23 m) (USFS 2011)].

However, fire retardant application within the range of bladderpod is most likely to occur during the primary fire season in southern California, which is August to October. Since the flowering season for bladderpod is May to June (67 FR 78570), most fire retardant applications in habitat for this species would occur after seed-set.

Also, while the average fire retardant application covers about 1-1.5 ac (0.4-0.6 ha), applications are linear, so only a small portion of a given application would be expected to occur in bladderpod occupied habitat. Thus, a fire retardant application is not likely to completely cover a population of this species and the portions of a population impacted could re-establish from adjacent individuals, if necessary.

#### Indirect Effects

Nonnative plants could be enhanced by fire retardant application and impact bladderpod. Nonnative plants could decrease water availability for bladderpod via competition and create a thatch from dead grasses that prevents bladderpod seedling establishment. Also, nonnative plants could shade bladderpod and reduce access to sunlight and photosynthesis. Further, nonnative plants could alter the fire regime including the frequency, intensity, extent and seasonality of fire, resulting in a feedback cycle for further enhancement of nonnative plant growth (Brooks et al. 2004) and ultimately result in type conversion. In addition, nonnative plants can change soil properties, resulting in alterations in plant community composition (Ehrenfeld et al. 2001). Finally, enhanced nonnative plants could help attract additional grazing animals, which may trample or consume bladderpod.



While fire retardant could enhance nonnative plants, it could also enhance growth. Fire retardants contain nitrogen and phosphorus that could act as nutrients to bladderpod. Individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. Studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on bladderpod.

Regardless, if fire retardant is applied to bladderpod occupied habitat, the Forest Service will monitor the site and implement actions to remove nonnative plants upon detecting the enhancement of nonnative plants due to fire retardant application. Based on the implementation of these measures, impacts to bladderpod due to nonnative plants enhanced from a fire retardant application should be short-term and temporary.

### Effect on Recovery

In September 1997, the Service completed the draft San Bernardino Mountains Carbonate Endemic Plants Recovery Plan (USFWS 1997b). This plan indicated that bladderpod should be considered for downlisting upon the development of a reserve system which includes 5,000 ac (2,000 ha) of protected land in an initial preserve and an additional 4,600 ac (1,860 ha), including some specific areas. Regardless, based on the discussion above, fire retardant application in bladderpod occupied habitat should occur rarely, especially during the flowering season. If fire retardant application does occur in bladderpod occupied habitat during the flowering season, impacts are expected to be effectively avoided or minimized due to the size and linear nature of fire retardant applications and the proposed removal of nonnative plants, as appropriate. With monitoring and appropriate nonnative plant removal, long term changes to bladderpod populations or habitat conditions are not likely to occur and implementation of the draft recovery plan for this species should not be impeded. Thus, the ability of this species to recover should not be affected.

### Cumulative Effects

We are not aware of any cumulative effects that would affect this species.

### Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of bladderpod. We reached this conclusion for the following reasons:

1. The potential for an application of fire retardant in bladderpod occupied habitat is low due to the amount of fire retardant applied annually compared to the extent of Forest Service land. Also, applications in occupied habitat will only occur due to misapplications or to save human life, and misapplications occur rarely.



2. Direct impacts should be effectively avoided or minimized due to the application of fire retardant in bladderpod occupied habitat primarily outside the flowering season and the size and linear nature of fire retardant applications.
3. Due to the proposal to conduct monitoring after a fire retardant application in bladderpod occupied habitat and remove nonnative plants, as appropriate, impacts due to nonnative plants enhanced from a fire retardant application should be short term and temporary.
4. Due to the expected short term and temporary nature of the potential impacts and size of potential impacts compared to the proposed reserves in the recovery plan for this species, we do not expect that the proposed action will impact the ability of this species to recover.

## **San Diego Thornmint (*Acanthomintha ilicifolia*)**

### Environmental Baseline

San Diego thornmint (–thornmint”) populations are located on the Cleveland National Forest on Viejas and Poser Mountains over about 212 ac (85 ha). Two populations occur on Viejas Mountain and two occur on Poser Mountain. The population size has been estimated at over 10,000 (USFWS 2009h). The populations occur near the urban interface and are adjacent to the Viejas Indian Reservation (USFS 2005).

### Effects of the Action

Fire retardant application in thornmint occupied habitat should occur rarely. Only a small portion of the Cleveland National Forest will be subject to fire retardant applications annually. Based on data from 2000-2010, the Cleveland National Forest averaged 61 ac (25 ha) of fire retardant applications per year over 439,035 ac (177,671 ha) of Forest Service land. Given the relatively low percentage of Forest Service land with fire retardant applications per year (<0.1 percent), the chance of an application occurring in the relatively small area of occupied habitat for thornmint is generally low. Also, since the Forest Service proposes to avoid fire retardant application in thornmint occupied habitat by providing maps and guidance to aerial fire-fighting personnel, the potential for an application to occur in thornmint occupied habitat is further minimized. Only in cases of a misapplication or to protect human life would fire retardant be applied in thornmint occupied habitat and misapplications occur rarely. Data from 2008-2010 indicate that misapplications occur on less than one percent of fire retardant applications (USFS 2011).

### Direct Effects

Fire retardant applications could impact thornmint via short-term (1-2 growing seasons) phytotoxic effects, including leaf burning, shoot die-back, a decrease in germination, and plant death. These impacts could occur over about 1-1.5 ac (0.4-0.6 ha) for the average fire retardant