United States Department of the Interior

FISH AND WILDLIFE SERVICE

5275 Leesburg Pike
MS-ES
Falls Church, Virginia 22041

February 13, 2023

In Reply Refer To:
FWS/AES/DER/BNC/078349

Jaelith Hall-Rivera
Deputy Chief for State and Private Forestry
U.S. Forest Service
1400 Independence Ave, SW
Washington, DC 20250-1111

Subject: 2023 Revised Final Biological Opinion for the U.S. Forest Service Programmatic Nationwide Aerial Application of Fire Retardant on National Forest System Land

Dear Ms. Hall-Rivera:

This letter transmits the U.S. Fish and Wildlife Service's (Service's) revised final Biological Opinion (Opinion) on the U.S. Forest Service's (USFS) proposed implementation of the Programmatic Nationwide Aerial Application of Fire Retardant on National Forest System Land and its effects on listed species and designated critical habitat in accordance with section 7 of the Endangered Species Act, as amended (16 U.S.C. 1531 *et seq*). We received your request for formal consultation via email on November 17, 2021. Additional coordination is described in the attached Opinion. A complete record of this consultation is on file at the U.S. Fish and Wildlife Service Headquarters office in Falls Church, VA.

This revised final Opinion is based on the information provided in the November, 2021 "Biological Assessment for the Nationwide Aerial Application of Fire Retardant on National Forest System Lands" provided with your request to initiate formal consultation, additional information provided by USFS, and other sources of information as described herein. Our programmatic Opinion addresses the aerial application of fire retardant on National Forest System Lands, related activities associated with preparing and loading aircraft with retardant at airtanker bases (including jettisoning activities that take place on airtanker bases), and the jettisoning of retardant in designated areas outside of airtanker bases.

We previously issued a biological opinion for this action on December 5, 2022. After further discussions with the USFS, we agreed to work with the USFS to clarify and revise the Incidental Take Statement, Terms and Conditions, and Conference Report/Conference Notice sections of the Opinion (attached).

We look forward to continued coordination with USFS and appreciate your commitment to the conservation of endangered species. If you have any questions or concerns about this Opinion, or the consultation process in general, please feel free to contact Sara Pollack (703-358-2371, sara_pollack@fws.gov) or Jeff Hill (703-358-2490, jeffrey_hill@fws.gov) of my staff.

Sincerely,

CRAIG AUBREY

Digitally signed by CRAIG AUBREY
Date: 2023.02.13 08:32:04 -05'00'

Craig Aubrey
Chief, Division of Environmental Review
Ecological Services Program

Enclosure

cc:
David Haston (USFS)
Laura Conway (USFS)

Final Biological and Conference Opinion on the Nationwide Aerial Application of Fire Retardant on National Forest System Land

Photo from cover of the Biological Assessment (USDA Forest Service 2021).

Prepared by:
U.S. Fish and Wildlife Service
Ecological Services Program, Headquarters

February 10, 2023 Final

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INTRODUCTION

This document represents the U. S. Fish and Wildlife Service's (Service's) Biological Opinion (Opinion) based on our review of the U.S. Forest Service's (USFS's) proposed Nationwide Aerial Application of Fire Retardant on National Forest System Land (the Action) and its effects on endangered and threatened species and designated critical habitat in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). On November 15, 2021, the USFS submitted a section 7 consultation initiation package, which requested formal consultation.

This Opinion is based on information provided in the final Biological Assessment for the Nationwide Aerial Application of Fire Retardant on National Forest System Land (BA); (USDA - USFS, 2021) and Addendum for Assessment of Effects Associated with Aerial Retardant Operations at Airtanker Bases (addendum; (USDA - USFS, 2022); many interagency meetings, workshops and conference calls; and other sources of information as described herein. A complete record of this consultation is on file at the Service's headquarters in Falls Church, VA.

Due to the complexity and duration of the Action, the USFS and the Service (collectively, the Agencies) agreed to evaluate the Action's effects to proposed species, proposed critical habitats, and candidate species via conferencing.

On July 5, 2022, the U.S. District Court of the Northern District Court of California vacated the 2019 regulations implementing section 7 of the Endangered Species Act (ESA). On September 21, 2022, the Ninth Circuit Court of Appeals granted a request to stay the U.S. District Court of Northern California's July 5, 2022, order that vacated the 2019 ESA regulations. On November 14, 2022, the U.S. District Court of Northern California issued an order remanding the 2019 regulations to the Services without vacating them. As a result, the 2019 regulations are in effect, and the Service has relied upon the 2019 regulations in rendering this Opinion. However, because of the potential for appeal, we considered whether our substantive analyses and conclusions in this consultation would have been different if the pre-2019 regulations were applied. Our analysis included the prior definition of "effects of the action," among other prior terms and provisions. We considered all the "direct and indirect effects" and the "interrelated and interdependent activities" when determining the "effects of the action." As a result, we determined the substantive analysis and conclusions would have been the same, irrespective of which regulations applied.

CONSULTATION BACKGROUND

The ESA section 7(a)(2) consultation process regarding the aerial application of fire retardant on National Forest System Land has a long history, as discussed in the BA and below.

In August 2011, the USFS submitted a BA to the Service for the Nationwide Aerial Application of Fire Retardant on National Forest System Lands. The BA analyzed the programmatic continued use of aerially applied fire retardant on National Forest System Lands throughout the U.S. and covered a ten year period (January 1, 2012 to January 1, 2022). The Service issued an Opinion in December 2011.

Since the 2011 Opinion, the USFS periodically re-initiated consultation as needed to address: changes in avoidance area maps; additions of species, species range changes, or newly designated critical habitat; and instances where the Incidental Take Statement was met or exceeded. A full description of reinitiated consultations is found in Appendix A of the *Nationwide Aerial Application of Fire Retardant on National Forest System Lands Supplemental Information Report* (USDA - USFS, 2020b). A summary of those consultations. which were sometimes referred to as "supplemental consultations" by the USFS, is described below in the Consultation History.

In preparation for reinitiating consultation for program activities conducted after January 1, 2022, the USFS prepared a supplemental information report (USDA - USFS, 2020b) to the *Nationwide Aerial Application of Fire Retardant on National Forest System Land, Final Environmental Impact Statement* (USDA - USFS, 2011) to document new information and conditions in addition to the 2021 BA.

CONSULTATION HISTORY

The following timeline describes early coordination and consultation between the Agencies and identifies key points in the consultation process. As the 2011 consultation and subsequent reinitiations inform the current reinitiation of consultation, we also briefly describe these earlier activities below.

2011 Consultation

- **June 2011** - The USFS initiated discussion about this consultation with the Service's Ecological Services Program headquarters in June 2011. The USFS engaged in ongoing communication among various Service offices regarding current species lists, analysis methods, and timeframes.

- **August 19, 2011** - The USFS provided the 2011 BA on Nationwide Aerial Application of Fire Retardant on National Forest System Lands to the Service. After an initial review, Service headquarters provided a draft Opinion to Service and USFS Field Offices on October 21, 2011.

- **December 6, 2011** – The Service provided the final BO to USFS.

2012 through 2019 Reinitiations

The USFS reinitiated consultation several times to address changes to the Action or the addition of newly listed species or designated critical habitat. In some cases, the USFS referred to the reinitiations as "supplemental consultations," in an effort to ensure other parties understood any changes or additions were still considered part of the aerial fire retardant program implementation.

- **2012** - USFS reinitiated consultation to allow removal of dry intermittent streams from avoidance areas in USFS Regions 3, 5, and 6. (Reinitiation was completed at the local Service Field Office level.)

- **2015** - USFS reinitiated consultation for the addition of Taylor's checkerspot butterfly and critical habitat, northern spotted owl revised critical habitat, and woodland caribou critical habitat (Reinitiation was completed at the local Service Field Office level).

- **2016** - The Service received a letter and Supplemental BA (to augment the 2011 BA) on March 17, 2016, from the USFS reinitiating consultation on six species based on changes to critical habitat or listing status: Canada lynx, gray wolf, fisher, northern long-eared bat, Gunnison sage grouse, and western yellow-billed cuckoo.

- **2018** - USFS reinitiated consultation (supplemental consultation) for wolverine, Canada lynx, gray wolf, California condor, northern long-eared bat, and Gunnison sage grouse. A formal reinitiation was also conducted for the Sierra Nevada yellow-legged frog, mountain yellow-legged frog, Yosemite toad, and their critical habitats, and for the western yellow-billed cuckoo.

- **2019** - USFS reinitiated consultation (supplemental consultation) for bull trout and critical habitat. (Reinitiation was completed at the local Service field office level).

2020 -2022 - Operational Field Evaluation reinitiation.

o In August 2020 , USFS reinitiated consultation to include an Operational Field Evaluation (OFE) for a new product (FR-100) to facilitate testing in advance of reinitiation of the national programmatic consultation.

o On July 1, 2021, USFS notified the Service that a new similar product (FR-200) would also be incorporated as a new operational field evaluation. USFS provided information on the proposed addition, noting that, based on location and effects to species and combined volume of the two products (FR-100 and FR-200), estimates of effects would remain the same as considered in their 2020 BA on the OFE. On July 16, the Service responded, confirming that the proposed changes to the OFE were not expected to trigger reinitiation.

o On March 22, 2022, the USFS notified the Service that the FR-200 OFE would be moving to a different nearby tanker base location, but confirmed that no new reinitiation triggers were met.

o On August 18, 2022, the USFS notified the Service that a third product would be added to the list of products being tested for the OFE. Three species originally considered (least tern, gray wolf, and Deseret milkvetch) are now delisted; therefore, these species were not evaluated for the additional operational field evaluation product. The proposed rule to list North American wolverine has been reinstated and wolverine is considered for this addition.

2021 Reinitiation - Current Consultation

Since the 2011 consultation covered a period of ten years of program implementation, through 2021, the agencies agreed to meet for a compliance review after 5 years, and begin planning for the 2021-2022 consultation, which covers a longer timeframe.

- **January 25, 2017** - The headquarters Service staff met with USFS for the stipulated 5-Year Compliance Review to discuss lessons learned and the path forward for aerial fire retardant use. Discussions included reporting, updates on data compiled from the previous year on misapplications, (since 2021 termed “intrusions”) and toxicity research being conducted on fire retardant products in aquatic environments. In addition, the agencies discussed reinitiation of the 2011 Biological Opinion and the supporting information included in the Supplemental 2016 BA (newly listed species and changes to listed species with large ranges).

- **July 16, 2020** - The Service met with the USFS to discuss the preparations the USFS was making for reinitiation of consultation. Discussions included minor revisions to the National and Wildlife screens in the BA, which inform the USFS’s determinations, the potential for revising the avoidance mapping for the Quino checkerspot butterfly, and a new methodology for adding new retardant products to the USFS Qualified Product List (QPL) for use during fires.

- **August 5, 2020** – The USFS sent a letter to the Service requesting reinitiation of the nationwide programmatic consultation for the use of aerial fire retardant on National Forest System Lands.

- **January 19, 2021** - Service headquarters staff and the USFS met to discuss the revisions the USFS made to the screening process diagrams for clarity and the definition and rationale for replacing the term “misapplication” with “intrusion” related to avoidance areas (i.e., misapplication implies inadvertent application, while intrusion reflects that applications are sometimes made within or near avoidance areas to address health and safety concerns).

- **February 17, 2021** -The USFS provided a draft BA to the Service. After an initial review, headquarters Service staff requested assistance from the Service Field Office species experts to review the draft BA for sufficiency and completeness. The Service provided comments to the USFS on May 11, 2021, for consideration during finalization of the BA.

- **November 15, 2021** - The USFS provided a final BA to the Service. The USFS also provided addenda and additional information in November and December of 2021, and between March through July of 2022.

- **August 5, 2022** – The Service provided a draft Opinion to the USFS.

- **September 15, 2022** – The USFS provided comments on the draft Opinion.

- **September 20, 2022** – The USFS and the Service meet to discuss the comments USFS provided on the draft Opinion.

- **September 20, 2022** – The USFS and Service HQ staff and Service species leads for the Quino checkerspot butterfly and Hermes copper butterfly meet to discuss and finalize the avoidance mapping for these two species.September – October 2022 – Based on feedback from the USFS, the Service revises the incidental take approach to provide a more stream-lined, step-down coordination process.

  November 2022 – The Service revises the draft Opinion based on the comments from the USFS and revises the approach to incidental take..

- **November 1, 2022** – The avoidance buffer is discused for the Hermes copper butterfly. The Service provides USFS with mapped GIS layers of occupied habitat to be buffered for avoidance mapping.

- **November 10, 2022**- The Service and USFS meet to discuss the step-down coordination process for incidental take.

- **November 14, 2022** – The HQ and Field Office staff from the Service and HQ and Field Biologists from the USFS meet to discuss and finalize the avoidance buffers for the Quino checkerspot butterfly and Hermes copper butterfly.

- **November 30, 2022** – USFS and Service meet again to discuss the step-down coordination process for incidental take, avoidance mapping for the yellow-billed cuckoo, and avoidance mapping for the Quino checkerspot and Hermes copper butterflies.

- **December 2, 2022** - USFS and Service meet again to discuss the step-down coordination process for incidental take to finalize the agreed-upon approach, and to finalize the avoidance mapping and notification process for when aerial fire retardant is anticipated to be used in proximity to the Quino checkerspot butterfly and its designated critical habitat, and Hermes copper butterfly.

- **December 5, 2022** – The Service transmits the Biological Opinion to the USFS.

- **January 2023 – February 2023** – The Service and the USFS discuss potential revisions to the the Opinion.

CONCURRENCE

In their BA for the Nationwide Aerial Application of Fire Retardant on National Forest System Lands, the USFS provided determinations of "no effect" for 160 listed species (of which 10 have experimental populations), and designated critical habitats for 42 species (see Appendix A of this Opinion). The Federal agency undertaking the action is responsible for determining if their action may affect listed species or critical habitat (*see* 50 CFR 402.14(a)).

The USFS made "may affect, not likely to adversely affect" (NLAA) determinations for 209 threatened and endangered species, and four proposed species (total of 213). Ten of the 213 species also have at least one non-essential experimental population (NEP), although for two of these species, the southern sea otter (*Enhydra lutris nereis*) and the American burying beetle (*Nicrophorus americanus*), the NEP does not overlap with USFS lands and are thus not considered in this document. Where listed species have NEPs that occur on National Forest System Lands, our analyses of the NEPs are included with the listed entities for species addressed herein. Additionally, the USFS made NLAA determinations for 77 designated critical habitats and three proposed critical habitats (total of 80). A complete list of these species and critical habitats and the USFS's rationales for their determinations are provided in Appendix B of this Opinion.

The USFS used screening tools to determine effects to species and critical habitat. After using a national screen (see **Table 1** below) to determine which species and critical habitats the Action *may affect*, the USFS used their Wildlife Screen, as described in the BA, to determine which species and critical habitats warrant a NLAA or a "may affect, likely to adversely affect" (LAA) determination. The USFS based their determinations on the relevant information of life history for each species, or physical and biological features[1] (PBFs) for critical habitat; 2) the relative amounts of aerial fire retardant expected to be used on National Forest System Lands where that species or critical habitat is found; and 3) proposed avoidance areas for particular species or critical habitats. During consultation, the USFS worked closely with the Service to reach agreement on methodologies for arriving at their "may affect, not likely to adversely affect" determinations based on insignificant effects. The USFS also clearly delineated their rationale for their calls for species with solely discountable effects. For species considered extinct or extirpated from the U.S. and its territories, in most cases, exposure was either not expected (if presumed extinct) or extremely unlikely to occur (if presumed extirpated).

National Effects Screening Process, Information and Assumptions Used

Because the Action is programmatic across the entire National Forest system, the USFS developed a screening process to standardize the process by which species determinations were made and described in the BA. The process was developed for the consultation completed in 2011 and has been updated for use in the current consultation. The screening process includes two levels: the National Effects Screen (which helps the USFS distinguish between likely "no

[1] For some critical habitats, physical and biological features are further defined by primary constituent elements (PCEs) in the final or proposed designation. We use "physical and biological features" or "PBFs" to include both PBFs and PCEs throughout this document.

effect" and "may affect" determinations), and the Wildlife Screens which helps distinguish between NLAA and LAA determinations.

Table 1 displays the standardized process used for evaluating all listed species and habitats for potential effects of aerial retardant use. Additional analysis may have been used to arrive at determinations, as described for each species group or individual species and is provided in the BA and in Appendices A and B of this Opinion.

Table 1. Effects screening process for analyzing aerial retardant impacts to federally listed species and critical habitat (reproduced from Table 13 in BA).

Impact[2]	**National Screening Factor Aerially Applied Retardant**	**Aerial Retardant Application Potential**
NE	Species/habitat occur in areas with no fires, therefore no potential retardant use. Examples: cliffs, caves, estuaries, marshes, lakes, ocean shoreline, sand dunes.	none
NE	Species occurs near, but not on National Forest System Lands and effects from aerial retardant use on forest lands are not possible	low - high
NE	No retardant use recorded on forests where species occur, are suspected, or critical habitat is designated.	none
NE	Use of aerial fire retardant does not impact or change the primary constituent elements, or physical and biological features of critical habitat.	low
Aquatics		
NLAA	Species occurs on forest with very low aerial retardant use and is protected with an avoidance area	very low
NLAA	Critical habitat is protected with avoidance area mapping, or use of aerial retardant would result in discountable or immeasurable changes to primary constituent elements or the physical and biological features of critical habitat	low-moderate
LAA	Species occurs on forest with moderate to high aerial retardant use.	moderate - high
LAA	Changes to primary constituent elements, or physical and biological features of critical habitat, are anticipated.	moderate-high
Terrestrial		
NLAA	Species is not an isolated population and aerial fire retardant is applied on less than 0.01 percent of forest landbase on average annually where species occurs or is suspected of occurring.	low

[2] NE = No Effect; NLAA = may affect, not likely to adversely affect; LAA = may affect, likely to adversely affect.

Impact[2]	**National Screening Factor Aerially Applied Retardant**	**Aerial Retardant Application Potential**
NLAA	Species occurs or is suspected of occurring on a forest with more than 0.01 percent of its landbase impacted by aerial retardant on average annually but occurs in habitats with very low likelihood of retardant application. Examples include alpine habitat, talus/scree slopes, desert,	low - moderate
NLAA	Critical habitat is protected with avoidance area mapping or use of aerial retardant would result in discountable or immeasurable changes to primary constituent elements or the physical and biological features of critical habitat.	low - high
LAA	Aerial fire retardant is applied on more than 0.01 percent of forest landbase on average annually where species occurs or is suspected.	moderate - high
LAA	Species is a small,isolated population[3] and occurs on any forest where aerial retardant application is likely to occur – recognizing potential impact to these species from an intrusion or invoking an exception.	low - high
LAA	Changes to primary constituent elements, or physical and biological features of critical habitat, are anticipated.	low - high

[3] A small, isolated population is a population in which the number of individuals is low, and the area occupied is geographically limited, such as occurring on a single national forest or within a single drainage.

Retardant Application Including Airtanker Base and Jettison Area Operations

The occurrence of past fires and retardant drops provide a baseline and indicator for considering when and where retardant may be used in the future (refer to **Table 14**, **Table 15** and **Table 16** of this Opinion) and we address these later in the Effects of the Action). That information was summarized for use in the National Screens as follows (complete data by National Forest is available in a separate report (USDA - USFS, 2020a).

Application and Assumptions

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

- ‘None’
    - annual average of 0 gallons,
    - maximum of 0 gallons
    - average aerial retardant used on 0 percent of forest unit annually, and
    - frequency is 0.

- ‘Very low’ retardant application potential:
    - annual average of less than 25,000 gallons,
    - maximum of 100,000 gallons,
    - average aerial retardant used on up to 0.01 percent of forest unit annually, and
    - frequency is generally less than 0.375.
- ‘Low’ retardant application potential:
    - less than 50,000 gallons on average annually,
    - less than 200,000 gallons maximum,
    - average aerial retardant used on up to 0.01percent of forest unit annually, and
    - generally, less than 0.625 frequency.
- ‘Moderate’ retardant application potential:
    - less than 150,000 gallons on average annually, and
    - less than 500,000 gallons maximum,
    - average aerial retardant used on up to 0.01 percent of forest unit annually, and
    - generally, between 0.5 to 0.8 frequency.
- ‘High’ retardant application potential:
    - 150,000 gallons on average annually,
    - greater than 500,000 gallons maximum,

- average aerial retardant used on more than 0.01 percent of forest unit annually, and
- greater than 0.8 frequency.

The USFS has identified several other assumptions related to fire seasons, avoidance areas and intrusions:

- Fire season statistics since 2012 provide a reasonable representation of the rate of retardant delivery in the next 10 to 15 years relative to the USFS land base even though past or future decades could have more fires (Geier-Hayes, 2011).
- Where avoidance areas are identified for known species occurrences or critical habitat, the USFS assumes that those avoidance areas would provide protection from adverse impacts. Designated critical habitat where the aerial application of fire retardant does not affect primary constituent elements, or the physical and biological features of critical habitat, does not require protection or avoidance mapping.
- Based on eight years of intrusion data, out of an estimated 56,868 retardant drops, there were 248 intrusions into water (0.43 percent) and 164 intrusions into the waterway buffer only (0.29 percent). There were 47 intrusions into terrestrial avoidance areas (0.08 percent). Overall, there were 459 intrusions into avoidance areas (0.81 percent). The intrusion rate is not expected to increase.
- Intrusions into avoidance areas are assumed to have a higher potential to occur on those units that have a high use of aerially applied retardant.

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

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

For several of these species and critical habitats, the USFS's NLAA determinations were based on conclusions of insignificant effects that were supported by assumptions and analyses detailed in the BA; for others, the USFS determined that exposure to fire retardant chemicals and other effects of the Action was extremely unlikely to occur. After reviewing the USFS' determinations and their rationales, we concur with their NLAA determination for the species and critical habitats listed in Appendix B, as we anticipate that any effects to the species and critical habitats in Appendix B will likely be insignificant (i.e., not be able to meaningfully measure, detect, or evaluate such effects) or discountable (i.e., such effects would be extremely unlikely to occur). We provide our rationale for concurrence below.

Much of the rationale for our concurrence for these species and critical habitats is based on the anticipated absence or low likelihood of fire retardant applications in the species' habitats or critical habitats. This assumption is based either on the low likelihood of the need for applications because of the habitat type (e.g., low risk of fire and thus need for treatment), or, in some cases, the inclusion of avoidance areas that are expected to reduce the likelihood of exposure to species or critical habitats by providing a buffer between likely treatment areas and the species' habitat or critical habitat. For example, we expect that habitats that are unlikely to need treatment, or where avoidance buffers are implemented, are unlikely to be exposed to fire retardant chemicals, and thus effects to these species and their critical habitats are extremely unlikely to occur (i.e., discountable).

Avoidance buffers

Avoidance buffers are designed to avoid applications or drift of retardant within known occurrences of species and/or their critical habitats. The USFS analyses presented in Appendix B of this Opinion includes information on the use of avoidance mapping, with either standard water body buffers of 300 feet (i.e., to protect certain aquatic species) or extended buffers to protect certain habitat components or resources within critical habitats or the species' range. We expect some species would have, in conjunction with avoidance buffers, an extremely low likelihood of exposure due to the anticipated absence of or low aerial fire retardant use on the respective forests they inhabit, such as any species or individuals of species in forests within the state of Florida, or within the Mark Twain, Croatan, Apache-Sitgreaves, and Mt. Hood National Forests. Individuals of these species are extremely unlikely to be exposed to the effects of the Action within these areas, as these forests have vegetation types, micro climates, or terrain that is not conducive to wildland fires. For example, individuals of several species inhabit the Mark Twain National Forest, including: the gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septentrionalis*), eastern hellbender (*Cryptobranchus alleganiensis*), Ozark hellbender (*C. alleganiensis bishopi*), scaleshell mussel (*Leptodea leptodon*), sheepnose mussel (*Plethobasus cyphyus*), snuffbox mussel (*Epioblasma triquetra*), spectaclecase (*Cumberlandia monodonta*), western fanshell (*Cyprogenia aberti*) and the Hine's emerald dragonfly (*Somatochlora hineana*). Due to the low likelihood of applications in the Mark Twain National Forest, as described in the BA, we anticipate that individuals of these species that occur within this National Forest would be extremely unlikely to be exposed. Where individuals of these species are found in other forest lands addressed in this consultation, the risk of exposure in those areas is also considered. For similar reasons, we anticipate the physical and biological features of critical habitats in these, and other no/low aerial fire retardant use forests are also extremely unlikely to be exposed to aerial fire retardant and other effects of the Action, and thus any effects would be discountable. Although we do not list the species and critical habitats in all of these areas by the national forest lands they inhabit in the body of this document, this information is provided for each species in Appendix B and in the BA.

In addition, several species had substantial avoidance mapping associated with their habitats. For a number of aquatic species, avoidance mapping went well beyond the standard 300 foot buffers for waterbodies. For other species, such as the California condor (*Gymnogyps californianus*) and northern Mexican garter snake (*Thamnophis eques melops*), the USFS maintains larger buffers (600 feet) to protect important areas within the species' range or critical habitat, which we expect reduce the likelihood of exposure to these species and their critical habitats.

For a subset of species and critical habitats, where the range or critical habitat is small, localized, and/or endemic (as described in Appendix B and the BA), the USFS (with Service Field Office input) defines avoidance areas to include the entirety of the species' range or critical habitat. For some other species that are wide-ranging, the USFS defines avoidance areas to include only occurrences or occupied habitat of species within their range or critical habitat or agreed upon areas between the Service and USFS that are the most critical to protect. For species and critical habitats described in this section that have avoidance areas that are smaller than their range or critical habitat, we describe additional factors below that support our rationale of insignificant or discountable effects.

For some species and critical habitats, the USFS has not identified the need for avoidance area mapping or buffers, particularly where the likelihood of exposure is already extremely low. For example, there is a small possibility of effects to the Jemez Mountains salamander (*Plethodon neomexicanus*) from aerial retardant application, as their range overlaps the lands where applications may occur. The species has a very limited distribution, a small home range, and limited mobility. However, we consider effects to this salamander from retardant use in the Santa Fe National Forest to be discountable because individuals of the species are fossorial. They remain below the surface throughout most of the year, where exposure to fire retardant chemicals would not be expected to occur. Individuals of the species would only be active on the surface from July to October, during the summer rains that generally fall outside of fire season for this area. In addition, since the species is active at night and remains below the surface during the day (i.e., when proposed activities are implemented), any additional impacts from the Action, such as sound or sight disturbance from associated aircraft traversing or applying within the area, is not anticipated.

Airtanker Base and Jettison Area Operations

There are ninety-eight permanent airtanker bases currently in use across the United States (**Figure 2** and **Figure 3**) where airtankers bound for National Forest Service Lands may originate. These bases are hosted by various federal (Bureau of Land Management, Bureau of Indian Affairs, USFS) or state agencies. Appendix H in the June 30, 2022 BA addendum provides information for each of the bases. Appendix G in the June 30, 2022 BA addendum displays aerial photos of a sample of the airtanker bases and their jettison areas. A jettison area is where airtankers release their load prior to landing, in the case of an emergency, or when flights are cancelled after take-off. This is done for a relatively small set of airtankers that cannot land loaded, such as DC-10s or Single Engine Airtankers (SEATS), or tankers that must release a partial load prior to landing to be under their maximum landing weight. In general, planes will jettison their retardant load at heights similar to a drop on a fire (60 feet above ground level for SEATs, 150 feet for large airtankers, and 250 feet for very large airtankers) or higher, depending on the requirements of the jettison area and the reason for jettisoning the load. The frequency and amount of each jettisoned load is documented at the closest airtanker base to the jettison area.

Airtanker base operations are seasonal and correspond to the fire season where the bases are found (see section 4.3.3.6 of the BA). Because of the spill containment and dust abatement controls in place at the bases, there is a very low probability of retardant entering habitat of any threatened or endangered species or critical habitats. A minor amount could wash into vegetation adjacent to the pits/tarmac, however, wash-down water management (as described in Section "Tanker Bases" in the BA addendum for airtanker information) would minimize the likelihood of that occurring. At airtanker bases using evaporation ponds to manage wash-down water, there is a higher probability of mobile species encountering retardant than at bases using municipal wastewater systems or holding tanks. When wash-down water enters an evaporation pond, retardant is much more diluted compared to the retardant concentration dropped from aircraft during firefighting operations. As the water evaporates, the residual retardant may become more concentrated, however retardant exposed to weather has been shown to become less toxic over time (Puglis, 2020).

Because operations at airtanker bases occur for the length of the fire season in that respective area, any disturbance to species near the airtanker bases is likely to be recurring and of overall longer duration than for drops of aerially delivered retardant on a particular fire. Nearly all airtanker bases occur at existing airfields or airports where there are other aircraft and associated activities occurring. The disturbance associated with aerial retardant operations, including aircraft arriving and departing, is in addition to those other activities, although the relative contribution of airtanker operations varies among bases. It is likely that species in the vicinity have become accustomed to the existing disturbance level. In most cases, we anticipate that species and critical habitats are extremely unlikely to be exposed to the impacts related to disturbance or retardant activities (loading, accidental spills, aircraft take-off and landing) within these areas, or effects would be so small as to not be measurable. We discuss potential effects in the following paragraphs, and address any species- or critical habitat-specific effects in the taxa group discussions below, as applicable.

Effects from use of jettison areas for retardants are similar to those already described for aerial retardant drops associated with firefighting (see to sections 5.4.4, 5.5.3, and 5.6.3 in the BA), with the exception that retardant drops on some jettison areas may occur repeatedly in the same area over time, including multiple drops during a single fire season. Potential effects associated with individual jettison areas depend on the frequency of use, and the relation to locations with species occurrences and/or potential habitat at each area.

Of 98 permanent bases, 18 have identified jettison areas on the airport grounds. These are generally parallel to runways, in vegetation that is maintained (mowed) regularly and is adjacent to areas with high levels of existing disturbance due to aircraft activity. For those reasons, these areas provide little if any suitable habitat for most species, and it is therefore unlikely that threatened or endangered species would use the areas with the possible exception of plant species growing within the airport perimeter, or species occupying vernal pool habitat within the airport perimeter. Loads jettisoned within airport perimeters could cause effects to plant species located there due to fertilization, over-fertilization, or increased competition from non-native invasive species (see section 5.6.3 of the 2021 BA for details about potential effects of retardants to plant species). If a jettisoned load lands within, or runs off into occupied vernal pool habitat, it can result in acute toxicity to wildlife species occurring there, or it could alter the water quality and become detrimental to species found there.

Many airtanker bases have identified off-site jettison areas. These generally occur on ridges or in fields away from concentrated human activities. These jettison areas are a minimum of 300 feet from waterways, and in many cases, farther. Vegetation in most jettison areas is low growing, and generally comprised of grasses, forbs and shrubs. The potential effects to species in jettison areas are discussed within the species assessments below.

The amount of use of jettison areas varies, with airtanker bases that use more retardant generally using jettison areas more often. Detailed information is not available on the frequency and amount of retardant dropped on each jettison area.

Effects by Taxa Groups

In the sections below, we provide a summary of our rationale for our concurrence with the USFS' NLAA determinations for species and critical habitats as listed in Appendix B.

<u>Amphibians</u>

Species rationales

This category includes the following species: frosted flatwoods salamander (*Ambystoma cingulatum*); Jemez mountains salamander (*Plethodon neomexicanus*); Ozark hellbender (*Cryptobranchus alleganiensis bishopi*); eastern hellbender – Missouri DPS (*Cryptobranchus alleganiensis alleganiensis*); and Neuse River water dog (*Necturus lewisi*).

We anticipate that exposure of individuals of these species to fire retardant chemicals is extremely unlikely to occur, and other stressors from the Action (e.g., disturbance from operation of aircraft deploying the fire retardant) are not likely to measurably affect the species. While all of these species' ranges overlap with potential application areas, we anticipate that effects from use of fire retardant chemicals will be discountable, including effects to their prey or forage base. Some of these species are located on forests in the eastern part of the United States that have vegetation types, micro climates, or terrain that is not conducive to wildland fires and receive no to low retardant applications. For example, individuals of species that inhabit the Mark Twain National Forest: e.g., the eastern hellbender and Ozark hellbender or any species located in National Forests in Florida or North Carolina (e.g., frosted flatwoods salamander) are in areas where we anticipate little to no retardant will be applied. Direct exposure to individuals may occur in application areas but are also expected to be low based on the species' life histories and habitats. Some of these species are fossorial and remain in underground burrows for much of their life history or a large portion of the year (frosted flatwoods salamander, Jemez mountains salamander,) and so are unlikely to be exposed. For some species (e.g., Jemez mountains salamander), impacts to breeding would also not occur, as they breed outside of the fire season during the rainy time of the year when applications would not occur. Others of this taxa group are completely aquatic or have breeding areas that are aquatic (Ozark hellbender, eastern hellbender, Neuse River water dog). These aquatic and semi-aquatic species are not likely to be impacted by retardant applications as they are located in low retardant use forests, and in addition, they are not likely to be exposed when in their aquatic habitats because all aquatic habitats will be mapped and managed as required avoidance areas. In addition, we considered potential impacts to the diet of these amphibians which consume mostly insects, crayfish, snails, or earthworms. Although we expect that all of the amphibians could experience minor reductions in their prey and other forage base where these food items are exposed to fire retardant chemicals, we anticipate such exposure would be extremely rare, and would not result in measurable effects to food availability for individuals of these amphibian species. Furthermore, we anticipate that any minor reductions in prey resources would be locally variable and would not substantially affect the overall abundance of available prey resources for individuals of these species.

Although the allowable chemicals have toxicity to amphibians, the likelihood of an event occurring where individuals of these species are directly exposed to the fire retardant, or individuals consume prey or other food items that were exposed to the fire retardant, is extremely unlikely, and therefore impacts would be considered discountable. Thus, we expect that exposure of individuals of these species to fire retardant chemicals is extremely unlikely to occur.

We also do not anticipate the individuals of these species would experience any measurable disturbance from operation of aircraft flying overhead between application areas and bases. We anticipate that individuals that are in burrows or in aquatic habitats are unlikely to detect or be measurably affected by noise or other effects from such operation, and we also expect that any individuals that are in terrestrial environments would also not be measurably impacted by occasional overhead noise or other disturbance.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the frosted flatwoods salamander, Jemez mountains salamander, Ozark hellbender, eastern hellbender – Missouri DPS, and Neuse River water dog.

Critical habitat

Critical habitats for the Jemez mountains salamander, Chiricahua leopard frog (*Rana chiricahuensis*), Oregon spotted frog (*Rana pretiosa*), arroyo toad (*Anaxyrus californicus*), California red-legged frog (*Rana (aurora) draytonii*), mountain yellow-legged frog (Southern California distinct population segment, Northern California distinct population segment) (*Rana muscosa*), Sierra Nevada yellow-legged frog (*Rana sierrae*), and Yosemite toad (*Anaxyrus canorus*) include PBFs such as:

- Acidic, depressional standing bodies of fresh water that are seasonally flooded
- Tree communities with supporting vegetation dominated by grasses and grass-like species in the understory with an overstory or pond-cypress, blackgum and slash pine
- A relatively open canopy; and burrowing crayfish fauna
- Rocky, clear creeks and rivers, usually where there are large shelter rocks
- Herbaceous wetland vegetation
- Stream channels and adjacent upland habitat for overwintering
- Habitat with refugia from predators

We anticipate retardant may impact the water-quality related aspects of the PBFs, where exposure occurs. However, the Action includes required avoidance areas that extend at least 300 feet from the aquatic habitat. For the California red-legged frog, mountain yellow-legged frog, Sierra Nevada yellow-legged frog, Yosemite toad critical habitats, a 300 foot avoidance buffer is required. The use of avoidance areas will significantly reduce the likelihood of retardant entering these systems. In addition, some critical habitats are found on forests with low retardant usage, further reducing the risk of exposure. The use of fire retardant is not likely to impact specific land formations (rocky substrate, refugia from predators), but could impact the vegetation in the species' habitats and both the invertebrate and vertebrate prey bases for these species. However, effects to the vegetation and prey based PBFs are considered discountable and insignificant, as the presence of avoidance buffers make exposure and effects of these types PBFs unlikely. Further, we anticipate that only minor reductions in the amount of vegetation, prey or other forage items as defined in the PBFs would occur from exposure to fire retardant. These reductions are not anticipated to be measurable, and any exposure would be short-term and infrequent.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the critical habitat for the Jemez mountains salamander, Chiricahua leopard frog, Oregon spotted frog, arroyo toad, California red-legged frog, mountain yellow-legged frog (Southern California distinct population segment, Northern California distinct population segment), Sierra Nevada yellow-legged frog, and Yosemite toad.

Mammals

We have separated the discussions of similar groups of mammals into carnivore, ungulate, and rodent categories for clarity.

Carnivores

Species rationales

This category includes the following species: jaguar (*Panthera onca*), ocelot (*Leoparadus paradalis*), San Joaquin kit fox (*Vulpes macrotis mutica*), Pacific marten (coastal distinct population segment [DPS]), *Martes caurina*), black-footed ferret (*Mustela nigripes*), Sierra Nevada red fox (*Vulpes vulpes necator*), fisher (west coast DPS, *Pekania pennant*), Canada lynx (*Lynx canadensis*), grizzly bear (Lower 48 states, *Ursus arctos horribilis*), Mexican wolf (the listed entity and its non-essential experimental population) (*Canis lupus baileyi*), and gray wolf (*Canis lupus*).

We do not anticipate that these mammalian carnivores will experience measurable effects from applications of aerial fire retardant, and in many cases, we expect that exposure of individuals is extremely unlikely to occur. Thus, while all of these species' ranges overlap with application areas, we anticipate that effects will be insignificant and discountable, including effects to their prey or forage base. For large, wide-ranging carnivores, the USFS does not require avoidance mapping. Retardant use in the forest lands where these species are found can range from very low to high, depending on the species and the forest(s) in which they occur; however, due to the species' mobility, we anticipate individuals of the species would be able detect the oncoming fire and evade the immediate area (i.e., path of the advancing fire and areas where retardant would likely be dropped); thus avoiding any direct exposure from fire retardant. In addition, we considered potential impacts to the diet of strict carnivores, such as large cats (jaguar, ocelot, and lynx) and members of the weasel family (martens and ferrets), as well as omnivores, such as fishers, foxes, wolves, and bears, which would consume both prey and plant material. The use of retardant may result in changes to food resources for these predatory species by potentially reducing availability of rodent or plant resources in very localized areas. However, we anticipate any localized exposure of food resources will be limited to a very small percentage of the home range of each species, and would not measurably affect the availability of sufficient prey or other food items. Therefore, the effects from exposure to prey resources are anticipated to be insignificant.

Based upon that analysis, we anticipate that all of the mammalian carnivores would forage outside of treated areas when minor reductions in their prey and other forage base occur due to rare instances of fire retardant use within their habitat. In the extremely unlikely event that individuals of these species consumed prey or other food items that were exposed to the fire retardant products, we anticipate these individuals would not experience measurable effects. The allowable chemicals have low toxicity to large mammalian species, and an individual would have to consume large quantities of the contaminated prey or food items to experience any measurable toxic effects (Auxilio Management Services, 2021).

Direct exposure is also expected to be low based on the species' life history. Most mammalian carnivores are primarily nocturnal or crepuscular during the summer; grizzly bears can be active at any time of day, although they tend to be more crepuscular/nocturnal when temperatures are high, and other carnivores may occasionally be active during the day. However, as noted above, we do not anticipate individuals of any of these species would be exposed to concentrations of fire retardant that would result in adverse effects. During inactive periods, carnivores tend to be in protected areas where they would not be exposed. Since retardant is not applied during nighttime hours, the potential for exposure is minimal for most carnivore species. Although the fire season overlaps the birthing and rearing periods for all these species, these species all use dens for those activities, minimizing the potential for effects from disturbance of the approaching aircraft. Many of the species may move young between dens if disturbed; however, this practice is not unusual and is generally not expected to result in measurable impacts to survival or reproduction. Also, noise disturbance from low-flying aircraft making retardant drops is also anticipated to affect very few individuals. While individuals of these species may encounter noise disturbances from aircraft operations, the brief, intense noise levels are likely briefly experienced over a very small area and these species are highly mobile such that disturbances may cause the animals to avoid proximity to the source, but the effects of such are anticipated to be rare and of such short duration as to not measurably affect the animals. Any effects are anticipated to be discountable (not likely to occur) or insignificant (not meaningfully measured).

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the jaguar, ocelot, San Joaquin kit fox, Pacific marten (coastal DPS), black-footed ferret, Sierra Nevada red fox, fisher (west coast DPS), Canada lynx, grizzly bear (Lower 48 states), Mexican wolf, and gray wolf.

<u>Critical habitat</u>

There are no critical habitats for mammalian carnivores for which the USFS made a NLAA determination.

Ungulates

<u>*Species rationales*</u>

We do not anticipate that individuals of the listed ungulates described below are likely to be exposed to fire retardant chemicals during application of these chemicals or exposed from airtanker base or jettison area operations in the case of the wood bison (*Bison bison athabascae*), which overlaps with the operation areas (discussed further below). While the other three ungulates addressed in this consultation (Sierra Nevada bighorn sheep (*Ovis canadensis californiana*), Peninsular bighorn sheep (*O. canadensis nelson*), and the woodland caribou (*Rangifer tarandus caribou*)) all occur within USFS units where retardant application potential is high, retardant use is unlikely in the steep, rocky open habitat used by bighorn sheep, or in the high elevation, old growth habitat used by caribou. The Sierra Nevada bighorn sheep may be in lowland areas in winter, but fires are highly unlikely during that time of year. All three ungulate species considered here are highly mobile, have large home ranges, and are therefore expected to avoid direct retardant exposure by moving away from the area (i.e., evade active/advancing fire areas and areas where fire retardant may be applied). We also considered effects to the forage base of these three ungulate herbivores. If retardant is dropped into the range of these ungulates, it may temporarily impact the food source (vegetation) for these species. Constituents (ammonia salts) of fire retardants can create adverse effects including leaf burning, shoot die-back, decreases in germination, or plant death as well as cause fertilizing effects including overgrowth of invasive plant species, altering plant communities. However, due to the large home range size of these species, fire retardant drops as a percentage of the range are likely to be very small and thus the forage area impacted is not anticipated to be significant. Additionally, the likelihood of retardant being used in areas where these species are frequently found foraging (e.g., steep, rocky areas; high elevations) during the fire season are considered so unlikely as to be considered discountable, and any short-term temporary effects to the species from alteration of their food base would not be measurable. Lastly, noise disturbance from low-flying aircraft making retardant drops is also anticipated to affect very few individuals. While individuals of these species may encounter noise disturbances from aircraft operations, the brief, intense noise levels are likely briefly experienced over a very small area and these species are highly mobile such that disturbances may cause the animals to avoid proximity to the source, but the effects of such are anticipated to be rare and of such short duration as to not measurably affect the animals.

We do not anticipate that the wood bison is likely to be exposed to fire retardant chemicals during airtanker base operations or related jettison protocols. The wood bison is found in wet meadows with sedges and grasses in the winter, and summer foraging habitats include meadows with slough sedge, northern reed-grass, and willow. Deciduous and pine forests associated with these meadow types are used for resting, ruminating, avoiding flies, protection from deep snow and wind, and foraging at various times of the year. McGrath airtanker base and McGrath jettison area are identified as being within this species' range. Effects from exposure to fire retardant to large mammals like a wood bison would be very unlikely to occur as they would need to consume a tremendous amount of heavily coated forage base to acquire any toxicity via dietary ingestion. Some disturbance to wood bison from the activities of the aircraft taking off and landing, and occasionally during jettison could occur.

As with other airtanker bases, there are procedures in place to contain any spills or washdown water so the likelihood of retardant getting onto the sedges and grasses they feed upon would be very low. In addition, the jettison area for the McGrath airtanker base is located in a wooded area northeast of the airport and aircraft would avoid the foraging habitat (meadows and associated deciduous and pine forests) where bison would feed, during a jettison; in the rare event that individual bison would forage in areas where jettison has occurred, we do not anticipate they would consume sufficient retardant to result in measurable effects. Furthemore, the amount of retardant use at McGrath airtanker base is also very low (20,343 gallons per year on average or about 10 P-3 medium airtanker type aircraft loads per year which equates to 8-9 drops per year or 11-12 total acres covered with retardant; see Appendix G in this Opinion); therefore, effects to the wood bison at McGrath airtanker base or jettison area are considered discountable. Because the McGrath airtanker base and its jettison area are used so infrequently for fire retardant activities, noise disturbance to the wood bison from these procedures would not be measurable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the Sierra Nevada bighorn sheep, Peninsular bighorn sheep, the woodland caribou, or wood bison.

<u>*Critical habitat*</u>

There are no critical habitats for ungulates for which the USFS made a NLAA determination.

Rodents

<u>*Species rationales*</u>

This category includes the Stephens' kangaroo rat (*Dipodomys stephensi*), Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*), Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*), Peñasco least chipmunk (*Neotamias minimus atristriatus*), Giant kangaroo rat (*Dipodymys ingens*), Fresno kangaroo rat (*Dipodymys nitratoides exilis*), and Tipton kangaroo rat (*Dipodymys nitratoides nitratoides*).

Stephens' kangaroo rat is found in three regions located within one mile of both the Cleveland and San Bernardino National Forests but not known to occur on them; therefore, any resulting exposure to individuals of the Stephens' kangaroo rat to fire retardant chemicals or disturbance from aircraft and tanker base operations would be extremely unlikely and therefore would be considered discountable.

The Mount Graham red squirrel is found on the Coronado Forest (a high retardant use forest). Although the species occurs in mature growth tree stands, we expect the use of fire retardant would be extremely unlikely to occur in these types of habitats, as retardant is considered to be less effective for this habitat type. These squirrels may also be impacted by the noise disturbance from the aircraft delivering the retardant near their habitat, such as on nearby openings or ridges. However, although fire season occurs during the nesting season, nests are in tree cavities and nesting squirrels would not likely leave the nest due to noise disturbance. These squirrels would also not likely be directly impacted by a retardant drop as retardant would generally not be used over mature trees. Therefore, we consider these effects to be discountable.

The Carolina northern flying squirrel is found in high elevation forests in the southern Appalachians, typically in cool, moist mature forests of spruce–fir on the National Forests in North Carolina which are low retardant use forests, Tennessee (Cherokee National Forest which is a very low retardant use forest), and Virginia (the George-Washington Jefferson National Forest does not use retardant). Similar to the Mount Graham red squirrel, retardant application is extremely unlikely to occur in the mature stands where this species is found because it is not effective in this type of vegetation. We also expect that while there may be some potential for minor disturbance from the aircraft operations, any such disturbance would not result in measurable effects to individuals of these nocturnal, highly mobile, and wide-ranging species.

The Peñasco least chipmunk is proposed as endangered and has a very limited range, all of which is found on the Lincoln National Forest, which has moderate retardant potential. However, this species occurs in subalpine habitats which are very unlikely to require fire retardant treatments. Although we anticipate toxicity effects where exposure occurs, as well as some potential for disturbance from the aircraft for this chipmunk, we expect exposure to fire retardant is extremely unlikely to occur, and that any disturbance impacts would not be measurable. Due to their wide variety of food sources, any unlikely impacts from ingestion of occasional small amounts of contaminated dietary items are not likely to cause measurable impacts from toxicity as individuals would not be limited to one source that would increase their dietary load of retardant. Lastly, while individuals of this species may encounter noise disturbances from aircraft operations, the brief, intense noise levels are anticipated to be rare and of such short duration as to not measurably affect the animals.

Giant kangaroo rats are found in annual grassland communities with few or no shrubs on gentle slopes that do not flood in winter. Small, scattered populations of this species can also occur atop hills and ridges, where slopes are flat enough and soils are deep enough for burrowing. The giant kangaroo rat feeds on seeds, green herbaceous vegetation and occasionally insects. The Fresno kangaroo rat's habitat includes sandy or silty soils with a crumbly texture, with no to moderate shrub cover and scattered herbaceous plants; sparsely vegetated alkali sink communities with sandy or silty soils; valley grassland; and saltbrush and sink scrub. It feeds on seeds and consumes some insects and green vegetation in the spring. The Tipton kangaroo rat prefers open, desert communities with large alkali scalds (areas naturally bare of vegetation), and no apparent signs of past or present agriculture. Sparse ground cover with bush seepweed (*Suaeda nigra*) and few invasive grasses are also suitable habitat for the Tipton kangaroo rat. Its diet is most likely made up of similar forage base as other kangaroo rat species, although this is not well understood.

For the giant kangaroo rat and Fresno kangaroo rat range, a 300-ft avoidance buffer is implemented on the San Joaquin Experimental Range Station, which is located just outside of the Sierra National Forest. Paso Robles airtanker base, Fresno airtanker base/jettison area, and Porterville airtanker base are all within the range of the giant kangaroo rat, Fresno kangaroo rat, and Tipton kangaroo rat, respectively. There are no jettison areas within the range of the giant or Tipton kangaroo rat. However, the likelihood of retardant impacting the giant, Fresno, or Tipton kangaroo rats at any of these airtanker bases is extremely low, as there are measures in place at all airtanker bases for containing any spills and designated areas for containing wash down water. For the Fresno kangaroo rat, any impacts from fire retardant activities occurring at the designated Fresno jettison area would be insignificant because the Fresno jettison area is northeast of the airport on a ridge with dense shrub cover that is not likely used by the species. Also, this jettison area requires loads to be jettisoned at least 1000 feet above ground, which results in the retardant dissipating prior to reaching the ground and becoming undetectable.

Therefore, any impacts to these kangaroo rat species or their forage base would be so minimal as to be considered discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the Stephens' kangaroo rat, Mount Graham red squirrel, Carolina northern flying squirrel, the Peñasco least chipmunk, Giant kangaroo rat, Fresno kangaroo rat, and Tipton kangaroo rat.

Critical habitat

The Action area includes critical habitats of the New Mexico meadow jumping mouse, Preble's meadow jumping mouse, San Bernardino Merriam's kangaroo rat, and Peñasco least chipmunk.

Critical habitat PBFs for the New Mexico meadow jumping mouse include riparian communities along rivers and streams, springs and wetlands, or canals and ditches that support various plant species used for food sources (insects and seeds) and structural material. Critical habitat PBFs for the Preble's meadow jumping mouse include riparian corridors with associated riparian vegetation, and adjacent floodplain and upland habitat with limited human disturbance, including areas supporting recreational trails and urban-wildland interfaces. Critical habitat PBFs for the San Bernardino Merriam's kangaroo rat include alluvial fans, washes and associated floodplain areas that provide burrowing habitat, and adjacent upland areas containing alluvial sage scrub habitat and associated vegetation. These areas may include urban/wildland interfaces. Other PBFs for these species focus on habitat areas such as flowing water, movement corridors, or adjacent floodplain features that would not be affected by retardant. Critical habitat PBFs for the Peñasco least chipmunk include rock outcrops or talus, subalpine Thurber's fescue meadow/grassland communities found within openings of spruce-fir forest, and their forage base consisting of seeds, flowers of forbs, wheat, oats, flowers and fruits of gooseberry, wild strawberry, pinyon nuts, Gambel oak acorns, insects, and other items.

Critical habitats for these small mammals are found on or near National Forest System Lands that range from very low to high retardant use. Regardless, we anticipate effects would be discountable or insignificant. The critical habitats and associated vegetation-related PBFs are not likely to be exposed to fire retardant chemicals, primarily due to the use of avoidance buffers extending 300 feet from critical habitat boundaries that would preclude exposure for the New Mexico meadow jumping mouse, Preble's meadow jumping mouse, and the San Bernardino Merriam's kangaroo rat. In the unlikely event exposure occurs, while toxicity from retardant may affect vegetation (Auxilio Management Services, 2021), we anticipate any impacts to vegetation-related PBFs and their functions would be insignificant because vegetative structure and communities are expected to remain intact. Furthermore, while effects to vegetation are likely to be variable, exposure would be short-term, and plants are expected to remain largely unaffected or recover in a brief period of time.

For the Peñasco least chipmunk critical habitat, which is found on the Lincoln National Forest (a moderate retardant use forest), the Thurber's fescue meadow/grassland communities PBFs and their forage base PBFs as discussed above would be susceptible to the effects of retardant where exposure occurs through fertilizing effects as well as changes to species composition, and growth of, or increased presence of, invasive non-native plant species. However, similar to the discussion for the species, retardant is extremely unlikely to be used in the subalpine habitats where this critical habitat is found, and thus such effects are considered discountable. Furthermore, in the unlikely event of exposure, effects to plants are likely to be variable by species, exposure would be short-term, and plants are expected to remain largely unaffected or recover in a brief period of time. The use of aerial application of fire retardant also has the potential to benefit these PBFs in terms of fertilization of forage species or protection of areas from impacts of fire. Therefore, effects to the critical habitat for the Peñasco least chipmunk from the use of aerial fire retardant are discountable and some may be potentially beneficial.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the critical habitat for the New Mexico meadow jumping mouse, Preble's meadow jumping mouse, San Bernardino Merriam's kangaroo rat, and the Peñasco least chipmunk.

Bats

<u>Species rationales</u>

The USFS made NLAA determinations for six bat species in their BA: northern long-eared bat (*Myotis septentrionalis*); Mexican long-nosed bat (*Leptonycteris nivalis*); Ozark big-eared bat (*Corynorhinus townsendii ingens*); Virginia big-eared bat (*Corynorhinus townsendii virginianus*); gray bat (*Myotis grisescens*); and Indiana bat (*Myotis sodalis*). All of these species are wide-ranging and highly mobile. They are also mostly found on forests with no to low retardant use, with the exception of the Mexican long-nosed bat that occurs in the Coronado National Forest, which is a high retardant use forest. Avoidance mapping is required for all waterways over which many of these species are likely to forage, thus reducing impacts to their invertebrate prey resources, many of which may have aquatic life stages and/or remain near waterbodies as adults.

For the analyses of all bat species, we made several assumptions. First, we do not expect individual bats would be exposed to aerial retardant applications because all of these bat species are highly mobile and would be able to avoid areas where wildland fires and firefighting activity are occurring. Bats remaining in areas where application occurs are likely to be protected inside trees, snags, under bark, or within structure or caves. Bats roosting in caves or under bark or inside trees or snags are also unlikely to be disturbed by flights associated with aerial retardant applications. Finally, while disturbance to roosting bats and maternity colonies is possible if drops occur near occupied sites, we anticipate the likelihood of this occurring to be extremely low, due in large part to the low levels of use on most forests occupied by these species.

Measurable effects to individual bats from contaminated insect prey items is also not a likely scenario for these species. Bats may ingest retardant found on insects, which may result in a risk to this species (Auxilio Management Services, 2021). However, because of the limited retardant use across the species' ranges, the large area available to forage in relation to the small area impacted by retardant drops each year, and avoidance areas around water bodies where much of bat foraging occurs, the likelihood of individual bats foraging on contaminated insects is extremely unlikely to occur, and any effects via their prey resources are expected to be discountable. We also do not expect that small, localized reductions in invertebrate prey, should they be exposed the fire retardant chemicals, would result in measurable effects to the abundance of prey.

Noise disturbance from low-flying aircraft making daytime retardant drops is also anticipated to affect very few individuals, as bats are nearly universally nocturnal or crepuscular, including all of the North American species analyzed here. While individuals of these species may encounter noise disturbances from aircraft operations, the brief, intense noise levels are anticipated to be briefly experienced over a very small area, but the effects of such are anticipated to be so rare and of such short duration as to not measurably affect the animals (i.e., insignificant).

Nursery colonies and day roosting sites occur in cavities beneath loose bark in trees or snags. A low, fast retardant drop has the ability to break the tops off trees or knock weak snags over. However, there is a very limited chance of a retardant drop causing physical damage to these roost or colony trees because the low and very low retardant potential on most units where these species occurs greatly reduces the possibility of damage occurring to occupied trees. Retardant use can occur during the hibernation or maternity roosting periods in USFS Regions 8 and 9 (Service Regions 3, 4, 5 and in Oklahoma and Texas in Region 2) for those bats that roost in caves or mines (Indiana bat, Ozark big-eared bat, Mexican long-nosed bat, Virginia big-eared bat), however, the low and very low retardant potential on most units where all of these species occur greatly reduces the possibility of damage occurring to occupied trees and these species would not be impacted by the retardant applied or the disturbance from the aircraft delivering the retardant (given that they roost in caves and mines, which provide cover). Thus, although aerial retardant could impact many of these bat species' forest habitat, we expect that any impacts would be localized and limited in scale and duration, and would be extremely unlikely to impact individual bats, their prey, or their habitat. Thus, we anticipate such effects would be discountable.

Additionally, for the Mexican long-nosed bat, which is the only species that may occur in a high retardant use forest, there is limited concern for retardant use impacting either individual bats, their forage base, or their habitat. This species uses caves and mines for roost sites and individuals are only in the southern United States briefly during the summer months before heading south again into Mexico. Thus, the impacts to maternity/nursery colonies and roosting are expected to be even less likely to occur than for the other species for impacts from fire retardant applications. Additionally, this species eats nectar and pollen from agave and cacti flowers rather than relying on invertebrate prey. We do not anticipate fire retardant activities will result in measurable effects to individuals of the species, given that roosts are known to occur in two areas, Big Bend National Park and Romney Cave, Big Hatchet Mountains, Hidalgo County, New Mexico. The fertilizing properties of retardant can impact the cactus food of the Mexican long-nosed bat. In limited amounts, fertilizer can increase the growth of cacti. Too much fertilizer can lead to slow development, or poor root growth or root rot. Although these effects can reduce the foraging opportunities for this species, we anticipate any effects would be highly localized, as retardant impacts less than 500 acres on average each year on the Coronado National Forest, or less than 0.03 percent of the land base. Based on the large foraging distances for this species, (50 km from roost sites; Mexican long-nosed bat SSA 2018), potential effects are discountable.

For the Mexican long-nosed bat species and others which roost in caves or mines with vertical openings, retardant drops at the surface of these vertical openings could be washed by rain into the cave or mine. This could affect the water quality within the cave or mine, possibly affecting northern long-eared bat habitat (McDonald 2015) or other species that roost in caves or mines with vertical openings. That said, we anticipate that such events would be extremely rare as the northern long-eared bat is found on multiple forests with no to low retardant use and is wide-ranging. In addition, any effects to water quality would be very localized and effects to water quality are likely to be short in duration, and therefore considered discountable. In such situations, the local unit may choose to include these vertical mine shafts in avoidance areas, which we expect would further reduce the likelihood of exposure of individuals of the species.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the northern long-eared bat, Mexican long-nosed bat, Ozark big-eared bat, Virginia big-eared bat, gray bat, and Indiana bat.

Critical habitat

There are no critical habitats for bats for which the USFS made a NLAA determination.

Birds

Species rationales

We do not anticipate that individuals of the bird species listed below, including the raptors, riparian, and woodland and upland birds, are likely to be exposed to fire retardant chemicals during applications of retardant, due primarily to their high mobility and ability to forage widely, and the use of avoidance buffers that would preclude such exposure to these species, their forage base, and their habitats. Similarly, for the coastal and wetland birds, we anticipate that exposure is unlikely during airtanker base operations or implementation of related jettison protocols. Again, this is primarily due to the high mobility and ability of these species to forage widely, as well as the measures in place at airtanker bases to contain retardant spills and wash-down water that would preclude such exposure to these species, their forage base, and their habitats. This category includes the following species and critical habitats (species with an *, *see* critical habitat discussion below), where designated:

- Raptors: northern aplomado falcon (its non-essential experimental population) (*Falco femoralis septentrionalis*); California condor (the listed entity and its non-essential experimental population) (*Gymnogyps californianus*).

- Riparian birds: southwestern willow flycatcher (*Empidonax traillii extimus*); least Bell's vireo (*Vireo bellii pusillus*), and western yellow-billed cuckoo (*Coccyzus americanus* [*occidentalis*]).

- Woodland and Upland birds: Gunnison sage grouse (*Centrocercus minimus*), Florida scrub jay (*Aphelocoma coerulescens*), Mount Rainier white-tailed ptarmigan (proposed threatened; *Lagopus leucura rainierensis*, and red-cockaded woodpecker (*Picoides borealis*).

- Coastal and Wetland birds: Eastern black rail (*Laterallus jamaicensis jamaicensis*), California clapper rail (*Rallus longirostris obsoletus*), California least tern (*Sterna antillarum browni*)

The raptors and riparian, woodland and upland birds, are also relatively wide-ranging and highly mobile. These species are extremely unlikely to be impacted by fire retardant use within the forests they occupy, which can range from having very low to high retardant use. In addition, due to their mobility, individuals of these species would be able to detect either the oncoming fire or the aircraft transporting the retardant and would likely flee or avoid these areas once fire retardant applications begin. Noise disturbance from aircraft making retardant drops is anticipated to affect very few individuals, and, while noise levels may briefly be high, such effects would be brief in duration and unlikely to measurably affect individual birds. The Stage 3 noise standards require planes to operate between 89-106 decibels (depending on flight phase, number of engines, aircraft weight). For some of the large airtankers the worst case scenario is 88.7 decibels, others operate between 94 and 98 decibels (U.S. Department of Transportation, Federal Aviation Administration, 2001). In the rare instance that individuals of these species in the vicinity of these activities may encounter noise disturbances from aircraft operations, the brief, intense noise levels are likely experienced over a very small area. These species are highly mobile such that disturbances may cause the animals to avoid proximity to the source, but the effects of such are anticipated to be so rare and of such short duration as to not measurably affect these species (i.e., insignificant effects). Likewise, they would be able to forage outside of these areas if localized impacts to their forage base occurred as a result of aerial fire retardant applications in a portion of their range. There is the potential for aerial fire retardant to be applied during peak fire season that coincides with the time of year when nesting occurs and offspring are beginning to fledge (i.e., May through July for USFS Regions 3 and 5 which could impact the Least Bell's vireo, yellow-billed cuckoo, and southwestern willow flycatcher). However, we anticipate impacts are extremely unlikely to occur to individuals of these species or measurably impact their reproductive success, as avoidance buffers will greatly reduce the likelihood that retardant will enter the riparian areas where nesting occurs for these species.

In addition, several of these species have avoidance mapping requirements for their critical habitat, ranges, or other important areas. For example, there are required ¼ mile buffers for nest, roost, and hack sites for the California condor and 300-foot buffers for the southwestern willow flycatcher. For the Least Bell's vireo, avoidance mapping for the species' critical habitat (which we expect would also greatly decrease the likelihood of exposure for individuals of the species) is covered by a 300-foot riparian buffer. Similarly, for the western yellow-billed cuckoo in USFS Region 3, there is required aviodance mapping for occupied areas and nesting locations (based on the most recent survey data), as well as all designated critical habitat. These areas encompass all yellow-billed cuckoo areas needing protections as additional populations are discovered through survey efforts. These buffers are specifically designed to reduce the likelihood of exposure for these species such that exposure of individuals is extremely unlikely to occur. Although the risk assessment provided by USFS indicates that threatened and endangered songbirds that reenter an area after firefighting activities subside would experience effects to individual survival, growth, and reproduction if they inadvertently ingest retardant in areas with anticipated application rates (i.e., 3 gallons per 100 square feet and above), the avoidance areas are intended to preclude such exposure. Thus, because of the low likelihood of retardant being applied into these habitats due to the avoidance mapping, and the ability of these species to evade and forage in areas outside of a fire or retardant impacted area in the extremely unlikely event an intrusion occurs, we anticipate the effects would be discountable. In addition, application of retardant can provide protection to these habitats from catastrophic wildfires, which would ultimately be beneficial to the species.

Similarly, avoidance mapping is required for the Gunnison sage grouse, red-cockaded woodpecker (in the state of Mississippi), and Florida scrub jay, as the areas these birds inhabit are identified as potentially low to high use retardant forest lands.. Use of aerial retardant has the potential to cause localized (i.e., application area) fertilizing effects that impact the vegetation community within the habitat of these species as they are heavily reliant on the sage brush, Great Basin shrub steppe ecosystem or other scrub-brush type areas for feeding, breeding, and sheltering. Such fertilizing effects may encourage the localized growth of other plant species in this habitat, although we do not anticipate that such use would measurably impact the forage base or habitat for individuals of this species. However, the use of retardant can also have beneficial effects, particularly for the Gunnison sage grouse, where catastrophic or too frequent fires remove the essential sage brush growth, or allow for the colonization of invasive species like cheat grass that alter habitat essential for Gunnison sage grouse. Similarly, for the red-cockaded woodpecker, use of retardant can preserve old growth forest tree types (even if use in these habitats is unlikely) that these species rely on for nesting and breeding. Thus, we anticipate any impacts to individuals of these species, their forage base, and their habitat are likely to be minor, localized, and would either not be measurable or wholly beneficial.

The Mount Rainier white-tailed ptarmigan occurs in alpine habitat where retardant use is limited and, on forests where the combined retardant use does not impact more than 0.01 percent of the total land base. These include Mount Baker-Snoqualmie National Forest, which does not use retardant, the Gifford Pinchot National Forest, which has low retardant application potential, and the Okanogan-Wenatchee National Forest, which has high retardant application potential; however, we expect that fire retardant would be unlikely to be used in the habitats the ptarmigan inhabits within the Gifford Pinchot and Okanogan-Wenatchee National Forests. Individuals of this species are not expected to be measurably impacted by ingestion of retardant on prey items (Auxilio Management Services, 2021), nor is disturbance from the aircraft an anticipated effect to this species based on the limited retardant use in their habitat type. These birds also breed in the alpine zone where retardant application is not likely to occur, so effects to nesting birds and their offspring is also not a likely occurrence. Therefore, we anticipate any impacts to individuals of these species, their forage base, or their habitat will likely be minor, localized, and discountable.

For the coastal and wetland birds, the Mesquite airtanker base, Gateway (Phoenix) airtanker base and Gateway (Phoenix) jettison area are identified as being within the range of the California least tern. The Paso Robles airtanker base is within the range of the California clapper rail. The Canon City SEAT, NoCo SEAT, and Pueblo airtanker bases (all in Colorado) are within the range of the Eastern black rail, and the species' range does not overlap with any jettison areas. All three of these bird species are extremely unlikely to be impacted by fire retardant operations, either during preparations for aircraft being loaded with retardant, or after aircraft return from a retardant delivery flight, because they do not nest or forage directly within the confines of these areas. In addition, due to their mobility, individuals of these species would be able to detect the aircraft transporting the retardant and would be able to flee or avoid these areas. Noise disturbance from airtanker base operations or jettison activities is likely to occur throughout the fire season. However, it is likely that species that occupy habitat within the vicinity of these activities are relatively acclimated to associated disturbances, and thus would not experience deleterious effects. In addition, jettison areas are generally located on ridges or in fields at least 300 feet from waterways. Thus, retardant in jettison areas is not likely to impact these species, as they rely on wetland, marsh, or beach areas that are not likely to be exposed to retardant.

We do not anticipate these operations would negatively impact the forage base for these species. Dietary items include small fish, mussels, clams, small crabs, mosquitoes, and spiders. Because of the measures in place at airtanker bases to contain retardant spills and wash-down water, the effects to eastern black rail, California clapper rail, and California least tern prey items due to airtanker base operations would be discountable because the retardant wash is not likely to reach any waterbodies or other marsh or wetland areas where they would be feeding. All three of these bird species are wetland, marsh or beach obligates, and generally nest and breed in these areas as well. We anticipate impacts are extremely unlikely to occur to individuals of these species or measurably impact their reproductive success.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the northern aplomado falcon, California condor, southwestern willow flycatcher, least Bell's vireo, western yellow-billed cuckoo, Gunnison sage grouse, Florida scrub jay, Mount Rainier white-tailed ptarmigan, red-cockaded woodpecker, eastern black rail, California clapper rail, or California least tern.

Critical habitat

Critical habitat for coastal California gnatcatcher (*Polioptila californica californica*), marbled murrelet (*Brachramphus marmoratus*), Mexican spotted owl (*Strix occidentalis lucida*), northern spotted owl (*Strix occidentalis caurina*), least Bell's vireo (*Vireo bellii pusillus*), western yellow-billed cuckoo (*Coccyzus americanus* [*occidentalis*]), southwestern willow flycatcher (*Empidonax trailli extimus*), and Gunnison sage grouse (*Centrocercus minimus*) covers a wide range of vegetation types including coastal sage scrub, Douglas-fir, redwoods, cedars, hemlock, forest of mixed-conifer, pine-oak, evergreen oak, general riparian woodland species, mature willows, riparian, xeroriparian, and/or nonriparian tree and large shrub species along perennial, intermittent, and ephemeral drainages in montane canyons, foothills, desert floodplains, and arroyos, and Great Basin shrub steppe. PBFs specified in critical habitat rules include features such as steep canyons, riparian corridors, canopy, understory, adequate invertebrate or vertebrate prey base, and areas these birds use for nesting, roosting, and foraging. The use of fire retardant could impact the vegetation in the species habitat and both the invertebrate and vertebrate prey base for these species. However, effects to the critical habitat PBFs from impacts to supporting vegetation and prey are considered to be discountable and insignificant, as the presence of avoidance buffers will avoid or minimize impacts to the PBFs for the riparian bird species' habitats (i.e., coastal California gnatcatcher and marbled murrelet, least Bell's vireo, western yellow-billed cuckoo and southwestern willow flycatcher) to the point where effects are extremely unlikely to occur. For the marbled murrelet, northern spotted owl and Mexican spotted owl, aerial retardant is most likely to be applied along ridges or openings in the canopy or in areas with younger trees where it can penetrate to the ground and is more effective at stopping the fire spread. Therefore, although retardant will be used in critical habitat, the anticipated effects to PBFs would be insignificant and/or discountable because target areas are less likely to contain PBFs. Where PBFs occur within aerial retardant applications areas, we anticipate that effects to the PCEs of critical habitat (e.g., large trees, canopy, etc.) would be discountable.

For example, critical habitat for marbled murrelet is confined to 35 miles along the Pacific Ocean coast, mainly on the Mt. Baker-Snoqualmie, Olympic and Siuslaw National Forests, which do not use retardant, and on the Siskiyou and Six Rivers National Forests, which have high retardant application potential in the interior parts of these forests. However, given the moist conditions in the coastal zone, actual use within the marbled murrelet critical habitat is anticipated to be low in these areas. When used in these areas, there is a small potential for delivery of aerial fire retardant that would alter the structure of a stand of trees if a significant enough amount is dropped from an aircraft that would result in physical damage to the trees or branches, but again this would be an extremely rare occurrence because the Forest Service does not anticipate using retardant in mature and late seral forest habitats. Thus, we anticipate any effects to the PBFs for critical habitat for these species is insignificant and discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect critical habitat for the coastal California gnatcatcher, marbled murrelet, Mexican spotted owl, northern spotted owl, least Bell's vireo, western yellow-billed cuckoo, and southwestern willow flycatcher.

Crustaceans

Species Rationales

This category includes the following species:

- San Diego fairy shrimp (*Branchinecta sandiegonensis*)
- California freshwater shrimp (*Syncaris pacifica*)
- Conservancy fairy shrimp (*Branchinecta conservatio*)
- vernal pool fairy shrimp (*Branchinecta lynchi*)
- vernal pool tadpole shrimp (*Lepidurus packardi*)
- Riverside fairy shrimp (*Streptocephalus woottoni*).

Each of the species has limited distribution, and would be unlikely to be exposed when pools contain water due to the use of avoidance areas. Furthermore, for these species, the period during which aerial fire retardant would be applied (i.e., the fire season) occurs during the dormant period of the species' life cycle (USDA - USFS, 2020a). The dormant cysts, which in essence serve as hard, non-porous shells to guard against desiccation, are very resilient and unlikely to be measurably affected by exposure to fire retardant chemicals. Lastly, based on studies conducted by the United States Geological Survey, the toxicity of any retardant drops in pools when they are dry would be reduced by weathering events (Puglis, 2020).

We do not anticipate that individual San Diego fairy shrimp or California freshwater shrimp are likely to be exposed to fire retardant chemicals during airtanker base operations or related jettison protocols, with which they overlap; these species are not in areas in which any of the other proposed fire retardant activities would occur. The San Diego fairy shrimp has limited distribution, and would be unlikely to be exposed when the pools they inhabit contain water due to the seasonality of these pools filling during the rainy season, which does not coincide with fire season when aerial fire retardant would be loaded onto an aircraft or jettisoned. The dormant cysts, which in essence serve as hard, non-porous shells to guard against desiccation, are very resilient and unlikely to be measurably affected by exposure to fire retardant chemicals. The California freshwater shrimp is found in low elevation, low gradient, freshwater, perennial streams. While there is risk (mortality and sub-lethal effects to reproduction) to aquatic invertebrates from exposure to fire retardant chemicals (Auxilio Management Services, 2021), these habitats are at least 300 feet from the jettison area and are not likely to be inundated with retardant (see discussion below on the Sonoma jettison area). Dietary items for these species include fine particulate organic matter.

The Ramona airtanker base/jettison area, and the Sonoma airtanker base/jettison area are identified as being within range of the San Diego fairy shrimp and the California freshwater shrimp, respectively. All procedures involved with loading the aircraft and releasing retardant (jettison areas) are all within the confines of the Ramona airtanker base. The measures in place at both the Ramona and Sonoma airtanker bases to contain retardant spills and wash-down water, as discussed in Section "Airtanker Bases and Jettison Areas" minimize the likelihood that retardant will enter the vernal pool habitat where the San Diego fairy shrimp is found and therefore are not likely to impact the San Diego fairy shrimp or its forage base. The Sonoma jettison area is on a ridgetop and is more than 300 feet from any waterbody. Therefore, the likelihood that jettisoned retardant will enter the streams where the California freshwater shrimp is found is minimal based on the physical distance from the habitat and will not likely adversely impact this species or its forage base. Therefore, the effects to the San Diego fairy shrimp and the California freshwater shrimp due to airtanker base operations would be discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the San Diego fairy shrimp and the California freshwater shrimp.

Critical habitat

This category includes critical habitat only for the San Diego fairy shrimp, and the vernal pool fairy shrimp.

The USFS determined the Action is not likely to adversely affect critical habitat for the vernal pool fairy shrimp and the San Diego fairy shrimp.

PBFs for the vernal pool fairy shrimp critical habitat include: topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools; isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years; sources of food, expected to be detritus occurring in the pools; and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter. The physical and topographic features of the PBFs for the vernal pool fairy shrimp, such as the land formations, pools or flowing water would not be impacted by applications of fire retardant.

Water quality in aquatic habitats could be impacted by the ammonia or magnesium salt constituents of the retardants. However, water quality-related PBFs were not specified in the critical habitat rule. Additionally, the aquatic habitats would be unlikely to be exposed when pools contain water due to the use of avoidance areas and because the period during which aerial fire retardant would be applied (i.e., the fire season) occurs during the dormant period of the species' life cycle (USDA - USFS, 2020a). In addition, as discussed above, studies conducted by the United States Geological Survey indicate the toxicity of any retardant drops in pools when they are dry would be reduced by weathering events and would not impact water quality when rains occur and refill the vernal pools in critical habitats for this species.

For the above reasons, we anticipate effects to the critical habitat would be discountable or insignificant. Thus, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the critical habitat for the vernal pool fairy shrimp.

The Ramona airtanker base is identified as being within critical habitat for the San Diego fairy shrimp and the PBFs of critical habitat are:

- Vernal pools with shallow to moderate depths (2 to 12 inches) that hold water for sufficient lengths of time (7 to 60 days) necessary for incubation, maturation, and reproduction of the San Diego fairy shrimp, in all but the driest years;
- Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools described above, providing for dispersal and promoting hydroperiods of adequate length in the pools; and
- Flat to gently sloping topography, and any soil type with a clay component and/or an impermeable surface or subsurface layer known to support vernal pool habitat.

Airtanker base operations will not alter the presence of vernal pools, the adjacent uplands, flowing water, the topography, or soils. If retardant enters the vernal pool habitat when it is dry, it could alter the availability and water quality of vernal pool habitat in the following year, however measures are in place to minimize the probability of retardant entering the pools. Fire retardant is not likely to enter the vernal pools when filled as this is during the rainy season, as previously discussed, and the rainy season does not coincide with fire season. In addition, based on studies conducted by the United States Geological Survey, the toxicity of any retardant drops in pools when they are dry would be reduced by weathering events (Puglis, 2020).

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect critical habitat for the San Diego fairy shrimp.

<u>Terrestrial Invertebrates</u>

Species rationales

This category includes the following arachnid and insects: spruce-fir moss spider (*Microhexura montivaga*), rusty patched bumble bee (*Bombus affinis*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), American burying beetle (*Nicrophorus americanus*), Hine's emerald dragonfly (*Somatochlora hineana*), Dakota skipper (*Hesperia dacotae*), Poweshiek skipperling (*Oarisma poweshiek*), and the Carson wandering skipper (*Pseudocopaeodes eunus obscurus*).

We do not anticipate that individuals of the invertebrate species listed above are likely to be exposed to fire retardant chemicals during applications of retardant, due primarily to the use of avoidance areas/buffers that would preclude such exposure to these species, their forage base, and their habitats, and the very limited amounts of retardant use on the USFS units they occupy. For the same reasons, (i.e, limited use/exposure in occupied areas, avoidance areas/buffers), we anticipate that the above terrestrial invertebrates are unlikely to be affected by reductions in food resources, or disturbance from retardant applications.

Avoidance areas/buffers are required for the spruce-fir moss spider, valley elderberry longhorn beetle (based on a required avoidance for all waterbodies), Dakota skipper, Poweshiek skipperling, and the Hine's emerald dragonfly. These species require a 300-foot avoidance buffer and the Hine's emerald dragonfly requires a very large avoidance buffer (i.e., entire areas between ridgetops that parallel occupied fens), that would preclude retardant exposure to these species, their forage base, and their habitats. While the remaining species in the invertebrate category do not have avoidance areas (rusty patched bumble bee and American burying beetle), they are located on USFS units with very low or no retardant usage and are unlikely to be exposed to fire retardant or other related activities either through direct application or through minor reductions in food resources. The rusty patched bumble bee is found on the Midewin National Tallgrass Prairie, the Monongahela National Forest, and the George Washington and Jefferson National Forests, where no application of retardant occurs. Only on the Chippewa National Forest, where the bumble bee is found, is there any retardant use documented and application potential is very low. Similarly, the American burying beetle occupies USFS units (Nebraska and Samuel R. McKelvie National Forests) with very little or no retardant application potential. Where applications do occur, the relative area treated is so extremely small within the forest units (less than 0.01 percent of its land base annually), we anticipate that potential exposure to individuals of these species is extremely unlikely and effects to these species are discountable.

We do not anticipate that individual Carson wandering skippers are likely to be exposed to fire retardant chemicals during airtanker base operations or related jettison protocols, with which they overlap. The Carson wandering skipper is found in alkaline desert seeps dominated by saltgrass. As larval caterpillars, this species feeds solely on the leaves of the saltgrass. Adults nectar on flowering plants therefore need of a freshwater source sufficient to support summer nectar flowers is required for them to complete their lifecycle. Retardant impacts to vegetation that the Carson wandering skipper relies on may include the following:

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

Direct impacts to the species itself could be physical injury or mortality from retardant exposure or the impairment of ability to fly, impairment of ability to breathe, and potential suffocation.

The Carson wandering skipper is within the range of the Minden-Tahoe and Stead-Reno airtanker bases and Minden-Tahoe and Stead-Reno jettison areas. Both of these airtanker bases load retardant on an infrequent basis (i.e., 1 or fewer times in ten years; see Appendix G in this Opinion).

However, based on the procedures in place at all airtanker bases for containing any spills and designated areas for containing wash down water, the likelihood that Carson wandering skippers or their forage base would be exposed to retardant from an airtanker base is very low. In addition, the jettison areas are located on ridgetops where Carson wandering skipper habitat is not located, and any waterbodies they would be near and use as a water source are greater than 300 feet from the jettison area. Any impacts to the Carson wandering skipper at the Minden-Tahoe and Stead-Reno airtanker bases or jettison areas are considered discountable.

For the above reasons, we concur with the USFS's determination that the action may affect, but is not likely to adversely affect the spruce-fir moss spider, rusty patched bumble bee, valley elderberry longhorn beetle, American burying beetle, Hine's emerald dragonfly, Dakota skipper, Poweshiek skipperling, and the Carson wandering skipper.

Critical habitat

Critical habitats for the spruce fir moss spider, Hine's emerald dragonfly, Dakota skipper and Poweshiek skipperling includes PBFs related to habitat type, vegetation and forage base, such as moss or liverwort mats (spider); shallow, small, slow-flowing waterbodies, emergent herbaceous and woody vegetation, sufficient prey-base of aquatic macroinvertebrate (dragonfly); and wet-mesic tallgrass prairie and native grasses (Dakota Prairie National Grasslands), and native forbs for larval host plant and adult nectaring plants (skippers).

Aerial fire retardant is not likely to impact the critical habitats for these species. Moss mats used by the spruce fir moss spider and that are part of its critical habitat are found on the highest peaks (greater than 5,400 feet elevation) in isolated areas that support fir or spruce fir trees in areas that are humid and well-drained in the Pisgah, Cherokee, and Jefferson National Forests. These areas are not typically vulnerable to wildfires and thus would not require the application of fire retardant. Additionally, the spider's critical habitat is located on very low retardant use forests (see above) and requires a 300-foot avoidance buffer. Hine's emerald dragonfly critical habitat is also found on a no or very low use forest (both the Hiawatha National Forest and Midewin National Tallgrass Prairie, and Mark Twain National Forest, respectively). While macroinvertebrate prey and emergent herbaceous species PBFs may be vulnerable to the impacts from fire retardant, areas of critical habitat on the Mark Twain have a 1/2 mile avoidance buffer, and retardant is rarely used in this forest (i.e., retardant was only used twice from 2012-2019). Finally, the Dakota Prairie National Grasslands where the skipper critical habitats occur are also within a very low retardant use USFS unit and both skipper critical habitats have a 300-foot avoidance buffer, further reducing the likelihood of exposure of PBFs to fire retardant and associate activities. If exposed, vegetative structure and communities PBFs are expected to continue to provide habitat functions. Any exposure would be very rare, short-term, and plant species are expected to remain unaffected or recover. Therefore, it is extremely unlikely that retardant use will measurably impact the PBFs of the critical habitat for these two prairie butterflies.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the spruce fir moss spider, Hine's emerald dragonfly, Dakota skipper or Poweshiek skipperling critical habitat.

<u>Molluscs (mussels and snails)</u>

Species rationales

This category includes 33 mussels and 4 snails: Appalachian elktoe (*Alasmidonta raveneliana*); fat three-ridge mussel (*Amblema neislerii*); Ouachita rock pocketbook (*Arkansia wheeleri*); spectaclecase (*Cumberlandia monodonta*); purple bank climber (*Elliptoideus sloatianus*); oyster mussel (the listed entity and its non-essential experimental population) (*Epioblasma capsaeformis*); Curtis pearlymussel (*Epioblasma florentina curtisi*); tan riffleshell (*Epioblasma florentina walkeri*); upland combshell (*Epioblasma metastriata*); southern acornshell (*Epioblasma othcaloogensis*); snuffbox mussel (*Epioblasma triquetra*); finerayed pigtoe (the listed entity and its non-essential experimental population) (*Fusconaia cuneolus*); finelined pocketbook (*Hamiota altilis*); shinyrayed pocketbook (*Hamiota (Lampsilis) subangulata*); pink mucket (*Lampsilis abrupta*); scaleshell mussel (*Leptodea leptodon*); Alabama moccasinshell (*Medionidus acutissimus*); Coosa moccasinshell (*Medionidus parvulus*); Ochlockonee moccasinshell (*Medionidus simpsonianus*); littlewing pearlymussel (*Pegias fabula*); sheepnose mussel (*Plethobasus cyphyus*); southern clubshell (*Pleurobema decisum*); southern pigtoe (*Pleurobema georgianum*); Georgia pigtoe (*Pleurobema hanleyianum*); ovate clubshell (*Pleurobema perovatum*); oval pigtoe (*Pleurobema pyriforme*); slabside pearlymussel (*Pleuronaia dolabelloides*); triangular (rayed) kidneyshell (*Ptychobranchus greenii* (*P. foremanianus*)); fluted kidneyshell (*Ptychobranchus subtentum*); rabbitsfoot (*Quadrula cylindrica cylindrica*); Cumberland bean (the listed entity and its non-essential experimental population) (*Villosa trabalis*); Atlantic pigtoe (*Fusconaia masoni*); western fanshell (*Cyprogenia aberti*); Tumbling creek cave snail (*Antrobi culveri*); Anthony's river snail (the listed entity and its non-essential experimental population) (*Athearnia anthonyi*); noonday globe (*Patera (Mesodon) clarki nantahala*); and Alamosa spring snail (*Tryonia alamosae*).

Individuals of the mussel and snail species listed above are not likely to be exposed to fire retardant chemicals during applications of retardant, due primarily to the use of avoidance buffers that would preclude such exposure to these species, their forage base, host fish (where applicable), and their habitats. In addition, all of the mussels and snails are located on forest units with no to low retardant use except for the Alamosa springsnail located on the Cibola National Forest which is a moderate retardant use forest. For the Alamosa springsnail, the Cibola National Forest has not reported any intrusions of retardant into avoidance areas in the last eight years. The forest has more than one retardant drop a year, and thus an intrusion could occur. However, because the occupied habitat is approximately 0.6 miles from the forest boundary, an avoidance area will be used, and we do not anticipate risk from runoff use of aerial retardant (see the risk assessment, (Auxilio Management Services, 2021) any effects to these mussels and snails are discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the Appalachian elktoe, fat three-ridge mussel, Ouachita rock pocketbook, spectaclecase, purple bank climber, oyster mussel, Curtis pearlymussel, tan riffleshell, upland combshell, southern acornshell, snuffbox mussel, finerayed pigtoe, finelined pocketbook, shinyrayed pocketbook, pink mucket, scaleshell mussel, Alabama moccasinshell, Coosa moccasinshell, Ochlockonee moccasinshell, littlewing pearlymussel, sheepnose mussel, southern clubshell, southern pigtoe, Georgia pigtoe, ovate clubshell, oval pigtoe, slabside pearlymussel, triangular (rayed) kidneyshell, fluted kidneyshell, rabbitsfoot, Cumberland bean, Atlantic pigtoe, western fanshell, Tumbling creek cave snail, Anthony's river snail, noonday globe, and Alamosa spring snail.

Critical habitat

The USFS determined the Action is not likely to adversely affect critical habitats for the following mussels: Appalachian elktoe; Atlantic pigtoe; fat three-ridge mussel; purple bank climber; finelined pocketbook; Alabama moccasinshell; southern clubshell; southern pigtoe; Georgia pigtoe; slabside pearlymussel; triangular (rayed) kidneyshell; fluted kidneyshell; rabbitsfoot; and western fanshell.

Most PBFs for mussel critical habitats involving structural characteristics of critical habitat (substrate, stream channel, etc.) will not be impacted by aerial retardant, although water quality and fish host availability, which are PBFs of these critical habitats, could be impacted where aerial fire retardants are applied on or near aquatic habitats. However, we anticipate any such effects are extremely unlikely to occur due to the establishment of avoidance areas that serve as buffers to the critical habitats. All aquatic PBFs have required avoidance mapping that extends at least 300 feet from the aquatic habitat. In some instances, they are extended to larger distances, such as the 500-feet buffers on the Cherokee, Ozark, Ouachita National Forests. The Mark Twain National Forest implemented ridgetop to ridgetop avoidance areas, or a minimum of ¼ mile-wide areas for all critical habitat units and areas occupied by threatened and endangered species. The George Washington and Jefferson National Forests have a retardant avoidance area that includes the entire 6th-field watersheds (sub-watershed) around occupied habitat and designated critical habitat. The National Forests in North Carolina have 1,500-foot buffers around occupied areas and designated critical habitat for all listed species. These wider avoidance areas are expected to further reduce the probability of retardant entering water and causing any increases in ammonia that would be toxic to the mussels' fish hosts, which are identified as PBFs, or that would impair the water quality-related PBFs of the critical habitat for these mussels. Although aerially delivered retardant poses a toxicity risk to fish hosts for the mussels (Auxilio Management Services, 2021), where exposure occurs, the very low retardant application potential along with expanded avoidance areas reduce the probability of retardant entering habitat to levels where any effects to PBFs would be discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the critical habitat for the Appalachian elktoe, Atlantic pigtoe, fat three-ridge mussel, purple bank climber, finelined pocketbook, Alabama moccasinshell, southern clubshell, southern pigtoe, Georgia pigtoe, slabside pearlymussel, triangular (rayed) kidneyshell, fluted kidneyshell, western fanshell, and rabbitsfoot.

Fish

Species rationales

This category includes the following fish species: white sturgeon - Kootenai River population (*Acipenser transmontanus*); Warner sucker, (*Catostomus warnerensis*); June sucker (*Chasmistes liorus*); blue shiner, (*Cyprinella caerulea*); spotfin chub (the listed entity and its non-essential experimental population) (*Erimonax monachus*); Etowah darter (*Etheostoma etowahae*); dusky tail darter (the listed entity and its non-essential experimental population) (*Etheostoma percnurum*); Rio Grande silvery minnow (*Hybognathus amarus*); smoky madtom (*Noturus baileyi*); yellowfin madtom (*Noturus flavipinnis*); amber darter (*Percina antesella*); goldline darter (*Percina aurolineata*); Conasauga logperch (*Percina jenkinsi*); snail darter (*Percina tanasi*); Kendall Warm Springs dace (*Rhinichthys osculus thermalis*); pallid sturgeon (*Scaphirhynchus albus*), and the Arkansas River shiner (*Notropis girardi*).

In addition, the following species are present on or near airtanker base or jettison areas: beautiful shiner (*Cyprinella formosa*); Pecos gambusia (*Gambusia nobilis*); Virgin River chub (*Gila seminuda*); delta smelt (*Hypomesus transpacificus*); Big Spring spinedace (*Lepidomeda mollispinis pratensis*); peppered chub (*Machrhybopsis tetranema*); Pecos bluntnose shiner (*Notropis simus pecosensis*); Topeka shiner (*Notropis topeka*); woundfin (*Plagopterus argentissimus*).

We do not anticipate that individuals of the fish species listed above will be exposed to fire retardant chemicals during applications of retardant or airtanker base and jettison operations, due primarily to the use of avoidance buffers that would preclude such exposure to these species, their forage base, and their habitats. Some species have even wider avoidance buffers than the standard 300-foot buffers for all water bodies (e.g., a ½ mile buffer for the Kendall Warm Springs dace on the Bridger-Teton National Forest, 500-foot buffers for the yellowfin madtom on the Cherokee National Forest). In addition, many of these fish species are found in larger rivers and streams and the risk assessment indicated there are no risks to threatened or endangered fish species such as the pallid sturgeon, amber darter, duskytail darter, Rio Grande silvery minnow, snail darter, and spotfin chub in large systems (with flow over 350 cubic feet per second). Long-term impacts from these retardants in the unlikely event exposure occurs are also less likely to occur because these materials are not repeatedly applied, would degrade over time, and would disperse in a flowing water body. For the MgCl-based products, the risk to fish is low, but risk would be greater if an accidental spill into a small stream were to occur at ≥ 6 GPC (Auxilio Management Services, 2021). However, such an event is extremely unlikely to occur with the required avoidance mapping USFS incorporated for all waterbodies.

In addition, we do not anticipate that individuals of the subset of fish species identified above will be exposed to fire retardant chemicals during operations at airtanker bases, due primarily to the measures in place at airtanker bases to contain retardant spills and wash-down water which would preclude such exposure to these species, their forage base, and their habitats. In addition, some of these fish species are found in larger rivers and streams and the risk assessment indicated there are no risks to threatened or endangered fish species that inhabit large systems (with flow over 350 cubic feet per second) such as the Pecos bluntnose shiner, Virgin River chub, peppered chub, delta smelt, Arkansas River shiner, and woundfin (found in the Pecos

River, Virgin River, Canadian River, Sacramento/San Joaquin Rivers, Arkansas River, and Virgin River, respectively). For the MgCl-based products, the risk to fish is low (Auxilio Management Services, 2021). Furthermore, such an event is extremely unlikely to occur with the required measures in place at airtanker bases to contain retardant spills and wash-down water incorporated for all fire retardant operations at airtanker bases. For species where the jettison areas are located outside of the airtanker bases, all waterbodies where the habitats for these fish are found are more than 300 feet from airtanker base activities, and unlikely to receive runoff or otherwise be affected. Dietary items among these fish species vary considerably and include young fish, amphipods, dipterans, cladocerans, filamentous algae, spiders, detritus, insect larvae, other plant material, plant seeds, and mollusks. While adverse risks to young fish, and other small aquatic invertebrates are known (mortality, growth, reproduction; (Auxilio Management Services, 2021), the likelihood of these effects occurring is extremely low due to measures in place at airtanker bases to contain washdown water or spills as well as any jettison area being at least 300 feet from any waterbody.

Several airtanker bases and jettison areas overlap with the range of listed fish species, but are either sufficiently far from the waterbodies these species inhabit, or include measures or other consideration that reduce the likelihood of exposure to discountable levels. Silver City airtanker base is identified as being within the range of the beautiful shiner, but the species range does not overlap with any identified off-site jettison areas. Roswell airtanker base and Roswell jettison area are identified as being within range of the Pecos gambusia and Pecos bluntnose shiner. The Roswell airtanker base is approximately 9 miles from the Pecos River, while the jettison area is more than 20 miles from any waterbodies, and is used only occasionally. Mesquite SEAT airtanker base is within the range of Virgin River chub and the woundfin, but the ranges for these species do not overlap with any identified off-site jettison areas. Furthermore, the Mesquite SEAT airtanker base does not use retardant very frequently. Chico airtanker base, Fresno airtanker base, Fresno jettison area, Grass Valley airtanker base, Grass Valley jettison area, McClellan airtanker base, Porterville airtanker base and Ukiah jettison area are all identified as being within range of the delta smelt. All of these airtanker bases are utilized for retardant activities frequently (Appendix G in this Opinion). However, all airtanker bases have measures in place to contain washdown water or spills and any waterbodies within the vicinity of the jettison areas are located 300 feet or more from any waterbody. Panaca airtanker base is within the range of the Big Spring spinedace. This species range does not overlap with any identified off-site jettison areas. Panaca airtanker base is not a heavily used airtanker base for retardant activities (a rate of 0.4 times used in 10 years time frame or 4 years out of 10 years). Amarillo jettison area is identified as being within range of the peppered chub. The Amarillo jettison area is within the Canadian River watershed, but is more than 10 miles from the Canadian River. The Valentine SEAT airtanker base in Nebraska is identified as being within range of the Topeka shiner. This species range does not overlap with any identified off-site jettison areas. The Valentine airtanker base is also a very low frequency use airtanker base (see Appendix G in this Opinion). Therefore, any impacts to these fish species from activities at the airtanker bases or jettison areas within the vicinity of their range are considered discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect, the white sturgeon - Kootenai River population, Warner sucker, June sucker, blue shiner, spotfin chub, Etowah darter, dusky tail darter, Rio Grande silvery minnow, smoky madtom, yellowfin madtom, amber darter, goldline darter, Conasauga logperch, snail darter, Kendall Warm Springs dace, pallid sturgeon, beautiful shiner (*Cyprinella Formosa*)Pecos gambusia,Virgin River chub, delta smelt, Big Spring spinedace, peppered chub, Pecos bluntnose shiner, Topeka shiner, Arkansas River shiner, and woundfin.

Critical habitat

This category also includes the critical habitats for Warner sucker (*Catostomus warnerensis*), June sucker, spotfin chub (*Erimonax monachus*), smoky madtom (*Noturus baileyi*), and Conasauga logperch (*Percina jenkinsi*).

The designated critical habitats for the fish species listed above consist of these general PBFs: high quality water habitat with adequate flow free from silt, adequate substrate type needed (gravel, rubble, etc.), and proper depth (depending on the species). Aerial fire retardant is not likely to impact the physical features such as water flow, depth, or substrate type associated with these critical habitats. The likelihood of retardants entering these areas is also low as previously discussed due to the required avoidance mapping for all waterbodies. Some of these critical habitats are also only adjacent to, and not within, National Forest units and are therefore less likely to be impacted by the application of fire retardant. Many of these critical habitats are also either found on low or very low retardant use forests (e.g., the Cherokee National Forest and George Washington and Jefferson National Forests, respectively) or National Forests in North Carolina which do not use aerial retardant. These forests also maintain very large avoidance buffers beyond the standard 300-foot avoidance (i.e., 500-foot buffers around spot fin chub designated critical habitats on the Cherokee National Forest). Therefore, we anticipate effects to the critical habitats for these fishes would be discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the critical habitat for the Warner sucker, June sucker, spotfin chub, smoky madtom, and Conasauga logperch.

<u>Reptiles</u>

Species rationales

We do not anticipate that individuals of the reptile species listed below are likely to be exposed to fire retardant chemicals during applications of retardant, due primarily to their fossorial lifestyle, and the use of avoidance buffers that would preclude such exposure to these species, their forage base, and their habitats. This category includes: the New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*); eastern indigo snake (*Drymarchon couperi*); narrow-headed garter snake (*Thamnophis eques megalops*); blunt-nosed leopard lizard (*Gambelia sila*); desert tortoise (*Gopherus agassizii*); northern Mexican garter snake (*Thamnophis eques megalops*), and the giant garter snake (*Thamnophis gigas*).

These listed reptiles are found on National Forests with retardant use that ranges from none to high and two have required avoidance buffers around occupied areas from 300 to 600 feet, or on or near airtanker bases in the case of the giant garter snake. For example, the blunt-nosed leopard lizard, with 300-foot buffers to minimize impacts from retardant use to the species, their food base, and habitat, and the northern Mexican garter snake with similar 600-foot buffers. The blunt-nosed leopard lizard is active during the months of fire season for USFS Region 5, however they spend most of their time in burrows underground where they feed, hibernate, and lay their eggs. The 300-foot avoidance buffer is implemented for occupied sites to further reduce exposure to fire retardant applications. The northern Mexican rattlesnake is a riparian obligate species that forages (prey items are native fish and adult and larval leopard frogs, earthworms, leeches, lizards, small rodents, salamanders, and treefrogs) along the banks of waterbodies. The 600-foot buffer is implemented specifically to include all occurrences and the riparian features of the critical habitat for this species, which we anticipate will greatly reduce the likelihood of exposure for this species. Thus, we do not anticipate that these species are likely to be exposed to aerial fire retardant in their habitats and effects are considered discountable.

The other three reptile species in this section do not require avoidance mapping, or avoidance mapping would be less feasible due to the wide ranging nature of the species. In these cases, we nonetheless anticipate individuals of each of these species are extremely unlikely to be impacted due to other life history considerations. For example, for these remaining three species without avoidance mapping, some are able to escape both fire and fire retardant applications by retreating into their underground burrows, such as the narrow-headed garter snake, desert tortoise, and New Mexico ridge-nosed rattlesnake. Furthermore, some would not be expected to nest or have their young during the fire season (i.e., the New Mexico ridge-nosed rattlesnake give birth in July and August, also outside the fire season for USFS Region 3). For some species, fires (and thus the need for fire retardants) are rare in the habitats in which they occur or during the months when they are most active and they are able to forage in areas other than where localized retardant drops would occur (e.g., desert tortoise, New Mexican ridge-nosed rattlesnake, eastern indigo snake). Use of retardant can also have beneficial effects to habitat for species by helping to control wildfires and limiting loss of habitat. Finally, we anticipate that any application of retardant impacting habitat, or other species (e.g., prey and other food resources) upon which these reptile species rely, would be extremely limited in time and spatial extent, and would not result in measurable effects to either the habitat quality or food availability for these species. Thus, we anticipate that all effects to individuals of these species would be insignificant or discountable.

Lastly, we do not anticipate that the giant garter snake is likely to be exposed to fire retardant chemicals during airtanker base operations. The giant gartersnake is endemic to wetlands of California’s Central Valley and inhabits marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways and agricultural wetlands, such as irrigation and drainage canals, rice fields, and the adjacent uplands. They feed on small fishes, tadpoles, and frogs (NatureServe 2022).

Chico airtanker base, Fresno airtanker base, McClellan airtanker base and Porterville airtanker base are all identified as being within this species’ range; the species does not overlap with any identified off-site jettison areas. While these are moderate to higher use airtanker bases, all airtanker bases have measures in place to contain retardant spills and wash-down water that would preclude such exposure to these species, their forage base, and their habitats. The prey items for the giant garter snake are at risk from retardant where exposure occurs (Auxilio Management Services, 2021); however, the likelihood these prey items would be exposed to retardant is extremely low due to the measures in place within the confines of the airtanker base grounds if giant garter snakes were to feed within airtanker base grounds.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the New Mexico ridge-nosed rattlesnake; eastern indigo snake, narrow-headed garter snake, blunt-nosed leopard lizard, desert tortoise, northern Mexican garter snake, and the giant garter snake.

Critical habitat

The USFS determined the Action is not likely to adversely affect critical habitat for the northern Mexican garter snake (*Thamnophis eques megalops*) and narrow-headed garter snake (*Thamnophis eques megalops*). PBFs for these species include perennial streams, woody debris, riparian vegetation, small mammal burrows, a large and small vertebrate and invertebrate prey base, and ponds with ephemeral channels that allow for periodic flooding with high quality water that meets or exceeds state water quality standards.

Aerially-delivered retardant will not affect the majority of the PBFs of the designated critical habitat for the northern Mexican garter snake and the proposed critical habitat for the narrow-headed garter snake. Streams and waterbodies are protected with standard avoidance areas. Retardant impacts to vegetation may include fertilization and can result in changes to species composition and increases in invasive non-native plant species. However, the vegetative critical habitat PBFs are in riparian areas, where retardant applications are unlikely to be applied and 300-foot avoidance buffers for all waterbodies in the critical habitat will be implemented. Therefore, impacts to critical habitat are anticipated to be discountable or insignificant.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the critical habitat for the northern Mexican garter snake and narrow-headed garter snake.

<u>Marine Species</u>

Species rationales

This category includes the loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), olive ridley sea turtle (*Lepidochelys olivacea*), West Indian manatee (*Trihechus manatus*), and southern sea otter (*Enydra lutris nereis*).

Marine species such as sea turtles, manatees, and the southern sea otter rarely occur within the boundaries of National Forest System Lands. For sea turtles that do come onto beaches that have a small portion of their suitable habitat on a national forest, the main impact of aerial retardant use would be disturbance to nesting or basking turtles. The loggerhead, green, hawksbill, olive ridley, and leatherback sea turtle all nest at night on beaches. Therefore, disturbance would not occur during nesting activities for these species, as fire retardant is applied during daylight hours. In addition, these species are highly unlikely to attempt nesting activities on beaches adjacent to a wildlfire. For those species that occur on the Los Padres and Siskiyou National Forests (high retardant use forests), avoidance mapping is required for all beach-shoreline areas in these forests. Therefore, disturbance to nesting and basking turtles on all of these forest shorelines is so minimal as to be considered discountable.

Kemp's ridley sea turtle is the only turtle that nests during daylight hours, when retardant is applied. However, because of the limited land base of beaches on the National Forests where they are found, the rarity of nesting in that limited area, and the retardant use potential in these forests, the likelihood that Kemp's ridley sea turtle would be disturbed by retardant use on these forests would rarely occur and is therefore discountable.

All of these species bask during the day and thus disturbance is possible but will be infrequent. However, retardant would not be used on beaches (although beaches may be used as an anchor point for retardant application in adjacent vegetation). These sea turtles rarely come ashore, and beach areas on National Forests are a very small percentage of the land base. In addition, beach-shoreline areas are all mapped as avoidance areas for the high retardant use forests (Los Padres and Siskiyou Forests) to mitigate any potential impacts of aerial retardant use, as well as any disturbance from the aircraft noise; therefore, any impacts to basking turtles from retardant use and including disturbance from the aircraft delivering the retardant would be so minimal that it is appropriately considered discountable.

The southern sea otter rarely comes on shore but occurs in the Monterey Ranger District of the Los Padres National Forest, which contains Bixby Creek and beach for the protection of the southern sea otter (Krueger, 2020). The Bixby Creek beach area has an avoidance area with a 300-foot buffer to minimize noise-related disturbance. Disturbance from low-flying aircraft noise associated with retardant drops in the vicinity of the beach may cause sea otters to leave the haul out area and return to the ocean; however, we do not anticipate any measurable adverse effects to the species from this activity.

Similarly, where habitat for the West Indian manatee is found (at the mouths of rivers on National Forest System Lands) there are required mapped avoidance areas for all aquatic areas, and these areas are situated where fires are not likely to occur. Thus, while individuals may be found within or adjacent to some National Forest System Lands (Apalachicola and Ocala National Forests in Florida, the Francis Marion National Forest in South Carolina, and the Croatan National Forest in North Carolina), these are forests with no to very low potential retardant use. Thus, any impacts to water quality would be extremely rare and any disturbance from the remaining stressor (aircraft noise) would be so minimal as to be considered insignificant, as this species spends most of its time submerged.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, olive ridley sea turtle, West Indian manatee, and southern sea otter.

Critical habitat

There are no marine turtle critical habitats that occur on National Forest System Lands and thus none were determined to be NLAA for this consultation. The southern sea otter does not have designated critical habitat.

West Indian manatee critical habitat was designated in 1977 but no specific PBFs or PCEs were identified. Manatee habitat includes shallow coastal waters, estuaries, bays, rivers, and lakes and thus we assume critical habitat to include these types of water bodies as well as an abundant forage base of submerged aquatic vegetation. Mapped avoidance areas are required where designated critical habitat for the West Indian manatee is found based on standard requirements for water bodies on or adjacent to National Forest System Lands. Therefore, impacts to designated critical habitat is unlikely to occur due to the avoidance mapping required for all waterbodies and effects are considered discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the critical habitat for the West Indian manatee.

Plants and Lichen

Species rationales

This category includes the following species: Sonoma alopecurus (*Alopecurus aequalis var. sonomensis*), San Diego ambrosia (*Ambrosia pumila*), Shale barren rockcress (*Arabis (Boechera) serotina*), Mead's milkweed (*Asclepias meadii*), Osterhout milkvetch (*Astragalus osterhoutii*), San Jacinto Valley crownscale (*Atriplex coronata var. notatior*), Sonoma sunshine (*Blennosperma bakerii*), Florida bonamia (*Bonamia grandiflora*), white sedge (*Carex albida*), Hoover's spurge (*Chamaesyce hooveri*), Sonoma spineflower (*Chorizanthe valida*), La Graciosa thistle (*Cirsium loncholepis*), Pennell's bird's-beak (*Cordylanthus tenuis ssp. capillaris*), Pima pineapple cactus (*Coryphantha scheeri var. robustispina*), smooth purple coneflower (*Echinacea laevigata*), Kuenzler hedgehog cactus (*Echinocereus fendleri var. kuenzleri*), Arizona hedgehog cactus (*Echinocereus triglochidiatus var. arizonicus*), Lompoc yerba santa (*Eriodictyon capitatum*), scrub buckwheat (*Eriogonum longifolium var. gnaphalifolium*), Zuni fleabane (*Erigeron rhizomatus*), San Diego button celery (*Eryngium aristulatum var. parishii*), Penland alpine fen mustard (*Eutrema penlandii*), Pine Hill flannel bush (*Fremontodendron californicum ssp. decumbens*), Gentner mission bells (*Fritillaria gentneri*), Spreading avens (*Geum radiatum*), Rock gnome lichen (*Gymnoderma lineare*), Harper's beauty (*Harperocallis flava*), Virginia sneezeweed (*Helenium virginicum*), Pecos sunflower (*Helianthus paradoxus*), Schweintz's sunflower (*Helianthus schweinitzii*), swamp pink *(Helonias bullata*), Neches River rose mallow (*Hisbiscus dasycalyx*), Mountain bluet (*Houstonia montana*), Roan mountain bluet (*Houstonia purpurea var. montana* (*Hedyotis purpurea var. montana*)), water howellia (*Howellia aquatilis*), mountain golden heather (*Hudsonia montana*), Pagosa skyrocket (*Ipomopsis polyantha*), small whorled pogonia (*Isotria medeoloides*), Burke's goldfields (*Lasthenia burkei*), Contra Costa goldfields (*Lasthenia conjugens*), white bladderpod (*Lesquerella pallida*), Heller's blazing star (*Liatris helleri*), Pitkin marsh lily (*Lilium pardalinum ssp. pitkinense*), Butte County meadowfoam (*Limnanthes floccosa ssp. californica*), large-flowered woolly meadowfoam (*Limnanthes pumila ssp. grandiflora*); Sebastopol meadowfoam (*Limnanthes vinculans*); Cook's lomatium (*Lomatium cookii*), Kincaid's lupine (*Lupinus oreganus var. kincaidii* (*Lupinus sulphureus ssp. kincaidii*)), rough-leaved loosestrife (*Lysimachia asperulaefolia*), whitebirds-in-a-nest (*Macbridea alba*), willowy monardella (*Monardella viminea*); many-flowered navarretia (*Navarretia eucocephala ssp. plieantha*), beardless chinchweed (*Pectis imberbis*), Knowlton's cactus (*Pediocactus knowltonii*), Fickeisen plains cactus (*Pediocactus peeblesianus var. fickeisenii*), blowout penstemon (*Penstemon haydenii*), DeBeque phacelia (*Phacelia scopulina var. submutica (Phacelia Penstemon haydenii submutica*)), Godfrey's butterwort (*Pinguicula ionantha*), whitebark pine (*Pinus albicaulis*), Ruth's golden-aster (*Pityopsis ruthii*), white fringeless orchid (*Platanthera integrilabia*), Lewton's polygala (*Polygala lewtonii*), western prairie fringed orchid (*Platanthera praeclara*), Maguire primrose (*Primula cusickiana var. maguirei*), Arizona cliffrose (*Purshia subintegra*), Leedy's roseroot (*Rhodiola integrifolia ssp. Leedyi*), Chapman's rhododendron (*Rhododendron minus var. chapmanii*), Colorado hookless cactus (*Sclerocactus glaucus*), Florida skullcap (*Scutellaria floridana*), San Francisco peaks groundsel (San Francisco ragwort) (*Packera franciscana*), Blue Ridge goldenrod (*Solidago spithamaea*), Virginia spiraea (*Spiraea virginiana*), Ute ladies' tresses orchid (*Spiranthes diluvialis*), Navasota ladies' tresses (*Spiranthes parksii*), showy Indian clover (*Trifolium amoenum*), running bufalo clover (*Trifolium stoloniferum*), and Relict trillium (*Trillium reliquum*).

These species, along with information on their location in National Forests, distribution, avoidance areas and the rationales for USFS's determinations are summarized in **Table 2**.

Table 2. Summary of all plant species and/or their critical habitat with a May Affect, Not Likely to Adversely Affect determination (adapted from Table 40 from the BA). Species with "N/A" in the Occurrence column overlap airtanker bases or jettison areas

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
Arizona cliffrose	E	*Purshia (Cowania) subintegra*	3	Coconino, Tonto	N	Y	N	Habitat
Arizona hedgehog cactus	E	*Echinocereus triglochidiatus var. arizonicus*	3	Tonto	N	N	N	Habitat
beardless chinchweed	E; CH	*Pectis imberbis*	3	Coronado	N	Y	N/N	Habitat
blowout penstemon	E	*Penstemon haydenii*	2	Nebraska (known), Medicine	N	N-Nebraska, Y-Medicine Bow-Routt	Y	LRUF

[4] T=Threatened, E=Endangered, PT=Proposed Threatened, CH= Designated Critical Habitat, PCH=Proposed Critical Habitat N = No, Y = Yes, LRUF = Low Retardant Use Forest, Measures = airtanker base has protocols in place to contain retardant spills or wash-down water, Habitat = species is not in a location where retardant would be jettisoned or species is not located on an airtanker base, No surveys = habitat does not indicate species would be present but no specific surveys were completed to confirm their presence or absence.

[5] Populations of individuals in a single isolated area refers to a narrow endemic or isolated population occurring only in a single small geographic area, on a National Forest where it may experience an aerial retardant drop because of accidental intrusion or use of an exception, and would be most vulnerable to impacts.

[6] Rationale is tied to the National Effects Screening Process section for terrestrial species, and relies on a combination of retardant application potential and vulnerability due to isolation/narrow endemic, habitat type, or

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
				Bow-Routt (suspected)				
Blue Ridge goldenrod	T	*Solidago spithamaea*	8	Cherokee, National Forests in North Carolina	N	N	Y	LRUF/Habitat
Burke's goldfields	E	*Lasthenia burkei*	5	N/A	N/A	N/A	N/A	No surveys
Butte County meadowfoam	E, CH	*Limnanthes floccosa ssp. californica*	5	N/A	N/A	N/A	N/A	No surveys
Chapman's rhododendron	E	*Rhododendron minus var. chapmanii (Rhododendron chapmanii)*	8	Suspected on National Forests in Florida	N	Y	N	LRUF/Habitat
Colorado hookless cactus	T	*Sclerocactus glaucus*	2	Grand Mesa-Uncompaghre, suspected on White River	N	N- Grand Mesa Uncompahgre, Y- White River	Y	LRUF
Contra Costa goldfields	E, CH	*Lasthenia conjugens*	5	N/A	N/A	N/A	N/A	Habitat, No surveys
Cook's lomatium	E, CH	*Lomatium cookii*	6	N/A	N/A	N/A	N/A	Measures
DeBeque phacelia	T, CH	*Phacelia scopulina var. submutica (Phacelia submutica)*	2	GrandMesa-Umcompahgre, White River	N	N	Y	LRUF
Fickeisen plains cactus	E, CH	*Pediocactus peeblesianus var. fickeisenii*	3	Kaibab	N	N	Y	LRUF

other factors as displayed in the table. Codes used are: Habitat = various specific conditions including species in habitats not likely to receive retardant, or protected within aquatic avoidance area, or suspected but not confirmed on National Forest System lands (see individual species discussions in the BA for details).

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
Florida bonamia	T	*Bonamia grandiflora*	8	National Forests in Florida	N	N	Y	LRUF
Florida skullcap	T	*Scutellaria floridana*	8	National Forests in Florida	N	N	Y	LRUF
Gentner mission-bells	E	*Fritillaria gentneri*	5, 6	Rogue River Siskiyou, suspected Klamath	N	Y	N	Habitat
Godfrey's butterwort	T	*Pinguicula ionantha*	8	National Forests in Florida	N	N	Y	LRUF
Harper's beauty	E	*Harperocallis flava*	8	National Forests in Florida	N	N	Y	LRUF
Heller's blazing star	T	*Liatris helleri*	8	National Forests in North Carolina	N	N	Y	LRUF
Hoover's spurge	T, CH	*Chamaesyce hooveri*	5	N/A	N/A	N/A	N/A	Measures, No surveys
Kincaid's lupine	T, (CH)	*Lupinus oreganus var. kincaidii (Lupinus sulphureus ssp. kincaidii)*	6	Umpqua, suspected on Siuslaw	N	Y	Y/ CH is NE, not on NFSL	Retardant use, habitat in retardant prone area
Knowlton's cactus	E	*Pediocactus knowltonii*	2,3	N/A	N/A	N/A	N/A	No surveys
Kuenzler hedgehog cactus	E	*Echinocereus fendleri var. kuenzleri*	3	Lincoln	N	Y	Y	Habitat
La Graciosa thistle	E, CH	*Cirsium loncholepis*	5	N/A	N/A	N/A	N/A	Measures
large-flowered woolly	E, CH	*Limnanthes pumila ssp. grandiflora*	6	N/A	N/A	N/A	N/A	Measures

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
meadowfoa m								
Leedy's roseroot	T	*Rhodiola integrifolia ssp leedyi*	2	Black Hills	N	N	Y	LRUF/Habi tat
Lewton's polygala	E	*Polygala lewtonii*	8	National Forests in Florida	N	N	Y	LRUF
Lompoc yerba santa	E, CH	*Eriodictyon capitatum*	5	N/A	N/A	N/A	N/A	Measures, No surveys
Maguire primrose	T	*Primula maguirei*	4	Uinta-Wasatch-Cache	Y	Y	Y	Habitat – populations in area where retardant would not be applied
many-flowered navarretia	E	*Navarretia eucocephala ssp. plieantha*	5	N/A	N/A	N/A	N/A	No surveys
Mead's milkweed	T	*Asclepias meadii*	9	Mark Twain, Midewin, Shawnee	N	N	Y	LRUF
mountain golden heather	T, CH	*Hudsonia montana*	8	National Forests in North Carolina	N	N	Y/Y	LRUF
Navasota ladies'-tresses	E	*Spiranthes parksii*	8	National Forests in Texas	N	N	Y – if identified on NFSL	LRUF
Neches River rose mallow	T,C H	*Hisbiscus dasycalyx*	8	Davey Crockett National Forests in Texas	N	N	Y/Y	LRUF
Osterhout milkvetch	E	*Astragalus osterhoutii*	2	Suspected on Arapaho, Medicine Bow-Routt	N	N	N- only suspected	LRUF

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
Pagosa skyrocket	E, CH	*Ipomopsis polyantha*	2	Suspected on San Juan	N	Y	If found on Forest, will be avoidance mapped/Y 300'buffer	LRUF/Habitat
Pecos sunflower	T, CH	*Helianthus paradoxus*	3, 8	N/A	N/A	N/A	N/A	Measures, Low use
Penland alpine fen mustard	T	*Eutrema penlandii*	2	Pike San Isabel, White River	N	N	Y	LRUF
Pennell's bird's-beak	E	*Cordylanthus tenuis ssp. capillaris*	5	N/A	N/A	N/A	N/A	Habitat, No surveys
Pima pineapple cactus	E	*Coryphantha scheeri var. robustispina*	3	Coronado	N	Y	N	Habitat
Pine Hill flannel bush	E	*Fremontodendron californicum ssp. decumbens*	5	N/A	N/A	N/A	N/A	Habitat, No surveys, Measures
Pitkin marsh lily	E	*Lilium pardalinum ssp. pitkinense*	5	N/A	N/A	N/A	N/A	No surveys
relict trillium	E	*Trillium reliquum*	8	Oconee	N	N	Y - is in the proclamation boundary of the Francis Marion NF	LRUF
running buffalo clover	E	*Trifolium stoloniferum*	8,9	Daniel Boone, Wayne, Mark Twain, Monongahela	N	N	Y on Mark Twain, N Wayne and Monongahela	LRUF
Roan Mountain bluet	E	*Hedyotis purpurea var. montana)*	8	National Forests in North Carolina, Cherokee	N	N	Y	LRUF/Habitat
Rock gnome lichen	E	*Gymnoderma lineare*	8	Chattahoochee-Oconee, Cherokee, George	N	N	Y	LRUF/Habitat

Common Name	**Federal Status and Critical Habitat[4]**	**Scientific Name**	**FS Region**	**Occurrence on Forest or State with National Forest**	**Populations or individuals in single**	**retardant use 0.01% or more land base annually[2]**	**Mapped Avoidance Areas (Species/CH)**	**Rationale for Determination[6]**
				Washington-Jefferson, National Forests in North Carolina				
rough-leaved loosestrife	E	*Lysimachia asperulaefolia*	8	National Forests in North Carolina	N	N	Y	LRUF
Ruth's golden-aster	E	*Pityopsis ruthii*	8	Cherokee	2 watersheds	Y	Y	Habitat
San Diego ambrosia	E, CH	*Ambrosia pumila*	5	N/A	N/A	N/A	N/A	Habitat, Measures, No surveys
San Diego button celery	E	*Eryngium aristulatum var. parishii*	5	N/A	N/A	N/A	N/A	Habitat, No surveys, Measures
San Francisco peaks groundsel (San Francisco ragwort)	T, CH	*Senecio franciscanus (Packera franciscana)*	3	Coconino	N	Y	N/N	Habitat
San Jacinto Valley crownscale	E, CH	*Atriplex coronata var. notatior*	5	N/A	N/A	N/A	N/A	Habitat, Measures, No surveys
Schweinitz's sunflower	E	*Helianthus schweinitzii*	8	National Forests in North Carolina	N	N	Y	LRUF
Scrub buckwheat	T	*Eriogonum longifolium var. gnaphalifolium*	8	National Forests in Florida	N	N	Y	LRUF
Sebastopol meadowfoam	E	*Limnanthes vinculans*	5	N/A	N/A	N/A	N/A	Measures

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
Shale barren rock-cress	E	*Arabis (Boechera) serotina*	8, 9	George Washington-Jefferson, Monongahela	N	N	N	LRUF
showy Indian clover	E	*Trifolium amoenum*	5	N/A	N/A	N/A	N/A	Habitat, No survey
small whorled pogonia	T	*Isotria medeoloides*	8,9	White Mountain., Monongahela, suspected or known on Wayne, Allegheny, Chattahoochee-Oconee, Cherokee, George Washington-Jefferson, National Forests in North Carolina, Francis-Marion Sumter	N	N	Y	LRUF/Habitat
Smooth purple coneflower	E	*Echinacea laevigata*	8	George Washington-Jefferson, Chattahoochee -Oconee, Francis-Marion-Sumter National Forests and suspected on the National Forests in North Carolina	N	N	Y (Francis-Marion only)	LRUF/Habitat
Sonoma alopecurus	E	*Alopecurus aequalis var. sonomensis*	5	N/A	N/A	N/A	N/A	Measures, No surveys

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
Sonoma sunshine	E	*Blennosperma bakerii*	5	N/A	N/A	N/A	N/A	Measures, No surveys
Sonoma spineflower	E	*Chorizanthe valida*	5	N/A	N/A	N/A	N/A	Measures, No surveys
spreading avens	E	*Geum radiatum*	8	Cherokee, National Forests in North Carolina	N	N	Y	LRUF/Habitat
spreading navarretia	T	*Navarretia fossalis*	5	N/A	N/A	N/A	N/A	Habitat
swamp pink	T	*Helonias bullata*	8	Chattahoochee-Oconee, George Washington-Jefferson, National Forests in North Carolina	N	N	Y	LRUF
Ute ladies'-tresses orchid	T	*Spiranthes diluvialis*	2,4, 6	Uinta, Targhee, near border of Ashley Suspected: Medicine Bow-Routt, Pike San Isabel, White River, Okanogan, Boise, Caribou Targhee, Salmon, Sawtooth, Wasatch Cache, Challis, Fish Lake	N	Y	Y where occurs	Habitat
Virginia sneezeweed	T	*Helenium virginicum*	8, 9	George Washington-Jefferson, Mark Twain	N	N	N George Washington/Jefferson, Y Mark Twain	LRUF/Habitat

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
Virginia spiraea	T	*Spiraea virginiana*	8, 9	Daniel Boone, Cherokee, George Washington-Jefferson, National Forests of North Carolina, Monongahela and suspected on the Wayne	N	N	Y	LRUF/Habitat
water howellia	T	*Howellia aquatilis*	1, 5, 6	Mendocino, Flathead, suspected on: Six Rivers, Lolo, Kootenai, Idaho Panhandle, Colombia River Gorge, Gifford Pinchot, Okanogan-Wenatchee, Mount Hood	N	Y in R6 (Oregon_; Y in R5 (California)	Y	Habitat
western prairie fringed orchid	T	*Platanthera praeclara*	1,2	Sheyenne National Grassland, in southeastern North Dakota, suspected in Nebraska National Forest, Samuel R McKelvie & Oglala, Buffalo Gap, or Fort Pierre National Grasslands Nebraska	N	N	N	LRUF/Habitat

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
whitebark pine	PT	*Pinus albicaulis*	1,4 and 5	Many	N	Y	N	Widespread
white birds-in-a-nest	T	*Macbridea alba*	8	National Forests in Florida	N	Y	Y	Retardant use
white bladderpod	E	*Lesquerella pallida*	8	National Forests in Texas	N	N	N	LRUF
white fringeless orchid	T	*Platanthera integrilabia*	8	National Forests in North Carolina, Chattahoochee, Alabama	N	N	Y	LRUF
willowy monardella	E, CH	*Monardella viminea*	5	N/A	N/A	N/A	N/A	No surveys
white sedge	E	*Carex albida*	5	N/A	N/A	N/A	N/A	Measures, No surveys
Zuni fleabane	T	*Erigeron rhizomatus*	3	Cibola	N	Y	N	Habitat
Ash-grey pantbrush	T, CH	*Castilleja cinerea*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Bear valley sandwort	T, CH	*Arenaria ursina*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Braunton's milk-vetch	E, CH	*Astragalus brauntonii*	5	Angeles Cleveland San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
California taraxacum	E, CH	*Taraxacum caifornicum*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Cushenbury buckwheat	E, CH	*Eriogonum ovalifolium var. vineum*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
Cushenbury milk-vetch	E, CH	*Astragalus albens*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Cushenbury oxytheca	E, CH	*Oxytheca parishii var goodmaniana (Acanthoscyphus parishii var. goodmaniana)*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Greene's tructoria	E, CH	*Tuctoria greenei*	5	Lassen Modoc	N/A	N/A	Y/N	NLAA for critical habitat only
Huachuca water umbel	E, CH	*Lilaeopsis schaffneriana spp. recurva*	3	Coronado	N/A	N/A	Y/Y	NLAA for critical habitat only
Munz's Onion	E, CH	*Allium munzii*	5	Cleveland	N/A	N/A	Y/Y	NLAA for critical habitat only
Nevin's barberry	E, CH	*Berberis nevinii*	5	Angeles Cleveland San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Parish's daisy	T, CH	*Erigeron parishii*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Purple amole	T, CH	*Chlorogalum purpureum (var. reductum)*	5	Los Padres	N/A	N/A	Y/Y	NLAA for critical habitat only
San Bernardino bludegrass	E, CH	*Poa atropurpurea*	5	Cleveland San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
San Bernardino Mountains bladderpod	E, CH	*Lesquerella kingii ssp. bernardina (Physaria kingii ssp. bernardina)*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
San Diego thornmint	T, CH	*Acanthomintha ilicifolia*	5	Cleveland	N/A	N/A	Y/Y	NLAA for critical habitat only

Common Name	Federal Status and Critical Habitat[4]	Scientific Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single	retardant use 0.01% or more land base annually[2]	Mapped Avoidance Areas (Species/CH)	Rationale for Determination[6]
slender orcutt grass	T, CH	*Orcuttia tenuis*	5	Lassen, Modoc, Plumas, suspected on Shasta Trinity	N/A	N/A	Y/N	NLAA for critical habitat only
Southern mountain buckwheat	T, CH	*Eriogonum kennedyi var. austromontanu m*	5	San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Thread-leaved brodiaea	T, CH	*Brodiaea filifolia*	5	Angeles Cleveland San Bernardino	N/A	N/A	Y/Y	NLAA for critical habitat only
Vail Lake Ceanothus	T, CH	*Ceanothus ophiochilus*	5	Cleveland	N/A	N/A	Y/Y	NLAA for critical habitat only
Wright's marsh thistle	PT, PC H	*Cirsium wrightii*	3	Lincoln	N/A	N/A	Y/Y	NLAA for critical habitat only
Webber's ivesia	T, CH	Ivesia webberi	4,5	Toiyabe, possibly on Tahoe, potential on Plumas	N/A	N/A	Y/Y	NLAA for critical habitat only
Wenatchee Mountains checkermall ow	E, CH	*Sidalcea oregana var. calva*	6	Okanogan-Wenatchee	N/A	N/A	Y/Y	NLAA for critical habitat only

The USFS made NLAA determinations for 77 plant species and one lichen. The rationales vary by species, but include several scenarios. For example, in some instances, listed species are present in forests where retardant use is considered to be low (less than 0.01 percent of its land base annually), and thus exposure is extremely unlikely to occur. This includes: Beaverhead-Deerlodge, Custer Gallatin, Dakota Prairie grasslands, Flathead, Arapaho & Roosevelt, Bighorn, Black Hills, Grand Mesa Uncompahgre and Gunnison, Nebraska, Pike and San Isabel, Rio Grande, Shoshone, Apache-Sitgreaves, Carson, Kaibab, Ashley, Caribou-Targhee, Fishlake, Payette, Salmon-Challis, Lake Tahoe Basin Management Unit, Columbia River Gorge, Fremont-Winema, Gifford Pinchot, Mt. Hood, Willamette, Chattahoochee-Oconee, Cherokee, National Forests in Texas, National Forests in North Carolina, Chippewa, Mark Twain, and Superior.

In other cases, the species are present, but avoidance mapping is required (see **Table 2**, column 8 above) and thus exposure is extremely unlikely to occur. In the case of still other species, individuals of the species are suspected to be present on the forest lands, and aerial fire retardant has been applied on more than 0.01 percent or more of land base annually, but the species occurs in specific habitats that have a low probability of retardant application, such as completely submerged aquatic species, wet cliff sides, dunes, and rocky outcrops. In all of these cases, the likelihood of exposure is extremely low and considered discountable. Thus, occurrences of these plants are protected from retardant effects through use of avoidance areas, or specific site conditions exist where aerial retardant delivery is not possible or feasible due to terrain conditions, or the probability of retardant application is extremely low (e.g., some forests in the eastern U.S.).

In the extremely unlikely event exposure should occur, there may be minor, localized effects due to the toxicity of the fire retardant chemicals. The Auxilio risk assessment (2021) provided information on retardant impacts to vegetation which can also be applicable to impacts to listed plants. These known effects include fertilization that results in growth of other species and changes to species composition in the affected area, and growth of or increased presence of invasive non-native plant species that may be present in the area. Other impacts may include direct physical effects (leaf loss, plants physically knocked down), or effects on plant growth and health as a result of over-fertilization or toxicity. However, any potential effects to all of these plants are discountable, as the effects are all extremely unlikely to occur (see **Table 2** for species- and habitat-specific rationales).

We do not anticipate that the Sonoma alopecurus, San Diego ambrosia, San Jacinto Valley crownscale, Sonoma sunshine, white sedge, Hoover’s spurge, Sonoma spineflower, La Graciosa thistle, Pennell’s bird’s-beak, Lompoc yerba santa, San Diego button celery, Pine Hill flannel bush, Pecos sunflower, Burke’s goldfields, Contra Costa goldfields, Pitkin marsh lily, Butte County meadowfoam, large-flowered wooly meadowfoam, Sebastopol meadowfoam, Cook’s lomatium, willowy monardella, spreading navarretia, many-flowered navarretia, Knowlton’s cactus, and showy Indian clover are likely to be exposed to fire retardant chemicals during airtanker base operations or related jettison area protocols. These plant species are found in various habitats within range of several airtanker bases and jettison areas used to prepare, load, and jettison retardant used for fire fighting activities. Threats to these plants from exposure to retardant chemicals include the following:

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

For those species that rely on insects for pollination or seed dispersal, direct impacts to these insects could be physical injury or mortality from retardant exposure or the impairment of ability to fly, impairment of ability to breathe, and potential suffocation.

The airtanker bases within the range of where these species are found are Ramona, Sonoma, Hemet, Santa Maria, Paso Robles, Ukiah, Medford, Grass Valley, Chico, Durango, and San Bernardino and their respective jettison areas where applicable. As previously discussed, there are measures in place on all airtanker bases to contain retardant spills and wash-down water, and so the likelihood of species or their pollinators or seed dispersers within the range of the airtanker bases being impacted by fire retardant is extremely low. Similarly for the jettison areas not located within the confines of the airtanker bases, the likelihood of impacts to plants or their pollinators/seed dispersers is extremely low. Many of the jettison areas are located near but not within the elevation where the species would be found, (e.g., the species is located on a steep slope and retardant would not be jettisoned in a steep slope habitat). Alternatively, some of these plant species (Sonoma alopecurus, Pennell's bird's-beak, San Diego button-celery, Burke's goldfields, Contra Costa goldfields, willowy monardella, spreading navarretia, and showy Indian clover) are located in or near jettison areas that are not used very frequently (less than twice per year, if at all). These jettison areas are the Ramona, Sonoma, and Ukiah jettison areas which are all categorized as "light use" or used from "0-2 times per year" from information provided by the USFS (see Appendix G in this Opinion). Furthermore, individuals would generally be expected to be present in habitats that are in the vicinity of jettison areas, but would not necessarily be in the areas in which retardant was discharged. For example, individuals of these species would be expected to be found in habitats such as ridgetops or waterbodies such as wetlands/marsh, vernal pools, swales, and riparian shrub communities, where retardant is not allowed to be jettisoned (waterbodies) or less likely to be jettisoned, and any exposure is likely to be extremely rare. Therefore, any effects to these plant species or their pollinators/seed dispersers from retardant activities within airtanker bases involving loading or preparing aircraft for retardant as well as protocols for jettison areas on site or within range of the airtanker base are considered discountable.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the plants listed in **Table 2** above.

Critical habitat
This category includes critical habitats for the following species: San Diego thornmint (*Acanthomintha ilicifolia*), Munz's onion (*Allium munzii*), Bear Valley sandwort (*Arenaria ursina*), Cushenbury milk-vetch (*Astragalus albens*), Braunton's milk-vetch (*Astragalus brauntonii*), Nevin's barberry (*Berberis nevinii*), thread-leaved brodiaea (*Brodiaea filifolia*), ash-grey paintbrush (*Castilleja cinerea*), Vail Lake ceanothus (*Ceanothus ophiochilus*), purple amole

(*Chlorogalum purpureum*), Wright's marsh thistle (*Cirsium wrightii*), Parish's daisy (*Erigeron parishii*), Southern Mountain buckwheat (*Eriogonum kennedyi var. austromontanum*), Cushenbury buckwheat (*Eriogonum ovalifolium var. vineum*), Webber's ivesia (*Ivesia webberi*), San Bernardino Mountains bladderpod (*Lesquerella kingii ssp. bernardina*), Huachuca water umbel (*Lilaeopsis schaffneriana var. recurva*), Slender orcutt grass (*Orcuttia tenuis*), Cushenbury oxytheca *(Oxytheca (Acanthoscyphus) parishii var. goodmaniana),* San Bernardino bluegrass (*poa atropurpurea*), Wenatchee Mountains checker-mallow (*Sidalcea oregana var. calva*), California taraxacum (*Taraxacum californicum*), Greene's tuctoria (*Tuctoria greenei*),Neches River rose mallow (*Hisbiscus dasycalyx*); mountain golden heather (*Hudsonia montana*); Pagosa skyrocket (*Ipomopsis polyantha*); beardless chinchweed (*Pectis imberbis*); Fickeisen plains cactus (*Pediocactus peeblesianus var. fickeiseniae*); DeBeque phacelia (*Phacelia submutica*); San Francisco peaks groundsel *(Senecio franciscana (Packera franciscana*)), and Cook's lomatium. The PBFs for the plant critical habitats in **Table 2** collectively contain, but are not limited to[7]:

- Intermittent or perennial wetlands and Mancos shale soils
- Elevation and climate
- Suitable native plant communities
- Barren shales
- Open montane grassland (primarily Arizona fescue) understory at the edges of open Ponderosa pine, or clearings within the Ponderosa pine/Rocky Mountain juniper and Utah juniper/oak communities
- Pollinators within 1,000 m and habitat for pollinators
- Appropriate disturbance regime
- Eroding limestone or granite bedrock substrate
- Steep, south-facing, sunny to partially shaded hill slopes
- Soils derived from limestone
- Suitable soils and geology
- Topography (e.g., moderately steep slopes, benches, and ridge tops adjacent to valley floors; occupied slopes that range from 2 to 42 degrees with an average of 14 degrees)
- Maintenance of the seed bank and appropriate disturbance levels
- Vernal pools and ephemeral wetlands and depths and the adjacent upland margins of these depressions.

Impacts to the PBFs that are physical in nature such as slope, temperature, climate, topography, or substrate type are not expected to be impacted by aerial fire retardant use. We would assume similar effects of aerially applied fire retardants to the specific types of water bodies, plants and plant communities that are part of the critical habitat PBFs for these species. Impacts to water quality or vegetation from both ammonia-based and magnesium chloride based products depend on a number of factors including exposure to retardant (rates and formulations), environmental responses, and correlation of scientific results to potential geographic areas where retardant could be used in the future; species characteristics (habitats, physiological and morphological characteristics), soil types, timing of application (active growing season vs. dormant); and what

[7] The BA and the Status of the Species Appendix E of this Opinion provide more detail on the PBFs for these plant critical habitats

happens to the retardant after application (i.e., weathering). However, all of these critical habitats are either on no, low or very low retardant use forests, and /or have required avoidance mapping of 300-foot buffers or more (e.g., the Neches River rose mallow critical habitat occurs on the Davey Crockett National Forest, which has very low retardant potential and avoidance buffers of 300 feet; mountain golden heather critical habitat occurs on the Pisgah National Forest, which has very low retardant potential coupled with a 1,500-foot buffer). Other critical habitats are found within a few miles of a National Forest, but are not located within one (e.g., the Pagosa skyrocket).

Retardant effects on pollinators that are critical habitat PBFs are also not anticipated from the Action. Impacts to pollinators (most likely insects, birds, or bats) are so unlikely to occur that we consider the effects to be discountable, as any of these pollinators visiting the listed plants for which critical habitat has been designated would be protected by the avoidance areas and are present on forests that do not use or use a very small amount of retardant. Those pollinators included as PBFs for critical habitat on forests with moderate to high retardant use will also be protected by avoidance areas (the critical habitat for the Fickeisen cactus on the Coconino Forest, which is a moderate retardant use forest). Even with avoidance mapping, we anticipate that some populations of pollinators may be impacted, but there would still be a sufficient number and diversity of pollinators to continue to provide the resources needed for these critical habitats. We do not anticipate any impacts from retardant use on physical means such as water or wind as pollination or seed disperser strategies.

Other effects to plant critical habitat PBFs from the Action, such as physical damage from drops of retardant (e.g., to trees, plants, or other habitat structures such as rocky ledges or outcrops), including those from airtanker base and jettison area operations, are extremely unlikely to occur. Retardant use could cause the breaking of treetops that may create small openings in the canopy; however, this would happen rarely as retardant is not usually applied in mature and old growth habitat and is not anticipated to impact habitat structure. Retardant dropped on plants in open areas could potentially impact some species; however, for a fire in 2010, results from monitoring indicated no foliar burn, phytotoxicity, or mortality to a listed plant, *Eriogonum ovalifolium* var. *vineum* (Cushenbury buckwheat), 4 months after application (Phos-Chek P100, Division Fire, San Bernardino National Forest, June 2010). Thus, we anticipate similar effects to non-listed plant vegetation identified as critical habitat PBFs. In addition, use of avoidance mapping will lessen the probability of this occurring for listed plants to the point that we expect effects to be discountable. Similarly, measures are in place at the airtanker bases and jettison areas to minimize the probability of retardant entering habitats (e.g., critical habitat for Cook's lomatium), such as designated areas for containment of spills or wash down water. Furthermore, fire season does not generally coincide with the rainy season when seasonal habitats (e.g., vernal pools) are used by species or at risk for effects to water quality from retardant applications. Disturbance from aircraft noise is not anticipated to affect individual plants or their pollinators or seed dispersers. Therefore, any effects to the PBFs of these critical habitats is considered discountable or insignificant.

For the above reasons, we concur with the USFS's determination that the Action may affect, but is not likely to adversely affect the plant critical habitats listed above and in **Table 2**.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed Federal action addressed in this Opinion (hereafter, the Action) is the USFS's proposal to continue the nationwide use of and aerial application of fire retardant[8].

Aerial use of fire retardant is an ongoing programmatic activity that includes annual coordination with the Service, as well as related reporting and monitoring requirements. Although the USFS has not indicated a finite duration of the Action, the USFS has included a reinitiation framework (Appendix C of this Opinion, and Appendix A of the BA) as part of their Action, to ensure any reinitiation triggers are recognized when they occur and that any necessary reinitiation with the Service occurs in a timely manner. Thus, there is currently no end date for the Action or target date for reinitiation of consultation, as was specified in the 2011 consultation (e.g., a 10-year timeframe). However, the USFS has committed to ensuring that any changes to the Action, such as effects to the species based on new information, or newly listed species or designated critical habitat to be considered in the future, will be addressed following the provisions of 50 CFR 402.16. For example, new retardant products may be added to the Qualified Products List under the framework of this program and applied without requiring reinitiation of the Opinion, so long as their use would not result in effects (e.g., extent, duration, level, or type of toxicity) to species and critical habitat not addressed in this consultation. Additionally, the USFS will periodically coordinate with the Service to ensure implementation of the Action is proceeding according to the assumptions in the BA and this Opinion.

The following description of the Action is largely taken from the BA:

The Action allows aerially applied fire retardants, included now or in the future on the USFS Qualified Products list (Wildland Fire Chemicals), to be used on National Forest System Lands as follows:

- Aerial retardant drops would be prohibited in aerial retardant avoidance areas (see definition below), which include:
    - Waterways or their buffers, whether mapped or not, when water is present (also referred to as aquatic avoidance areas)
    - All or part of the habitat of ESA threatened, endangered, proposed, or candidate species or Regional Forester sensitive species, as mapped per the requirements described in the "Aerial Retardant Avoidance Areas Mapping Requirements" section
    - Areas mapped by the local unit

[8] This Action does not include the use of water, foams, water enhancers, or ground-based application of retardants.

- The above direction would be mandatory nationwide except when human life or public safety are threatened and retardant use in the aerial retardant avoidance area could be reasonably expected to alleviate the fire threat.

When an intrusion (formerly termed 'misapplication', see definition below) occurs for any reason, it would be reported, assessed for impacts, monitored, and remediated as necessary.

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

- The term 'aquatic avoidance area' refers to any avoidance area, whether mapped or not, that is based on the presence of waterways, or as mapped to protect ESA threatened, endangered, proposed, or candidate species or critical habitat or Regional Forester sensitive species or habitat associated with waterways, waterbodies, or riparian areas.
- The term 'terrestrial avoidance area' refers to any avoidance area that is mapped to protect ESA threatened, endangered, proposed, or candidate species or critical habitat or Regional Forester sensitive species or habitat or other resources that are not associated with waterways or riparian areas.
- The term 'misapplication' has been replaced by the term 'intrusion' for clarity of meaning. An intrusion is defined as *the intentional or unintentional application of aerial fire retardant into an aerial retardant avoidance area.*

In addition to the above direction, the Action includes five components that provide specific direction for aircraft operations, aerial retardant avoidance area mapping, coordination, reporting and monitoring, and procedures for additions to the Qualified Products List, as described below. Additional information on implementation of these components as well as guidance on operations planning and on the role and function of resource specialists are found in the Implementation Guide for Aerial Application of Fire Retardant ((USDA - USFS, 2019) or subsequent versions[9]).

The Action is intended to protect listed species and their critical habitats and continue to improve the documentation of retardant effects through reporting, monitoring, and application coordination. Aerial retardant drops are not allowed in mapped avoidance areas where specified or required for threatened, endangered, proposed, or candidate species, and their critical habitats; mapped avoidance areas for certain regional forester sensitive species; waterbodies or their buffers, mapped or not, where water is present; or avoidance areas mapped by the local unit. This national direction is mandatory and will be implemented in all cases except where human life or public safety are threatened and retardant use in the avoidance area could be reasonably expected

[9] This resource may be updated over the duration of the Action, and thus subsequent versions are also referenced.

to alleviate that threat. When an intrusion occurs for any reason, it will be reported, assessed for impacts, monitored, and remediated as necessary.

The following sections describe various aspects of the Action, and provides information on aerial fire retardants and their use, as well as USFS's implementation of the program and related conservation measures.

The Implementation of the program section discussed below includes a discussion of:

1) various tools and guidance available to decision-makers
2) the use of the USFS's national effects screening process
3) Conservation Measures that include guidance for aircraft operators
4) avoidance area mapping
5) annual coordination
6) reporting and monitoring; and
7) procedures by which products are added to the Qualified Products List.

Aerial Fire Retardant Information

Fire retardant, which is composed of approximately 85 percent water, slows the rate of fire spread by cooling and coating the fuels, robbing the fire of oxygen, and slowing the rate of fuel combustion with inorganic salts that change how the fire burns. Retardant is used in conjunction with other firefighting resources, most often in the building and holding of firelines that are intended to prevent fire from spreading further. Retardant is most effective with support from ground resources but can be used to hold a fire for long durations or even stop the fire. If overall conditions are favorable, retardant can stop the fire in some circumstances. In addition, retardants are used in situations where the operational tactic that has been employed is too slow to influence the forward rate of spread, or where effective fireline building may not be possible using other types of resources.

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

Retardant Components and Testing Requirements

Retardant formulations currently in use are comprised primarily of inorganic salts and water. As referenced in the BA, USFS specifications for long-term retardant include requirements for effectiveness, safety and environmental protection, materials protection, stability, and physical properties. The USFS has developed unique test methods or identified standard test methods for each requirement in the evaluation process.

Although retardant is primarily composed of water, inorganic salts constitute about 60 to 90 percent of the remainder of the product. The other ingredients include thickeners, such as xanthan gum; suspending agents, such as clay; dyes; and corrosion inhibitors (Johnson &

Sanders, 1977) (Pattle Delamore Partners, 1996). Corrosion inhibitors are necessary to minimize the deterioration of retardant tank structures and aircraft, which contributes to flight safety (Raybould, Johnson, & Alter, 1995).

Aerially applied long-term retardants covered in this consultation are limited to retardants that meet the USFS specifications (United States Department of Agriculture, USFS, Specification 5100-304 Long-term Retardant, Wildland Firefighting). Unacceptable ingredients (Section 3.4.1) include the following:

- sodium ferrocyanide
- dichromates
- thiourea
- borate or other boron-containing compounds
- polychlorinated biphenols
- polybrominated diphenyl ethers
- nonylphenol ethoxylates
- ammonium sulfate
- per- and polyfluoroalkyl substances (including but not limited to perfluorooctanoic acid and perfluorooctanesulfonate compounds).

As retardants are considered for inclusion on the Qualified Products List, the USFS will take certain factors into account. For example, environmental and health regulations (Section 3.4.2 of the specification) require a review of environmental regulations as they apply to the formulation and individual ingredients. Additionally, chemical profiles and risk assessments (per Section 3.4.3 of the specification) are required prior to their inclusion. Also, the USFS considers toxicity of the chemicals and their effects on species. For example, there are several toxicity requirements (per Section 3.5.2.1 and 3.5.2.2 of the specification), such as the following:

- Mammals - Acute oral toxicity – median lethal dose (LD_{50}) greater than 500 milligrams per kilogram for the concentrate and greater than 2000 milligrams per kilogram for the mixed product.

- Mammals - Acute dermal toxicity – median lethal dose (LD_{50}) of greater than 2000 milligrams per kilogram for the concentrate and mixed product.

- Aquatic toxicity – median lethal concentration (LC_{50}) to rainbow trout of greater than 200 milligrams per liter.

The Qualified Products List is maintained on the Wildland Fire Chemicals website and is updated as products are added or removed. The list also includes any conditionally qualified products. **Table 3** lists the long-term retardants on the September 5, 2020 Qualified Products List with a summary of their aquatic toxicity and active retarding ingredients. Both Fortress products in the table are conditionally qualified per the October 5, 2021 Qualified Products List.

Table 3. Amounts of retardant active ingredients reaching the ground at specified coverage levels (from USFS's 2021 BA).

Retardant	**Fish Toxicity (of concentrate)**	**4 GPC Coverage Level (lbs NH_3/ft^2)**	**4 GPC Coverage Level (lbs P_2O_5/ft^2)**	**8 GPC Coverage Level (lbs NH_3/ft^2)**	**8 GPC Coverage Level (lbs P_2O_5/ft^2)**
Fully qualified products	**LC_{50} (mg/L)**	**lbs NH_3/ft^2**	**lbs P_2O_5/ft^2**	**lbs NH_3/ft^2**	**lbs P_2O_5/ft^2**
Phos-Chek LC-95A-R	386	0.0095	0.0301	0.0190	0.0602
Phos-Chek LC-95A-Fx	399	0.0095	0.0273	0.0191	0.0546
Phos-Chek LC-95-W	465	0.0095	0.0276	0.0191	0.0553
Phos-Chek MVP-Fx	2,024	0.0053	0.0199	0.0105	0.0399
Phos-Chek 259-Fx	860	0.0070	0.0203	0.0140	0.0406
Phos-Chek LCE20-Fx	983	0.0073	0.0208	0.0147	0.0415
Conditionally qualified products	**LC_{50} (mg/L)**	**lbs Mg/ft^2**	**lbs Cl^-/ft^2**	**lbs Mg/ft^2**	**lbs Cl^-/ft^2**
Fortress FR-100	1,762	0.0093	0.0270	0.0185	0.0541
Fortress FR-200 LLX	3,672	0.0094	0.0275	0.0188	0.0549

Composition of Retardants

This section describes the specific composition of retardants that are currently approved and the chemical limits for any new retardants that may be added to the Qualified Products List in the future as part of the Action. Aerially delivered fire retardants are available as either a liquid concentrate or a dry concentrate. Water is added to either the liquid or dry concentrate, diluting the products, prior to the applicator loading the retardant onto an air tanker for application. Various combinations of di-ammonium phosphate, mono-ammonium phosphate, ammonium polyphosphate or magnesium chloride retardant salts have previously been or are currently contained in qualified retardant products, have been evaluated in prior consultations or reinitiations, and are also included as part of this consultation.

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

Table 4. Range and upper limits in pounds per square foot (lbs/ft^2) of allowable chemicals when applied at a coverage level of 8 GPC of mixed product.

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

The concentrations (**Table 4**, column 3) of ammonia, phosphate, magnesium, or chloride when delivered at 8 gallons per 100 square feet will represent the upper limit of retardant salts that can be included in newly developed retardants that may be added to the Qualified Products List without the need for re-initiation of consultation. These upper limit values reflect small increases in constituent levels compared to existing values, and allow for minor modifications in formulations as needed by the manufacturer without the need to re-initiate consultation. Furthermore, for any new formulation, the toxicity levels of the retardant product must not exceed those of currently approved products. In addition, the maximum extent and duration of effects from new products cannot exceed effects of products already considered in order to be approved without re-initiation of consultation.

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

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

Additional information regarding how the USFS will consider new products and limit values and how they relate to the need for reinitiation is in Appendix C and D of this Opinion (*Consultation*

Re-initiation Framework; and *Process for Supplementing Nationwide Consultation in this Opinion*; and Appendix E in the BA).

Retardant Use

Decision Authority

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

The single most important factor for the USFS in determining the appropriate strategy is the risk to human life –in this case, both of the firefighters and the public. The USFS's first responsibility on every fire is to provide for firefighter and public safety (USFS, 2020c). Strategies can range from quickly suppressing the fire on the initial attack, to developing longer term management strategies that can simultaneously achieve Land and Resource Management Plan objectives.

Tools

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

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

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

- Direction for pilots that pilot certification provides training in the use of retardant guidelines, and that the pilots receive maps of avoidance areas and briefings on the unit in advance of retardant use. It also provides guidance about the use of "dry runs" to better ensure protection of avoidance areas, and about evaluation of flight conditions to ensure that pilots maintain safety, and that they follow retardant use guidance.
- Guidance for fire operations that states agency administrators will include in their delegations of authority direction and expectations for operations if the fire has the potential to include or already includes any avoidance areas. The initial incident management team briefing should address areas that have been identified as potential for high risk for public and fire fighter safety that fall within or overlap avoidance areas. The exception to apply retardant may be involved in these cases, so advance awareness of the potential safety risk(s), presence of avoidance areas, and potential need for use of the exception is critical. The guide also provides an example of documentation to provide when using the exception.
- Reporting and monitoring guidance that states intrusion reporting should occur as soon as possible after discovery but not later than 30 days after drops have occurred. The required assessment and coordination with local Service offices then determines what subsequent actions may need to occur. Water quality monitoring where required, will be conducted to assess the extent of impacts and validate the estimates produced by the spill calculator.

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

Retardant Delivery

Aircraft

The use of aircraft (fixed and rotor wing) for the delivery of fire retardant is one of many suppression tools that fire managers use (see **Figure 1** and **Figure 4**). Large and very large airtankers, single engine airtankers, and helicopters, deliver retardant which fills an essential link in the overall suppression strategy. The main principle in the use of aerially delivered retardant is to use it early in sufficient quantity, and drop retardant from an effective altitude, with minimum time lapse between each drop.

Figure 1. Aerial retardant application for building fireline (Figure 3 in BA).

Retardant is stored, mixed, and loaded at airtanker bases, or in some instances on-site near a fire incident utilizing a mobile retardant base. There are ninety-eight permanent airtanker bases currently in use across the United States where airtankers bound for National Forest Service Lands may originate. These bases are hosted by various federal agencies (Bureau of Land Management, Bureau of Indian Affairs, USFS) or state agencies. Appendix H in the BA addendum (dated June 30, 2022) provides information for each of the bases. Permanent airtanker bases occur throughout the western United States, with a handful of bases found in the mid-west and southeast as displayed **Figure 2** and **Figure 3**. **Figure 2** diplays Single Engine Airtanker (SEAT) bases which are restricted to smaller airtankers. **Figure 3** displays bases that can accommodate airtankers of various sizes, including SEATs. Some of these bases can also accommodate very large airtankers.

Permanent airtanker bases are situated on existing airports and airfields. The base infrastructure includes retardant loading pits, mixing and pumping areas, storage tanks, areas where retardant deliveries are received and concentrates are stored, and where loaded airtankers are staged for dispatch. Municipal or well water is used for mixing with concentrates. There are many procedures in place to limit the potential for exposure at permanent airtanker bases, including:

- Spill containment systems at all locations where retardant is stored and handled (as described above) to keep retardant from entering waterways or moving into vegetated areas.
- Mixing systems for dry concentrates that limit the amount of particulate matter in the air for human health reasons under OSHA (Occupational Safety and Health Administration). These systems reduce the potential for drift of dry concentrate in the wind.

- Containment for wash down water in either an evaporation pond, through a sand/oil separator, or in some cases into a holding tank. An evaporation pond is monitored, and the solid matter is pumped out as needed. Generally, the sand/oil separator discharges into the city sewer system and on to the wastewater treatment plant. The holding tanks, if used, would be emptied by a vendor and removed to a proper disposal facility as needed.
- Reporting of ammonia to the Environmental Protection Agency is required under the Toxics Release Inventory Program (Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA; Emergency Planning Community Right-to-Know Act)) for those bases that meet the reporting criteria (more than 10 full time equivalent employees and more than 25,000 pounds of ammonia annually (approximately 1 million gallons of retardant).

In addition to the airtanker base facilities, bases also identify jettison areas. A jettison area is where airtankers release their load prior to landing, in the case of an emergency, or when flights are cancelled after take-off. This is done for airtankers that cannot land loaded, such as DC-10s or Single Engine Airtankers, or tankers that must release a partial load prior to landing to be under their maximum landing weight. In general, planes will jettison their retardant load at heights similar to a retardant load: 60 feet above ground level for SEATs, 150 feet above ground level for airtankers and 250 feet above ground level for very large airtankers, or higher depending on the requirements of the jettison area and the reason for jettisoning the load. The frequency and amount of each jettisoned load is documented at the closest airtanker base to the jettison area. The frequency of jettisoning a retardant load varies widely from airport to airport depending on its frequency of use and proximity to high fire areas.

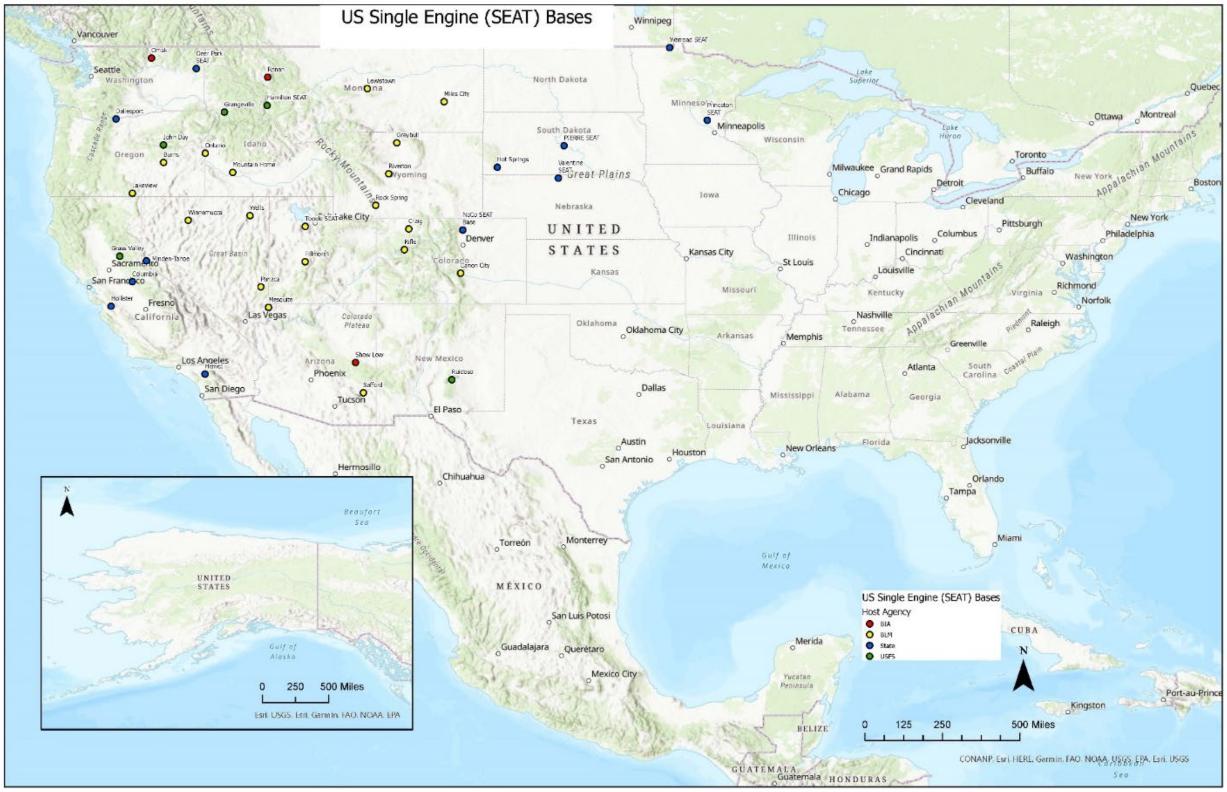

Figure 2. Single Engine Airtanker Bases in the United States by host agency (BLM; Bureau of Land Management, BIA; Bureau of Indian Affairs, state, USFS).

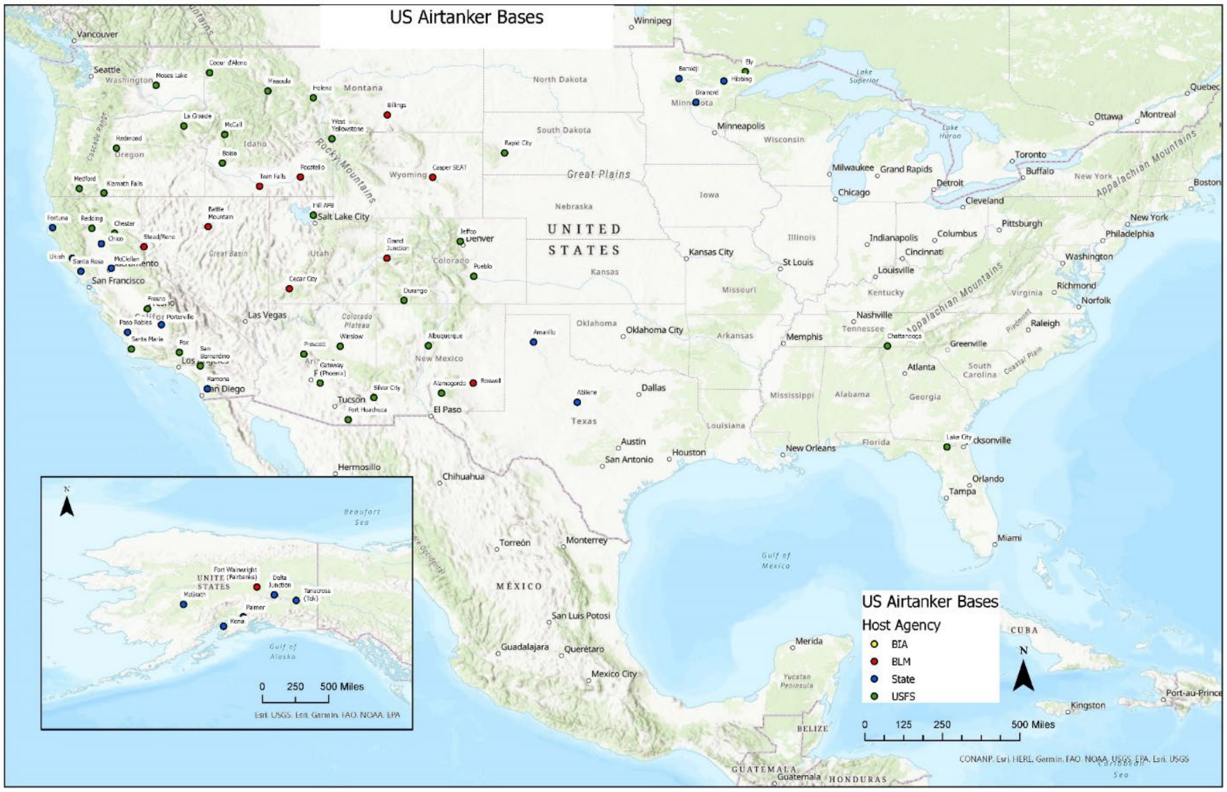

Figure 3. Airtanker Bases in the United States by host agency (BIA, BLM, state, USFS).

Figure 4. Helitanker at mobile retardant operation (Figure 4 in BA).

Airtanker and helicopter types are distinguished by their retardant tank capacity (National Wildfire Coordinating Group Standards for Wildland Fire Resource Typing). Helicopters can deliver retardant either with a bucket or with a "fixed tank", referred to as a "helitanker." Supplying helicopters is the primary reason for setting up mobile retardant bases (or "portable retardant bases"). Helicopters can carry up to 700 gallons of retardant. A helitanker can carry up to 1,100 gallons. A single engine airtanker, or SEAT, is the smallest airtanker. These aircraft can deliver up to 800 gallons fire retardant. Mid-size airtankers can carry from 800-2,999 gallons of retardant. Large and very large airtankers are for example such as the DC-10 can deliver over 8,000 gallons of fire retardant at one time. The Boeing 747 can carry 17,500 gallons of fire retardant (National Wildfire Coordinating Group Standards for Wildland Fire Resource Typing).

Operational Considerations

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

Most retardant delivery occurs on ridge tops and adjacent to human-made or natural fire breaks, such as roads, meadows, old fire scars, and rock outcrops. Occasionally, retardant is applied adjacent to aquatic environments that are used as a natural fire break, but always maintaining the 300-foot avoidance buffer for waterbodies (unless human life or public safety is at risk). Applying retardant adjacent to these human-made or natural fire breaks enhances the effectiveness of fire breaks by widening the fire break, which can be especially important when applying adjacent to aquatic environments.

How much fire retardant drifts depends on the height and speed of the aircraft at the time of the drop, wind direction, and wind speed. Fire retardants include a gum thickening agent which raises the viscosity and creates larger and more cohesive droplets to reduce drift. There are guidelines for the use of aircraft during suppression activities to ensure that operations can be conducted in a safe and effective manner (NWCG Standards for Aerial Supervision NFES 002544, February 2020) (NWCG, 2022). These include suspending flights during poor visibility and when wind conditions result in unsafe or ineffective operations.

Conservation Measures

The Action includes conservation measures in five categories, as described in the BA: Aircraft Operation Guidance, Avoidance Area Mapping, Annual Coordination, Reporting and Monitoring and Procedures for Additions to the Qualified Products List. The descriptions of the following categories parts are largely excerpted from the BA:

Aircraft Operational Guidance

According to this guidance, pilots shall not be required to fly in a manner that endangers their aircraft or other aircraft or structures, or that compromises the safety of ground personnel or the public. The operational guidance ensures retardant drops will not made within avoidance areas.

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

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

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

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

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

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

Avoidance Area Mapping Requirements

All USFS units will review and update maps annually, following current national mapping protocols described in the Implementation Guide for Aerial Application of Fire Retardant (USDA - USFS, 2019) or subsequent versions). USFS requirements for mapping or identifying aerial retardant avoidance areas described in the Implementation Guide are summarized as follows:

- Any waterway (including but not limited to perennial streams, intermittent streams, lakes, ponds, identified springs, reservoirs, vernal pools, and riparian vegetation) in which water is present at the time of retardant application, and buffers extending no less than 300 feet on either side of a waterway, is considered an avoidance area (also called aquatic avoidance area), whether mapped or not.

- Mapping of waterways that are dry at the time of retardant application is not required, but these may be included in avoidance areas where there is a potential for downstream effects to occur.

- Avoidance areas must generally be mapped where aerial application of fire retardant may impact one or more aquatic or terrestrial threatened, endangered, proposed, or candidate plant or animal species or designated critical habitat[10]. (In some cases, the USFS would not require avoidance mapping, such as where aerial fire retardant is unlikely to be applied due to habitat type or fire risk.)

[10] Current avoidance areas for species and critical habitats referenced in this consultation have been discussed and coordinated with Service species biologists as of the date of this Opinion. Any subsequent adjustments or revisions needed after this date would be coordinated as described in the last bullet item in this list.

- Avoidance areas must be mapped where aerial application of fire retardant may impact certain aquatic or terrestrial Regional Forester sensitive species or their habitat.

- Avoidance areas may be adjusted for local conditions. Avoidance area buffers around waterways with water present may not be less than 300 feet on either side of a waterway in which water is present but may be increased where needed. Adjustments related to threatened, endangered, proposed, and candidate species would be coordinated with the local Service Field Offices and the headquarters offices for both the Service and the USFS[11].

Annual Coordination

The USFS will coordinate annually with the Service headquarters office, local Service offices, aviation managers and pilots, and cooperators/other agencies. Coordination will ensure requirements of the provisions of the Action are met, and will maintain relationships and allow problem resolution to occur at the lowest management level. Guidance on coordination meetings is provided in the Implementation Guide for Aerial Application of Fire Retardant ((USDA - USFS, 2019) or subsequent versions). Some examples from the Implementation Guide are summarized below:

- The USFS will use listed species population information and critical habitat information from Service biologists and Forest Service information to inform avoidance mapping for occupied sites.
- Updating of the national TEPCS (threatened, endangered, proposed, candidate species) mapped avoidance area layer in the Forest Service Enterprise Data Warehouse (USFS data site where maps are digitally stored) will only occur from November 1 – March 31.
- Buffer areas may be increased based on coordination with the Service.
- The Forest Service will annually coordinate with local Service offices to ensure that the mapped avoidance areas on National Forest System Lands incorporate the most up-to-date information.
- Terrestrial and waterway avoidance areas will be mapped using the best current information and can be updated as better data becomes available. As this information changes or is updated, the maps will be adjusted by the process defined in this chapter of the implementation guide.

Reporting and Monitoring

The USFS maintains a database for reporting intrusions of aerially applied fire retardant into avoidance areas. Intrusion reporting requirements are described in the Implementation Guide for Aerial Application of Fire Retardant ((USDA - USFS, 2019) or subsequent versions), and include requirements for upward reporting to the Service for any intrusions into avoidance areas for any threatened, endangered, proposed, or candidate species or critical habitat. The USFS will

[11] Such coordination is expected to occur at least annually during planning phases prior to the following fire season.

provide to the Service headquarters annual reports summarizing retardant use and intrusions, as well as a list of intrusions and a summary of observations and actions for each intrusion.

Procedures for Additions to the Qualified Products List

Private companies submit retardants to the USFS for qualification evaluation. New products or new formulations of existing products must meet current USFS specification for long-term retardant (United States Department of Agriculture, USFS, Specification 5100-304 Long-term Retardant, Wildland Firefighting) (USDA - USFS, 2007) to be included on the Qualified Products List. In addition to meeting those specifications, USFS will also evaluate any retardant that may be added to the Qualified Products List to confirm whether effects of use of the products or formulations to listed, proposed, or candidate species and their critical habitats are covered by this consultation or whether USFS will need to reinitiate consultation with the Service, using the following approach:

- Products or new formulations do not require additional consultation as long as the maximum extent and duration of effects of the new products do not exceed the effects (including the degree and type of effects) of other products already considered in the biological assessments and Opinions for this the Action. Products will generally meet these criteria when the percentages of retardant salts, thickeners, coloring agents, and performance ingredients in the total mixed product are similar to those in products for which consultation has been completed (as shown in **Table 4**). Retardant salts may include diammonium phosphate, monoammonium phosphate, ammonium polyphosphate and magnesium chloride. The toxicity levels must not exceed those of currently approved products, and there must be no new identified risk factors. The Service will be notified of additions to the Qualified Products list.

- Products or new formulations that do not meet the above criteria will result in reinitiation of consultation with the Service. The product is not eligible for the Qualified Products List until all required tests and consultation are completed.

In the future, any new retardant or formulation that is added to the Qualified Products List could be used under the direction described in the BA and will be addressed by this consultation.

ACTION AREA

The action area is defined as all areas to be affected directly or indirectly by the federal action, and not merely the immediate area involved in the action (50 CFR 402.02). Consistent with the ESA section 7 implementing regulations, in delineating the action area, we evaluated the physical, chemical, and biotic effects of the Action on the environment that would not occur but for the Action and are reasonably certain to occur.

The action area includes all National Forest System Lands encompassing 193 million acres, in 9 regions (**Figure 5**), in 42 states, and 1 territory. This includes 154 national forests, 20 national grasslands, 13 national monuments, 24 national recreational areas, 8 national scenic areas, and 21 national game refuge or wildlife preserves (**Figure 6**). The action area also includes existing and mobile airtanker bases (as shownin **Figure 2** and **Figure 3**) as well as areas upstream and downstream and downdrift of USFS lands where aerial fire retardant could disperse during application. These areas consist of numerous types of environments including terrestrial or aquatic ecosystems containing threatened, endangered, candidate, or proposed species, and any associated critical habitats.

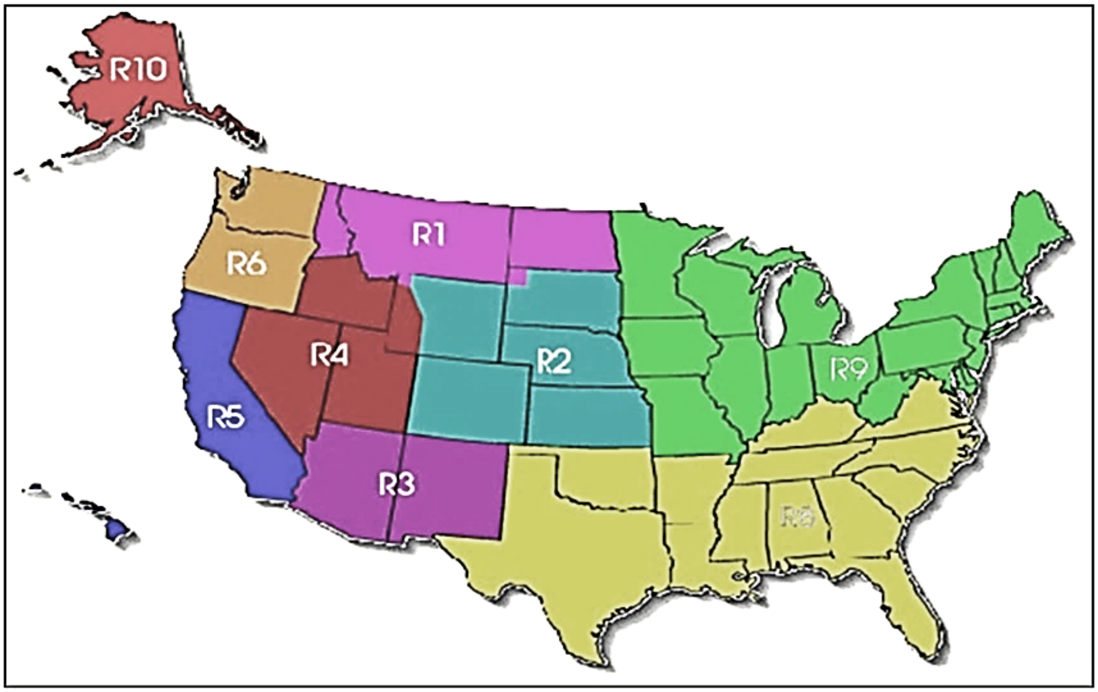

Figure 5. Map of USFS Regions (Figure 1 in BA).

Figure 6. Map of National Forest System Lands (Figure 2 in BA, Legend: green forested, yellow grasslands).

ANALYTICAL FRAMEWORK FOR JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the ESA requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this Opinion considers the effects of the Action, and any cumulative effects, on the rangewide survival and recovery of the listed species. It relies on four components: (1) the Status of the Species, which describes the rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the listed species in the action area, without the consequences to the listed species caused by the proposed action; (3) the Effects of the proposed action, which includes all consequences to listed species that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

For purposes of making the jeopardy determination, the Service: (1) reviews all the relevant information, (2) evaluates the current status of the species and environmental baseline, (3) evaluates the effects of the proposed action and cumulative effects, (4) adds the effects of the proposed action and cumulative effects to the environmental baseline, and in light of the status of the species, determines if the proposed action is likely to jeopardize listed species.

Adverse Modification Determination

Section 7(a)(2) of the ESA requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat.

The destruction or adverse modification analysis in this Opinion relies on four components: (1) the Status of Critical Habitat, which describes the range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, physical and biological features, or primary constituent elements) that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the Environmental Baseline, which analyzes the condition of the designated critical habitat in the action area, without the consequences to the designated critical habitat caused by the proposed action; (3) the Effects of the Proposed Action, which includes all consequences to the critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action; and (4) Cumulative Effects, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

For purposes of making the destruction or adverse modification determination, the Service: (1) reviews all relevant information, (2) evaluates the current status of the critical habitat and environmental baseline, (3) evaluates the effects of the proposed action and cumulative effects, (4) add the effects of the proposed action and cumulative effects to the environmental baseline, and, in consideration of the status of the critical habitat, determines if the proposed action is likely to result in the destruction or adverse modification of critical habitat.

STATUS OF THE SPECIES AND CRITICAL HABITAT

In their BA, the USFS identified 115 listed and 2 proposed species that may be adversely affected by the Action. Species addressed in this Opinion are listed in **Table 5** (terrestrial species), **Table 6** (aquatic species), and **Table 7** (plant species). In coordination with the Service, the USFS assigned each of the animal species to taxa groups for their assessment: Salamanders, Frogs and Toads (Amphibians); Raptors/Birds of Prey; Woodland and Upland Birds (Birds); Terrestrial Invertebrates: Insects, and Snails); Crustacean; Mammals; and Fish[12]. Plants were listed individually, without similar subtaxa groupings. The USFS also identified 3 proposed and 18 designated critical habitats that are likely to be adversely affected by the Action (also identified in Tables 5-7).

[12] Other taxa groups considered included arachnids, riparian birds, reptiles, and bivalves, although the USFS determinations for species in these groups were all NLAA, previously addressed in the Concurrence section.

For more information regarding the individual species and critical habitats with "may affect, likely to adversely affect" (LAA) determinations and the factors affecting their conservation status, see the Status of the Species and Critical Habitat accounts in Appendix E of this Opinion. Supporting information is available in the listing determinations, critical habitat designations, recovery plans, and 5-year status reviews available on the species profile pages at https://ecos.fws.gov/ecp/.

Table 5. Listed and proposed terrestrial species along with proposed and designated critical habitats addressed with adverse-affect determinations. Grayed out Critical Habitat Determinations are not included in the status of the species because they are either not applicable or were addressed in the above concurrence. (Compiled from Tables 21-25 in BA.).

Scientific Name	**Common Name**	**Status**[13]	**Critical Habitat Determination**[14]	**Species Determination**[2]	**Major Animal Type**	**Species Grouping**
Ambystoma tigrinum stebbinsi	Sonora tiger salamander	E	NA	LAA	Amphibians: Salamanders, Toads, and Frogs	Salamanders
Rana chiracahuensis	Chiricahua leopard frog	T, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Rana pretiosa	Oregon spotted frog	T, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Anaxyrus californicus	arroyo toad	E, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Anaxyrus canorus	Yosemite toad	T, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Rana (aurora) draytonii	California red-legged frog	T, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads

[13] T= Threatened, E=Endangered, XN= Non-essential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System Lands.
[14] NE= No Effect; NA= not applicable; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect)

Scientific Name	Common Name	Status[13]	Critical Habitat Determination[14]	Species Determination[2]	Major Animal Type	Species Grouping
Rana muscosa	mountain yellow-legged frog (southern California distinct population segment)	E, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Ambystoma californiense	California tiger salamander (Central Valley, Santa Barbara County , Sonoma County DPS)	E, E, T, CH	LAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Salamanders
Rana muscosa	mountain yellow-legged frog (northern California distinct population segment)	E, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Rana sierrae	Sierra Nevada yellow-legged frog	E, CH	NLAA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Rana boylii	foothill yellow-legged frog, South Sierra, South Coast, and North Feather distinct population segments	Newly listed; proposed threatened, proposed endangered	NA	LAA	Amphibians: Salamanders, Toads, and Frogs	Frogs and Toads
Strix occidentalis lucida	Mexican spotted owl	T, CH	NLAA	LAA	Birds	Raptors/Birds of Prey

Scientific Name	**Common Name**	**Status**[13]	**Critical Habitat Determination**[14]	**Species Determination**[2]	**Major Animal Type**	**Species Grouping**
Strix occidentalis caurina	Northern spotted owl	T, CH	NLAA	LAA	Birds	Raptors/Birds of Prey
Polioptila californica californica	Coastal California gnatcatcher	T, CH	NLAA	LAA	Birds	Woodland and Upland Birds
Brachyramphus marmoratus	Marbled murrelet	T, CH	NLAA	LAA	Birds	Woodland and Upland Birds
Bombas franklini	Franklin's bumble bee	E	NA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Bees
Lednia tumana	meltwater lednian stonefly	T	NA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Beetles and Stoneflies
Zapada glacier	western glacier stonefly	T	NA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Beetles and Stoneflies
Euphydryas editha quino	Quino checkerspot butterfly	E, CH	LAA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers
Pyrgus ruralis lagunae	Laguna Mountains skipper	E, CH	LAA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers
Hesperia leonardus montana	Pawnee montane skipper	T, PCH	LAA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers
Euphilotes enoptes smithi	Smith's blue butterfly	E, PCH	LAA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers

Scienctific Name	Common Name	Status[13]	Critical Habitat Determination[14]	Species Determination[2]	Major Animal Type	Species Grouping
Euproserpinus euterpe	Kern primrose sphinx moth	T	NA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers
Hermelycaena (Lycaena) hermes	Hermes copper butterfly	PT, PCH	LAA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers
Icaricia (Plebejus) shasta charlestonensis	Mount Charleston blue butterfly	E, CH	LAA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers
Euphydryas anicia cloudcrofti	Sacramento Mountains checkerspot butterfly	Newly listed; proposed endangered	NA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Butterflies and Skippers
Helminthoglypta walkeriana	Morro shoulderband (banded dune) snail	T, (CH)	NA	LAA	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Terrestrial Gastropod
Zapus hudsonius luteus	New Mexico meadow jumping mouse	E, (CH)	NLAA	LAA	Mammals	Small rodents
Dipodomys merriami parvus	San Bernardino Merriam's kangaroo rat	E, (CH)	NLAA	LAA	Mammals	Small rodents
Zapus hudsonius preblei	Preble's meadow jumping mouse	T, CH	NLAA	LAA	Mammals	Small rodents

Scientific Name	Common Name	Status[13]	Critical Habitat Determination[14]	Species Determination[2]	Major Animal Type	Species Grouping
Cynomys parvidens	Utah prairie dog	T	NA	LAA	Mammals:	Large rodents
Urocitellus brunneus	Northern Idaho ground squirrel	T	NA	LAA	Mammals:	large rodents
Brachylagus idahoensis	Columbia Basin pygmy rabbit	E	NA	LAA	Mammals	lagomorph

Table 6. Listed, and proposed aquatic species and proposed and designated critical habitats addressed with adverse-affect determinations. Grayed out Critical Habitat Determinations are not included in the status of the species because they are either not applicable or were address in the above concurrence. (Compiled from Tables 33-35 in BA.)

Scientific Name	Common Name	Status[15]	Critical Habitat Determination	Species Determination[16]	Grouping
Pyrgulopsis trivialis	Three Forks springsnail	E, CH	LAA	LAA	Gastropod
Pacifastacus fortis	Shasta crayfish	E	NA	LAA	Crustaceans
Catostomus discobolus yarrowi	Zuni bluehead sucker	E, CH	LAA	LAA	Fish
Catostomus santaanae	Santa Ana sucker	T, CH	LAA	LAA	Fish
Chasmistes brevirostris	shortnose sucker	E, CH	LAA	LAA	Fish
Crenichthys nevadae	Railroad Valley springfish	T, (CH)	NA	LAA	Fish

[15] T= Threatened, E=Endangered, XN= Non-essential Experimental, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System Lands.

[16] NE= No Effect; NA= not applicable; NLAA= May Affect, Not Likely to Adversely Affect; LAA= May Affect, Likely to Adversely Affect;)

Scientific Name	**Common Name**	**Status**[15]	**Critical Habitat Determination**	**Species Determination**[16]	**Grouping**
Cyprinodon macularius	desert pupfish	E, (CH)	NA	LAA	Fish
Deltistes luxatus	Lost River sucker	E, CH	LAA	LAA	Fish
Gasterosteus aculeatus williamsoni	unarmored 3-spine stickleback (Shay Creek stickleback)	E	NA	LAA	Fish
Gila(Siphateles) bicolor snyderi	Owens tui chub	E, CH	LAA	LAA	Fish
Gila cypha	humpback chub	T, (CH)	NA	LAA	Fish
Gila ditaenia	Sonora chub	T, CH	LAA	LAA	Fish
Gila elegans	bonytail chub	E, (CH)	NA	LAA	Fish
Gila intermedia	Gila chub	E, CH	LAA	LAA	Fish
Gila nigrescens	Chihuahua chub	T, (CH)	NA	LAA	Fish
Gila purpurea	Yaqui chub	E, (CH)	NA	LAA	Fish
Ictalurus pricei	Yaqui catfish	T, (CH)	NA	LAA	Fish
Lepidomeda vittata	Little Colorado spinedace	T, CH	LAA	LAA	Fish
Meda fulgida	spikedace	E, CH	LAA	LAA	Fish
Oncorhynchus aguabonita whitei	Little Kern golden trout	T, CH	LAA	LAA	Fish
Oncorhynchus apache	Apache trout	T	NA	LAA	Fish
Oncorhynchus clarki henshawi	Lahontan cutthroat trout	T	NA	LAA	Fish
Oncorhynchus clarki seleniris	Paiute cutthroat trout	T	NA	LAA	Fish
Oncorhynchus clarki stomias	greenback cutthroat trout	T	NA	LAA	Fish
Oncorhynchus gilae gilae	Gila trout	E	NA	LAA	Fish
Poeciliposis occidentalis occidentalis	Gila topminnow	E	NA	LAA	Fish
Ptychocheilus lucius	Colorado pikeminnow	E, (CH), XN	NA	LAA	Fish
Salvelinus confluentus	bull trout	T, CH, XN	LAA	LAA	Fish
Tiaroga cobitis	loach minnow	E, CH	LAA	LAA	Fish
Xyrauchen texanus	razorback sucker	E, CH	LAA	LAA	Fish

Table 7. Listed and proposed plant species with "may affect, likely to adversely–effect" determinations. None of the proposed or designated critical habitats for plants had "may affect, likely to adversely affect" determinations (Table 39 in BA).

Scientific Name	Federal Status and Critical	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated	retardant use 0.01% or more land base	Mapped Avoidance Areas	Rationale for Determination[3]
Acanthomintha ilicifolia	T, CH	San Diego thorn-mint	5	Cleveland	N	Y	Y/Y	Retardant use
Acanthoscyphus parishii var. goodmaniana (Oxytheca parishii)	E, CH	Cushenbury oxytheca	5	San Bernardino	N	Y	Y/Y	Retardant use
Allium munzii	E, CH	Munz's onion	5	Cleveland	Y	Y	Y/Y	Retardant use
Arabis mcdonaldiana	E	McDonald's rockcress	5, 6	Rogue-River Siskiyou, Six Rivers, Klamath and suspected on Shasta Trinity	N	Y	Y	Retardant use
Arenaria ursina	T, CH	Bear Valley sandwort	5	San Bernardino	N	Y	Y/Y	Retardant use
Argemone pleiacantha spp. pinnatisecta	E	Sacramento prickly poppy	3	Lincoln	N	Y	Y	Retardant use
Astragalus albens	E, CH	Cushenbury milk-vetch	5	San Bernardino	N	Y	Y/Y	Retardant use

[17] T= Threatened, E=Endangered, CH = designated Critical Habitat. 'P' preceding any of those indicates species or critical habitat is proposed for listing or designation, but a final rule has not been issued. Parentheses around CH indicates that critical habitat has been designated but is not on National Forest System Lands. *Isolated pop* means isolated population

Scientific Name	Federal Status and Critical	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated	retardant use 0.01% or more land base	Mapped Avoidance Areas	Rationale for Determination[3]
Astragalus brauntonii	E, CH	Braunton's milk-vetch	5	Angeles, suspected on San Bernardino	N	Y	Y/Y	Retardant use
Astragalus limnocharis var. montii (Astragalus montii)	T, CH	Heliotrope milk-vetch	4	Manti-La Sal	Y	Y	Y/Y	Isolated pop/ Retardant use
Astragalus tricarinatus	E	triple-ribbed milk-vetch*	5	San Bernardino	Y	Y	Y	Retardant use
Baccharis vanessae	T	Encinitas baccharis	5	Cleveland	N	Y	Y	Retardant use
Berberis nevinii (Mahonia nevinii)	E, CH	Nevin's barberry	5	Angeles, suspected on San Bernardino	N	Y	Y/Y	Retardant use
Brodiaea filifolia	T, CH	thread-leaved brodiaea	5	Angeles, Cleveland, suspected on San Bernardino	N	Y	Y/Y	Retardant use
Calyptridium pulchellum	T	Mariposa pussypaws	5	Sierra	Y	Y	Y	Retardant use / Isolated pop
Calystegia stebbinsii	E	Stebbin's morning glory	5	Tahoe	N	Y	Y	Retardant use
Castilleja cinerea	T, CH	ash-grey paintbrush	5	San Bernardino	N	Y	Y/Y	Retardant use

Scientific Name	Federal Status and Critical	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated	retardant use 0.01% or more land base	Mapped Avoidance Areas	Rationale for Determination[3]
Caulanthus californicus	E	California jewelflower	5	Los Padres, suspected on Sequoia	N	Y	Y	Retardant use
Ceanothus ophiochilus	T, CH	Vail Lake ceanothus	5	Cleveland	Y	Y	Y/Y	Retardant use / Isolated pop
Chlorogalum purpureum var. reductum (Chlorogalum purpureum)	T, CH	Camatta Canyon amole	5	Los Padres	N	Y	Y/Y	Retardant use
Cirsium vinaceum	T	Sacramento Mountains. thistle	3	Lincoln	N	Y	Y	Retardant use
Cirsium wrightii	PT; PCH	Wright's marsh thistle	3	Lincoln	N	Y	Y	Retardant use
Clarkia springvillensis	T	Springville clarkia	5	Sequoia	N	Y	Y	Retardant use
Coryphantha sneedii var leei	T	Lee pincushion cactus	3	Lincoln	Y	Y	Y	Retardant use
Coryphantha sneedii var sneedii	E	Sneed pincushion cactus	3	Lincoln	N	Y	Y	Retardant use
Dodecahema leptoceras	E	slender-horned spineflower	5	Angeles, Cleveland, San Bernardino	N	Y	Y	Retardant use

Scientific Name	Federal Status and Critical	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated	retardant use 0.01% or more land base	Mapped Avoidance Areas	Rationale for Determination[3]
Eriastrum densifolium ssp. sanctorum	E	Santa Ana River wollystar*	5	Suspected on San Bernardino (occurs on mutual aid boundary)	N	Y	Y	Retardant use
Erigeron parishii	T, CH	Parish's daisy	5	San Bernardino	N	Y	Y/Y	Retardant use
Eriogonum kennedyi var. austromontanum	T, CH	southern mountain buckwheat	5	San Bernardino	N	Y	Y/Y	Retardant use
Eriogonum ovalifolium var. vineum	E, CH	Cushenbury buckwheat	5	San Bernardino	N	Y	Y/Y	Retardant use
Graptopetalum bartramii	T	Bartram’s stonecrop	3	Coronado	N	Y	Y	Retardant use
Hackelia venusta	E	showy stickseed	6	Okanogan-Wenatchee	Y	Y	Y	Retardant use
Hedeoma todsenii	E	Todsen's pennyroyal	3	Lincoln	N	Y	N	Retardant use
Ipomopsis sancti-spiritus	E	Holy ghost ipomopsis	3	Santa Fe	Y	Y	N	Retardant use
Ivesia webberi	T, CH	Webber ivesia	4,5	Toiyabe, possibly on Tahoe, potential on Plumas	N	Y	Y	Retardant use
Lilaeopsis schaffneriana spp. recurva	E, CH	Huachuca water umbel	3	Coronado	N	Y	Y/Y	Retardant use

Scientific Name	**Federal Status and Critical**	**Common Name**	**FS Region**	**Occurrence on Forest or State with National Forest**	**Populations or individuals in single isolated**	**retardant use 0.01% or more land base**	**Mapped Avoidance Areas**	**Rationale for Determination[3]**
Mirabilis macfarlanei	T	Mac Farlane's four-o'clock	1,6	Nez Perce, Wallowa Whitman	N	N in WW Y in NP	Y	Retardant use, habitat in retardant prone area
Nolina brittonia	E	Britton's beargrass	8	National Forests in Florida	N	Y	Y	Retardant use
Opuntia treleasei	E	Bakersfield cactus	5	Sequoia	N	Y	N	Habitat
Orcuttia tenuis	T, CH	slender ocutt grass	5	Lassen, Modoc, Plumas, suspected on Shasta Trinity	N	Y	Y/ N	Retardant use
Phacelia argillacea	E	Clay phacelia	4	Uinta, suspected on Manti-La Sal	Y	Y	Y	Retardant use and isolated population
Phlox hirsuta	E	Yreka phlox	5	Klamath	N	Y	Y	Retardant use
Physaria kingii ssp. bernardina (Lesquerella kingii ssp. bernardina)	E, CH	San Bernardino Mountains bladderpod	5	San Bernardino	N	Y	Y/Y	Retardant use
Poa atropurpurea	E, CH	San Bernardino bluegrass	5	Cleveland, San Bernardino	Y	Y	Y/Y	Retardant use
Senecio layneae	T	Layne's butterweed (ragwort)	5	Eldorado, Plumas, Tahoe	N	Y	Y	Retardant use

Scientific Name	Federal Status and Critical	Common Name	FS Region	Occurrence on Forest or State with National Forest	Populations or individuals in single isolated	retardant use 0.01% or more land base	Mapped Avoidance Areas	Rationale for Determination[3]
Sidalcea oregana var. calva	E, CH	Wenatchee Mountains checker-mallow	6	Okanogan-Wenatchee	Y	Y	Y/Y	Retardant use and isolated population
Sidalcea pedata	E	pedate checker-mallow (bird-foot checkerbloom)	5	San Bernardino	N	Y	Y	Retardant use
Silene spaldingii	T	Spalding's catchfly	1,6	Nez Perce, Umatilla, Wallowa Whitman, suspected on Lolo, Kootenai, Idaho Panhandle	N	Y	Y	Local retardant use and habitat in retardant prone areas
Spiranthes delitescens	E	Canelo Hills ladies-tresses	3	Coronado	N	Y	Y	Retardant use
Taraxacum californicum	E, CH	California taraxacum	5	San Bernardino	N	Y	Y/Y	Retardant use
Thelypodium stenopetalum	E	slender-petaled mustard	5	San Bernardino	N	Y	Y	Retardant use
Townsendia aprica	T	Last Chance Townsendia	4	Dixie, Fishlake	N	Y	Y	Retardant use
Tuctoria greenei	E, CH	Greene's tuctoria (Orcutt grass)	5	Modoc, suspected. on Lassen	N	Y	Y/ N	Retardant use

ENVIRONMENTAL BASELINE

The environmental baseline is defined as "the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the Action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline." (50 CFR 402. 02, as revised August 27, 2019).

Due to the large size of the action area and the widespread distribution of species within the action area, this Opinion will consider the Environmental Baseline at a broad scale. Many of the ESA-covered species and their critical habitats are exposed to multiple stressors comprising the past and present impacts of actions and activities that are described below. Many of the ongoing stressors are also intensified by population growth and development pressures as well as variable effects of climate change and, for some species, ocean acidification. This Environmental Baseline focuses primarily on the status and trends of the ecosystems in which these species and their critical habitats occur in the United States and the consequences of that status for ESA-covered resources. In addition to past and ongoing use of fire retardant, we explore factors that affect the environmental baseline for listed species and designated critical habitats including, among others, habitat degradation, invasive species, pollution, harvesting, water-related issues, and climate change.

Past and Ongoing Use of Fire Retardant

The following discussion of the past and ongoing retardant use is excerpted from the BA:

Since 2012 the USFS has provided a yearly summary of retardant use and reports of retardant intrusions into avoidance areas to the Fish and Wildlife Service and NOAA Fisheries. The USFS has compiled data on aerial retardant use and fires from 2012 through 2019 (Appendix A of the BA) and provided a summary of the data (USDA - USFS, 2020a) to the Services.

Retardant Use Data

Data derived from Aviation Business System indicates approximately 102 million gallons of retardant (approximately 56,868 drops) were aerially applied to National Forest System Lands in the eight years from 2012 through 2019 (USDA - USFS, 2020a). It is estimated that the average annual acreage of National Forest System Lands that have retardant applied is between 8,586 and 22,552 acres, which is approximately 0.004 to 0.012 percent of the total National Forest System landbase annually[18] . USFS Regions 1 (Northern Region), 3 (Southwestern Region), 4

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

(Intermountain Region), 5 (Pacific Southwest Region), and 6 (Pacific Northwest Region) apply higher amounts of retardant compared to other regions.

One of the precepts of the 2011 Record of Decision was to use aerially delivered water where possible to limit the impacts of aerially applied retardant. **Table 8** displays the amount of product delivered aerially by percent of total, by year. This data is available by forest and USFS region in the summary report (USDA - USFS, 2020a).

Table 8. Percent of total aerially delivered fire retardant chemical by type and year (Table 3 in BA).

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

Use of aircraft for firefighting can result in disturbances to species and habitat. There is a potential for varying levels of effects dependent upon the type of aircraft used. **Table 9** displays the percent of retardant delivered by airtanker or helicopter by year. These data are available by forest and USFS region in the summary report (USDA - USFS, 2020a). The data are not available by the specific airtanker or helicopter type.

Table 9. Percent of retardant by airtanker or helicopter, by year (Table 4 in BA).

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

Use of aerially delivered retardant varies by USFS region, as shown in, **Figure 7** and **Figure 8**, and **Table 10** below. This information is used in this analysis to estimate where aerially delivered retardant may be used in the future (refer to the 'Effects Analysis' section in the BA for more information).

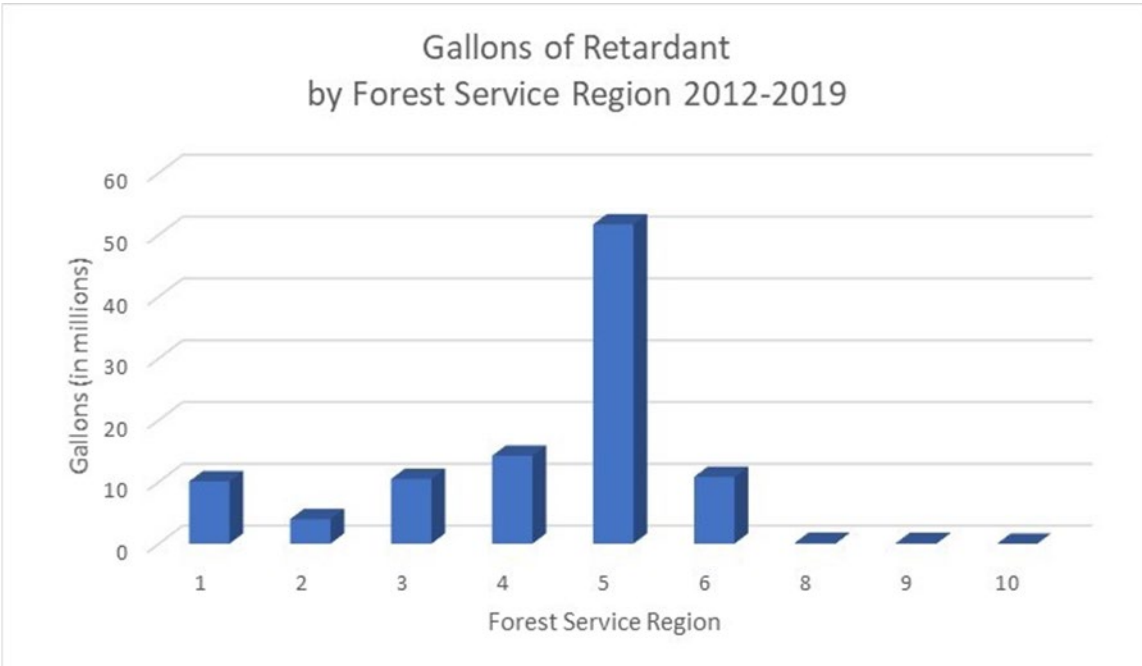

Figure 7. Fire retardant use by USFS region, 2012 through 2019 (Figure 5 in BA).

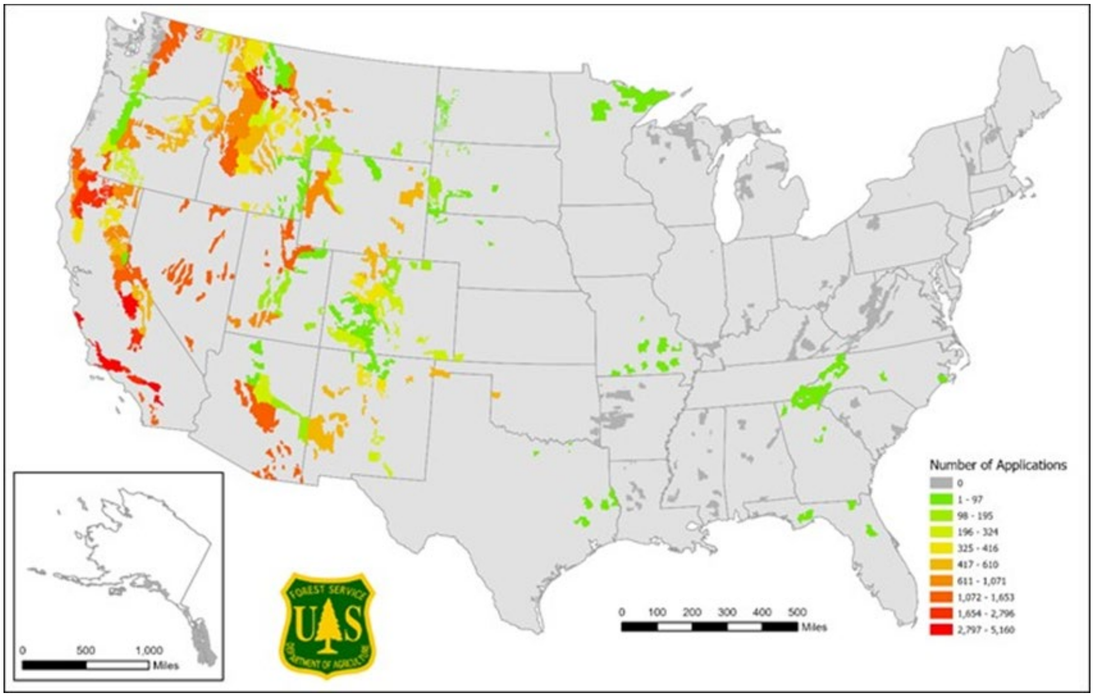

Figure 8. Aerial fire retardant applications on National Forest System Lands, 2012 through 2019 (Figure 6 in BA).

Table 10. Estimated area of aerial fire retardant application on National Forest System Lands, by USFS Region, 2012 through 2019 (Table 5 in BA).

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

Intrusions

An intrusion, previously referred to as a misapplication, is defined as "any application of aerial retardant, accidental or allowed under the exception, into an avoidance area." From 2012 through 2019, there were 244[19] fires with intrusions (0.46 percent of the total fires). There was a total of 459[20] reported intrusions on those fires. **Table 11** summarizes the intrusion reports (for additional information, see Appendix C of the BA).

Table 11. Summary of intrusion reports, by year (Table 6 in BA).

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

[19] Number changed from 245 to 244 to match data in Summary of intrusion reports, by year (Table 6 in BA).
[20] Number changed from 455 to 459 to match data in Summary of intrusion reports, by year (Table 6 in BA).

Year	2012	2013	2014	2015	2016	2017	2018	2019	Total
									number of fires
Percent of fires with intrusions (%)	0.5	0.41	0.45	0.4	0.54	0.51	0.61	0.28	0.46
									Total # of intrusion reports / Total # of drops
Total intrusions divided by estimated drops (%)	1.52	0.81	0.75	0.79	0.57	0.71	0.97	0.56	0.81

The USFS notes these data are different than that reported to the Service in the yearly monitoring report. The yearly reporting summarizes the number of intrusions into waterways and waterway buffers only. Additionally, the estimated number of drops was calculated differently over the years. The summary in **Table 11** standardizes the calculation for estimated number of drops.

The Wildland Fire Chemical Misapplication Reporting database identifies intrusions by their location as identified by the reported latitude and longitude coordinates. Appendix B of the BA contains maps of the intrusions reported from 2012 through 2019. The maps identify the intrusions by area and type. **Table 12** summarizes the intrusion type as accidental or exception by USFS Region. Possible intrusion areas include waterway; waterway buffer; dry intermittent stream; aquatic threatened, endangered, proposed, candidate or sensitive species habitat; or terrestrial threatened, endangered, proposed, candidate or sensitive species habitat. Because some intrusions occur in multiple areas (i.e., waterways, buffer zones, etc.), when summarized, the USFS uses a priority order to document intrusions. That order is aquatic threatened, endangered, proposed, candidate or sensitive species; terrestrial threatened, endangered, proposed, candidate or sensitive species; waterway; waterway buffer; and dry intermittent stream. In other words, if an intrusion occurs across an area that includes the waterway, buffer zones, and aquatic listed species habitat, the USFS indicates the intrusion as occurring in aquatic listed species habitat. **Table 13** summarizes the intrusions by area as mapped.

Table 12. Summary of intrusion reports by USFS region, identified as 'accident' or 'exception', for the period 2012 through 2019 (Table 7 in BA).

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

Table 13. Summary of intrusion reports by USFS region, identified by location of intrusion (Table 8 in BA).

Region	Aquatic TEPCS	Terrestrial TEPCS	Waterway	Waterway Buffer	Dry Intermittent Stream	Unknown	TOTAL
Region 1	9	0	16	6	1	0	**32**
Region 2	1	0	8	4	2	0	**15**
Region 3	5	1	4	4	1	0	**15**
Region 4	20	11	45	28	12	5	**121**
Region 5	56	22	92	48	33	1	**252**
Region 6	10	2	6	3	0	0	**21**

Region	Aquatic TEPCS	Terrestrial TEPCS	Waterway	Waterway Buffer	Dry Intermittent Stream	Unknown	TOTAL
Region 8	1	0	1	0	0	0	**2**
Region 9	1	0	0	0	0	0	**1**
Total	103	36	172	93	49	6	**459**

Some intrusions have resulted in take of threatened and endangered species, as described in the Incidental Take Statements (ITS) in the Opinion (USFWS, 2011). The 2011 Opinion has incidental take statements for 38 species: 23 fish, 3 birds, 1 reptile, 4 amphibians, and 7 terrestrial invertebrates. The amount of take for a species was described as acres affected or miles of stream impacted, or in some cases several drops/intrusions in a specified area. For some species with wide distribution, take was allocated for each forest based on the amount of occupied or suitable habitat that occurs on the forest. **Table 14** provides a summary of intrusions that resulted in take from 2012 through 2019. A complete listing of intrusions into avoidance areas is found in Appendix C, of the BA.

Table 14. Intrusion events resulting in take of threatened or endangered species (adapted from Table 9 in BA and Assessment for the Cameron Peak Fire- Final Fisheries Specialist Report for Arapaho and Roosevelt National Forests (Fairchild, 2020)).

Species	Forest	Incident	ITS Anticipated Take	Reported Take	Take Remaining
Quino checkerspot butterfly	San Bernardino	2013 Mountain 2019 Bautista	46.0 acres	25.1 acres 8.68 acres	20.9 acres 12.22 acres
Bull trout	Okanogan-Wenatchee	2014 Carlton Complex	6.7 miles	0.3 miles	6.4 miles
Bull trout	Boise	2014 Bull Creek	5.0 miles	1.0 miles	4.0 miles
Bull trout	Lolo	2017 Lolo Peak 2017 Rice Ridge 2017 Sunrise	1.6 miles	5.1 miles 24.97 miles 13.5 miles	take exceeded

Species	Forest	Incident	ITS Anticipated Take	Reported Take	Take Remaining
Greenback cutthroat trout	Arapaho	2020 Cameron Peak	0.1 miles	unknown	
Arroyo toad	Los Padres	2016 Rey 2016 Soberañes	10.0 miles	unknown unknown	

For example, take for bull trout was exceeded in 2017 on the Lolo National Forest and consultation was reinitiated at the local Field Office level. The Supplemental Amendment Opinion (USFWS, 2019) for the bull trout adopted seven additional Conservation Measures, valid through the term of the original action, January 1, 2022.

Avoidance Areas

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

Fire Season

The term 'fire season' generally refers to the time of the year when fires occur. It varies by location and yearly weather patterns. In general, the peak seasons are described by USFS region as shown in **Table 15**.

Table 15. Peak fire season, by USFS region, based on historical data (Table 10 in BA).

USFS Region	Peak fire season
1	April - October
2	June – October
3	May – July
4	June - October
5	August - October
6	June - October
8	September - July
9	April - October
10	June - September

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

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

The USFS also created charts for a visual representation. Below are examples of the available data (as described in **Table 16** below).

Table 16. Acres burned, by USFS Region and by month for the period 2000 through 2019. Total fire acres are attributed to the month in which the fire started (Table 11 in BA).

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

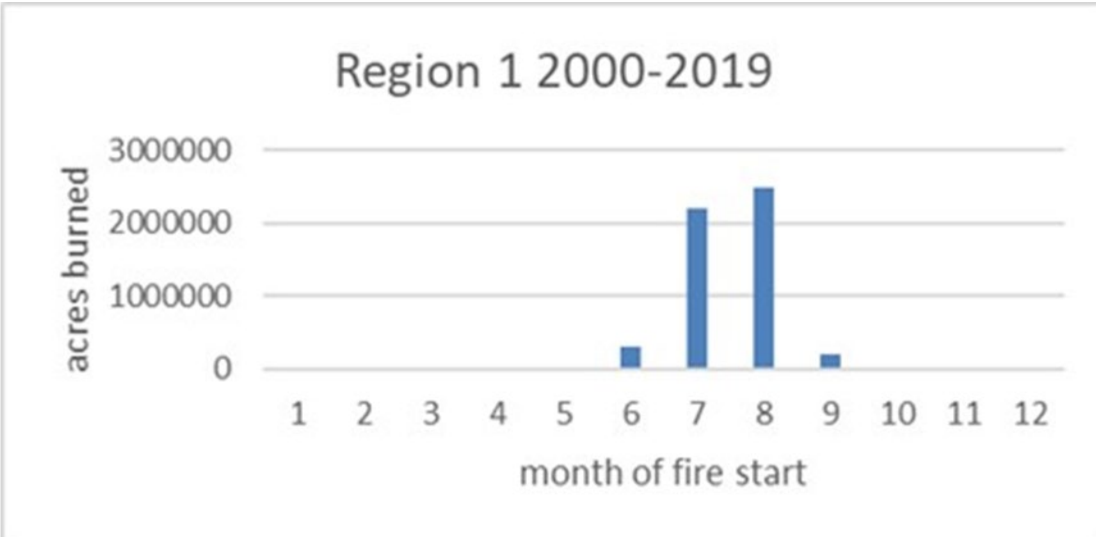

Figure 9. Acres burned, by month of fire start in USFS Region 1, from 2000 through 2019 (Figure 7 in BA).

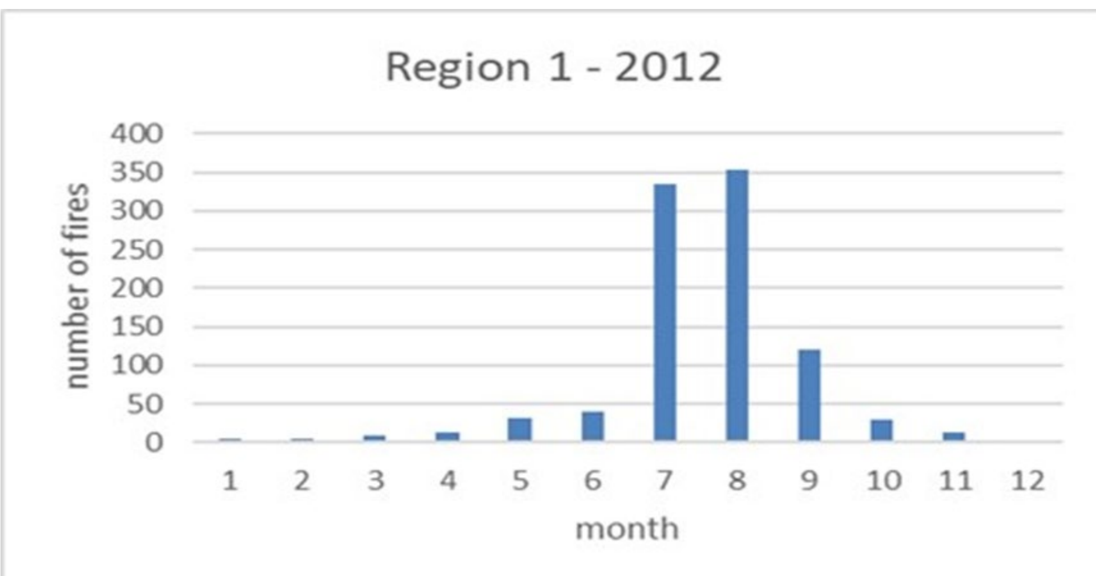

Figure 10. Number of fires in 2012, by month, in USFS Region 1 (Figure 8 in BA).

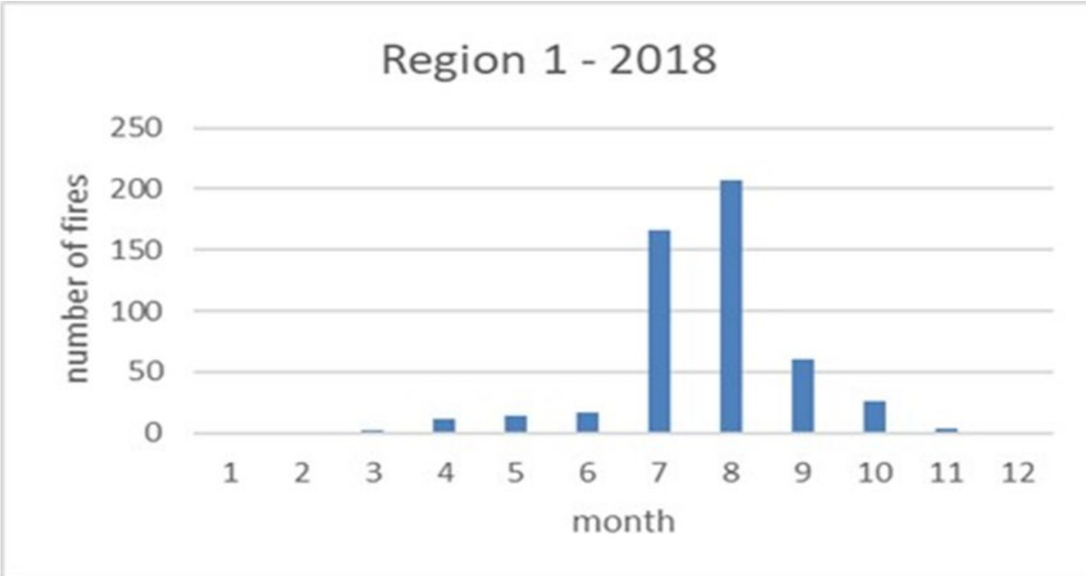

Figure 11. Number of fires in 2018, by month, in USFS Region 1 (Figure 9 in BA).

In addition to the analysis of Firestat data, the following **Table 17** was developed from retardant use data from 2012 through 2019. It provides the dates that aerially delivered retardant began and ended each year by USFS region. An entry of a single date indicates that is the only date when retardant was aerially delivered. These data are also found in the summary report broken out by each forest and delivery method (airtanker or helicopter) and for each Forest the number of days retardant was flown is indicated.

Table 17. Beginning and ending dates of aerially delivered retardant, by USFS region and by year. Region 10 (Alaska) does not use retardant on National Forest System Lands, so it is not included in the table. 'No use' indicates no use of aerially-delivered retardant (Table 12 in BA).

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

USFS Activities under Section 7(a)(1)

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

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

- Impacts of water temperature, pH, or presence of ash on dispersal of retardant in water.
- Influence of the flow rate, water hardness, and application rate on pulsed exposure of rainbow trout to retardant chemicals.
- Influence of the duration of exposure and application rate on toxicity to rainbow trout of a pulsed retardant exposure.
- Determine 96-hour mortality to rainbow trout after a second pulsed retardant exposure
- Influence of substrate and duration of weathering on toxicity in a simulated runoff event.
- Effects of ultraviolet (UV) exposure on chemical toxicity.
- Toxicity of pulsed chemical exposure to Ceriodaphnia (an aquatic invertebrate).
- Determine the concentration of chemical lethal to rainbow trout at various timepoints under 24-hours.

Additional studies, including repeating these studies on new retardant formulations, will occur as funds allow. While these activities are not necessarily part of the Action, as proposed, the results of completed studies will help to inform or refine assumptions related to implementation of the program.

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

The USFS Fire Retardant Misapplication Calculator, developed in collaboration with United States Geological Survey, was released in April of 2019. This tool is commonly referred to as the "spill calculator" and the 2019 release replaced the previous version of the spill calculator. It provides three results: (1) the load of tank mix delivered to the stream, (2) the affected reach length, and (3) the maximum exposure time over the specified toxicity value. The toxicity value is taken as 10 percent of the median lethal concentration for the specified retardant which adds a protection factor to the median lethal concentration. The use of the toxicity value as 10 percent of the median lethal concentration also allows the USFS to base their analysis of toxicity on a more conservative estimate while capturing any uncertainty in the LC_{50} value determined through toxicity testing. This tool is useful for determining potential effects of retardant intrusions into water.

In 2020, the USFS updated the specification for long-term retardant. The updated version of the retardant specification changed the allowable aquatic toxicity from a median lethal concentration (LC_{50}) for rainbow trout of greater than 100 milligrams per liter to a median LC_{50} of greater than 200 milligrams per liter. This addresses the conservation recommendation in the National Marine Fisheries Service's West Coast Region Opinion (USDOC NOAA Fisheries 2019, WCRO-2018-00288) to use less toxic formulations, and also influences the USFS' analysis in their BA prepared for this consultation with the Service. As advancements are made in the retardant industry, the USFS will continue to consider lowering the aquatic toxicity threshold in future revisions of the specifications.

Pesticides

Pesticides use is a common practice to kill or manage unwanted plants, animals, and other pests (e.g., fungi, microbes). Pesticide use can benefit forestry and public health, as well as agriculture. For example, benefits of pesticide use in agriculture are increased food production, increased profits for farmers, and the prevention of diseases. Pesticides benefit human health by killing pests such as mosquitos that that carry and transmit diseases (e.g., malaria, West Nile virus, and Zika). Pesticides are also used in non-agriculture sites for forestry and land management. For example, herbicides are used to control unwanted or invasive non-native plants in natural environments or to aid in the restoration of native habitat.

The use of pesticides and pesticide mixtures as part of past Federal and non-Federal actions have resulted in impacts to listed species, their habitats, and other species on which they depend. When pesticides are applied, they are often mobile in the environment and can enter air, water, and soil. They can have adverse effects to the health of wildlife. Pesticides are stressors that have contributed to the current status of some listed species and designated critical habitats.

Numerous Federal actions have undergone section 7 consultation, some of which are related to pesticide use. For example, the USDA Animal and Plant Health Inspection Service (APHIS) uses pesticides to achieve its mission and has consulted regarding their use, on multiple occasions. APHIS Pest Program activities have specifically focused on pest management and often included the use of pesticides as one of the program elements. APHIS's implementation of these activities are supported by a well-established program infrastructure that includes environmental compliance, training, monitoring, and reporting. Most APHIS activities have occurred on non-Federal lands.

The Service also recently completed consultation on Environmental Protection Agency's registration of the insecticide malathion, which addressed effects to all domestically endangered and threatened species and their critical habitats. Although this pesticide is not widely used on federal lands, label changes developed in coordination between the agencies and the pesticide registrants is expected to greatly reduce effects to many listed species and their critical habitats from use of this pesticide.

Habitat Degradation

One of the primary factors negatively affecting imperiled species are impacts or changes to their habitat. Human activities have significant and sometimes devastating effects on species and habitats, such as through the introduction of physical and chemical pollutants, or alternation of the environment and the complex ecological systems on which many species depend. There are many kinds of habitat modification activities that have occurred in the United States throughout human history. The earliest modifications likely included the use of fire to encourage or discourage the growth of certain plant communities. The types and extent of habitat changes have increased through time, with much of the land in the United States now used for agriculture, forestry, urban and industrial development, and mining. Each of these land-uses affects species and habitats somewhat differently. The following paragraphs discuss some of the general types of habitat impacts that have been caused by land use conversion and development. Subsequent sections will discuss impacts from various categories of land-use activities.

Data from the USDA (2013) suggest that more than 398,000 acres of grasslands, forests, and other lands were converted to cropland between 2011 and 2012 (**Figure 12**). Conversion of natural lands also occurs from urbanization, as population centers expand, or to meet demand for various products or resources. For example, beginning in the 1600s and continuing into the early twentieth century, forests of the United States were harvested at a high rate (Masek, et al., 2011). Over the last 100 years, the area of forest cover in the United States has been relatively stable (Masek, et al., 2011), though reforested areas may not provide the same quality of habitat as unharvested, mature growth forests for ESA-listed species.

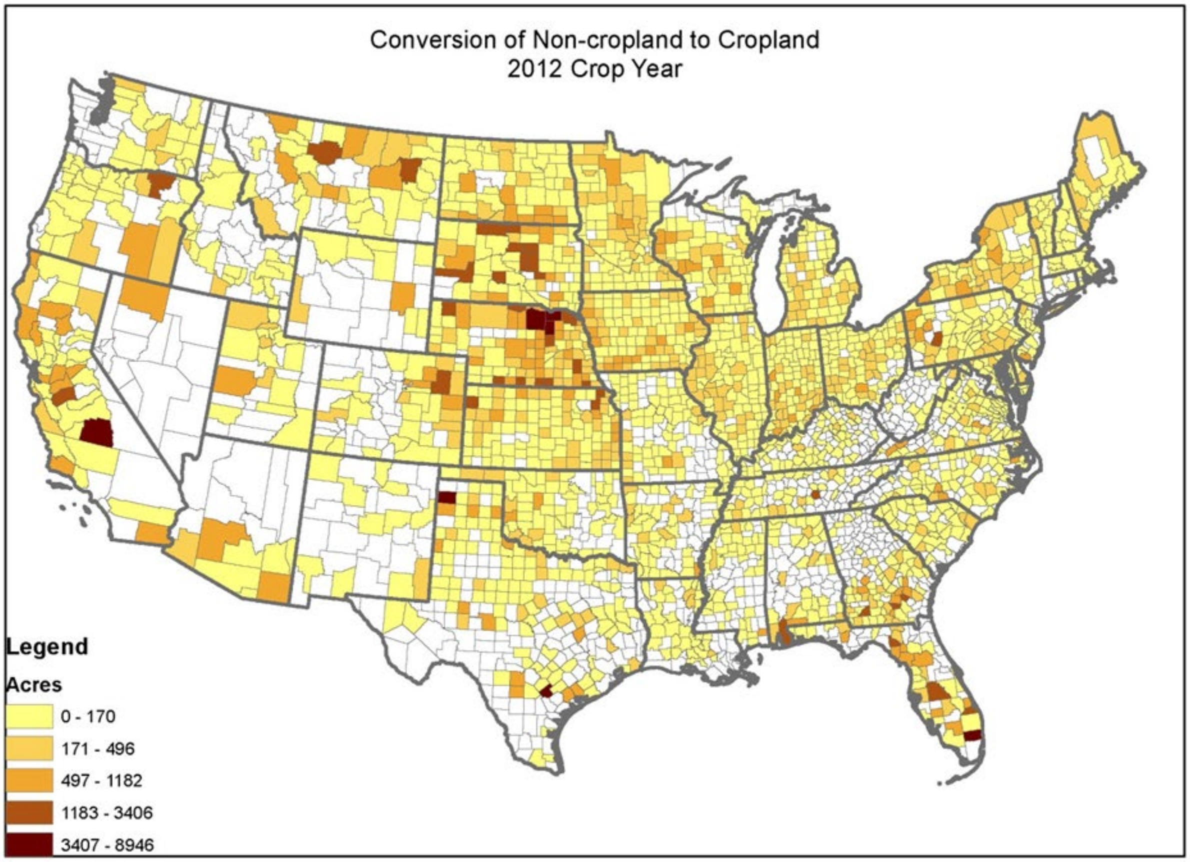

Figure 12. The conversion of land to cropland in 2012 (USDA, 2013).

Through an analysis of threat data compiled from Federal Register documents, Czech et al. (Czech, Krausman, & Devers, 2000) identified urbanization and agriculture as the second and third most common causes of species endangerment in the United States, following non-native species interactions. **Table 18** identifies the causes of endangerment to 877 ESA-listed species identified through Federal Register documents (Czech, Krausman, & Devers, 2000). Species may also be affected by multiple stressors at the same time.

Table 18. Causes of endangerment for ESA-listed species. Modified from Czech et al. 2000.

Cause	Number of Species Endangered by Cause (% of Species Endangered by Cause)
Non-native species	305 (35)
Urbanization	275 (31)
Agriculture	224 (26)
Recreation	186 (21)
Ranching	182 (21)
Reservoir and water diversions	161 (18)
Fire suppression	144 (16)
Pollution	144 (16)

Cause	Number of Species Endangered by Cause (% of Species Endangered by Cause)
Mining/oil & gas	140 (16)
Industry/military activities	131 (15)
Harvest	120 (14)
Logging	109 (12)
Roads	94 (11)
Loss of genetics viability	92 (10)
Aquifer depletion/wetland filling	77 (9)
Native species competition	77 (9)
Disease	19 (2)
Vandalism	12 (1)

ESA-listed species requiring ephemeral habitats, such as those maintained by fire or flooding, have experienced range reductions because the stochastic events that maintain their habitat are often incompatible with human infrastructure and other development. For example, suppression of wildfires and natural flood events that would occasionally disturb climax ecological communities and create early successional and transitory habitat have reduced habitat available for many species.

While human-induced impacts have occurred throughout history, some activities have also included strategies and actions to reduce these impacts such as the establishment of protected areas and reserves, and implementation of restoration or conservation activities to benefit listed species.

Loss and Degradation of Freshwater Habitats

Freshwater habitats are among the most threatened ecosystems in the world (Leidy & Moyle, 1998). Reviews of aquatic species' conservation status for the past three decades have documented the cumulative effect of anthropogenic and natural stressors on freshwater aquatic ecosystems, resulting in a significant decline in the biodiversity and condition of indigenous fish, mussel, and crayfish communities (Taylor, et al., 2007) (Jelks, et al., 2008). Anthropogenic stressors, the result of many different impacts, are present to some degree in all waterbodies of the United States. These stressors often lead to long-term environmental degradation associated with lowered biodiversity, reduced primary and secondary production, and a lowered capacity or resiliency of the ecosystem to recover to its original state in response to natural perturbations (Rapport & Whitford, 1999).

Rivers and Streams

Many of our nation's rivers and streams have been affected by anthropogenic factors. Degradation of water quality, changes in water quantity (e.g., flows and/or timing), and habitat changes, such as impacts to riparian zones and in-stream features, often reduce habitat quality for listed species. Other changes have included the construction and operation of dams, stream channelization, and dredging to stabilize water levels or depths in rivers or lakes or for other purposes. When examining the impacts of large dams alone, for instance, it is estimated that 75,000 large dams have modified at least 600,000 miles of rivers across the country (IWSRCC, 2011). More than 400 dams exist in the Columbia River Basin alone (Columbia Basin Trust, 2012). Habitat loss coupled with other stressors has led to impacts on fish communities as well. By the early 1980s, Judy et al (Judy, Jr., et al., 1984) estimated that approximately 81% of the native fish communities in the United States had been impacted by human activities.

Wetlands

Wetlands provide habitat and perform functions that contribute to the health of ecosystems used by many species. There are many kinds of wetlands (e. g., bogs, fens, estuaries, marshes, etc.), each with different characteristics and functions. Wetlands are found in diverse landscapes, including forests, prairies, deserts, and within floodplains of streams (WDOE, 2000). They help maintain cool water temperatures, retain sediments, store and desynchronize flood flows, maintain base flows, and provide food and cover for fish and other aquatic organisms (Beechie, Beamer, & Wasserman, 1994; Mitsch & Gosselink, 1993; WDOE, 1998). Wetlands also can improve water quality through nutrient and toxic-chemical removal and/or transformation (Hammer, 1989; Mitsch & Gosselink, 1993).

The United States originally contained almost 392 million acres of wetlands. During the period between the 1780s and the 1980s, 118 million acres of wetlands were lost. Arkansas, California, Connecticut, Illinois, Indiana, Iowa, Kentucky, Maryland, Missouri and Ohio lost 70% or more of their original wetland acreage. California had an estimated loss of 91%. Florida lost approximately 9. 3 million acres or 46% of its 1780s total (Dahl, 1990). Additionally, the functions of existing wetlands have been reduced. Various factors have contributed to wetland loss and wetland function reduction including agricultural development, urbanization, timber harvest, road construction, and other land-management activities. Efforts to create and restore wetlands and other aquatic habitats by agencies of Federal, state, and local governments, non-governmental organizations, and private individuals have dramatically reduced the rate at which these ecosystems have been destroyed or degraded, but many aquatic habitats continue to be lost each year. Between 2006 and 2009, approximately 13,800 acres of wetlands were lost per year (Dahl, 2011). While this is significantly less than losses experienced in the previous decades (**Figure 13**), an estimated 72% of U. S. wetlands have already been lost when compared to historical estimates (Dahl, 2011).

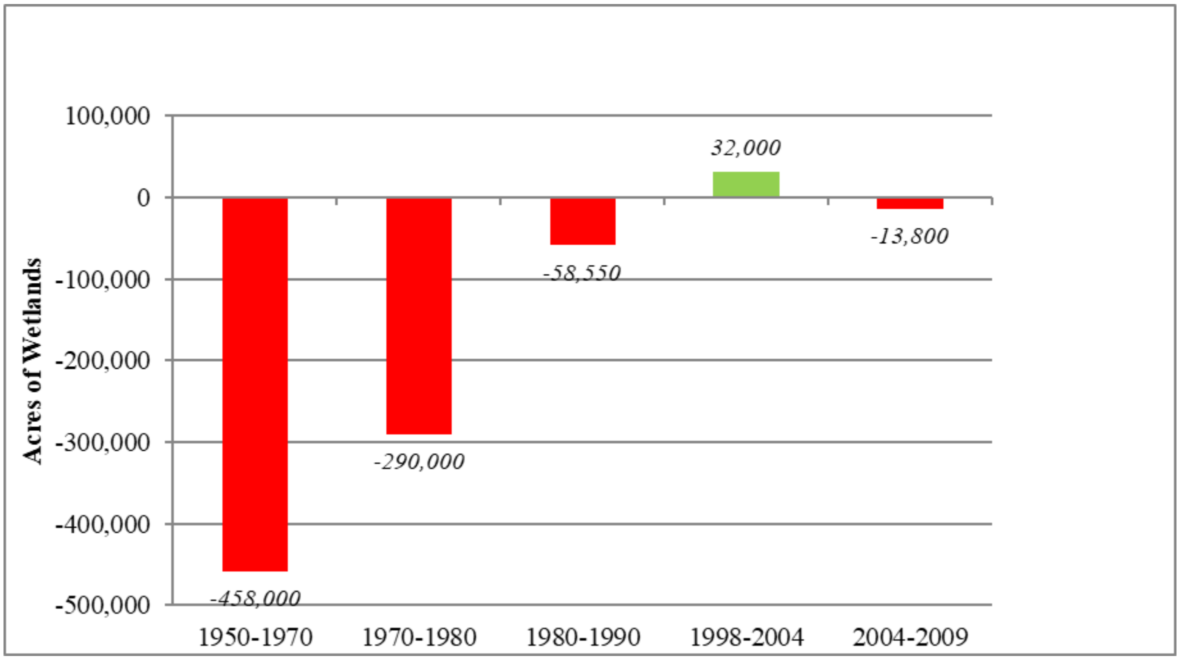

Figure 13. Average annual net wetland acreage loss and gain estimates for the conterminous United States (Dahl, 2011).

Estuaries

Estuaries are some of the most productive ecosystems in the world. Thousands of species of birds, mammals, fish, and other wildlife depend on estuarine habitats as places to live, feed, and reproduce. Many marine organisms, including most commercially important species of fish, depend on estuaries at some point during their development. Estuaries are important nursery and rearing habitat for fishes such as salmon and sturgeon, sea turtles, and many other species. For example, in estuaries that support salmon, changes in habitat and food-web dynamics have altered their capacity to support juvenile salmon (Bottom, Jones, Cornwell, Gray, & Simenstad, 2005) (Fresh, Casillas, Johnson, & Bottom, 2005) (Allen, Pondella, & Horn, 2006) (LCFRB, 2010). Diking and filling activities have reduced the tidal prism, reduced freshwater inflows, reduced sediment inputs, and eliminated emergent and forested wetlands and floodplain habitats. Similarly, dredging activities in shallow coastal estuaries can increase the tidal prism, increase salinities, increase turbidity, release contaminants, lower dissolved oxygen, and reduce nutrient outflow from marshes resulting in a host of negative consequences to these ecosystems. These changes have: reduced fishery productivity; contributed to land losses (e.g., Louisiana, Florida); contributed to fish kills; reduced avian habitats and use; and reduced the resiliency of these areas to stochastic events (e.g., hurricanes). Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns, may have begun to enhance estuarine productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats. Mitigation of losses of estuarine marsh in the mid-Atlantic and Gulf of Mexico may roughly keep pace with the losses of the last two decades, but they have not reversed the large losses of the mid-twentieth century (Dahl, 2011).

Shorelines

Significant development and urbanization along shorelines have also occurred in many areas throughout the action area. Impacts have been to mainstem river channels, estuarine, and nearshore marine habitats, and sub-basins in the lower part of major watersheds have been altered as well. Impacts have also occurred in key areas that are important to fish and wildlife, such as coastal and inland avian habitats and salmonid spawning and rearing areas, which may be well upstream of the lowlands.

Portions of nearshore and shoreline habitats in estuarine areas and certain freshwater lakes have been altered with vertical or steeply sloping bulkheads and revetments to protect various developments and structures (e.g., railroads, piers) from wave-induced erosion, stabilize banks and bluffs, retain fill, and create moorage for vessels (BMSL (Battelle Marine Sciences Laboratory), Pentec Environmental, Striplin Environmental Associates, Shapiro Associates, Inc., & King County Department of Natural Resources, 2001). Habitats at risk from direct human alteration include riparian buffers, freshwater habitats (e.g., streams, lakes), and shallow subtidal, intertidal, and shoreline habitats known collectively as the "marine nearshore." Depending on placement in relationship to drift cells, and other shoreline characteristics, armoring of the shoreline can interrupt the natural inputs of sand from landward bluffs, resulting in sediment deficits within the landscape.

Shoreline development has affected many sensitive habitats. One such sensitive habitat type is submerged aquatic vegetation such as seagrasses. For example, eelgrass beds on the Pacific and Atlantic coasts grow in the intertidal zone and in mud and sand in the shallow sub-tidal zone and support numerous aquatic species, from geese and dabbling ducks to spawning forage fish. Similarly, turtle grass, shoal grass, manatee grass, and wigeon grass occupy similar ecological niches in the estuaries of the northern Gulf of Mexico. Losses of these sensitive and highly productive habitats are estimated at 20% to 100% in northern Gulf of Mexico estuaries (Duke & Krucynski, 1992). Significant areas containing aquatic beds have been impacted due to harbor development, dock building, dredging, and bottom trawling. Shipping, docks, bulkheads, and other shoreline developments likely contribute to the reduction in submerged aquatic vegetation and other spawning and rearing areas for forage fish.

Agriculture and Grazing

Agriculture is one of the principal industries in many states. Agriculture operations include farming and animal operations and vary in size. Some geographic areas may produce large amounts of agricultural products. For example, according to the 2015 Crop Year Report from the California Department of Food and Agriculture, more than a third of the nation's vegetables and two-thirds of the nation's fruits and nuts are grown in California.

Many animal husbandry operations exist across the country. Large operations include cattle (beef and dairy) and poultry. Other smaller operations raise horses, pigs, sheep, geese and ducks, dairy goats, rabbits, and exotic animals (e.g., llamas, emus, alpacas, ostriches). In 2019, the cattle inventory in the United States was approximately 95 million head. Texas is the state with the most cattle (13%) in the United States, followed by Nebraska and Kansas. Thirty-one states have more than 1 million, fourteen have more than 2 million and nine have more than 3 million head of cattle (based on USDA NASS data as cited in (Cook, 2019)).

Past and present grazing activities have also occurred in a large portion of the action area. For example, grazing began in Washington in the mid-1800s, with sheep and cattle herds initially using the lush grasses that covered many parts of eastern Washington (Oliver, Irwin, & Knapp, 1994). Sheep grazing peaked in the 1930s and then rapidly declined, while cattle grazing increased steadily in most areas (Oliver, Irwin, & Knapp, 1994). In the early 1900s, livestock grazing was authorized on National Forest System Lands (Oliver, Irwin, & Knapp, 1994). Grazing fees and regulations were implemented in 1906, with grazing allotments initiated the following year, although enforcement efforts were not substantial enough to prevent trespass by unregulated livestock. Grazing resulted in several effects, including a general decline in range conditions; excessive use of available forage and resulting conflicts between livestock owners; removal of highly flammable fuels and reduction in ground fires; purposeful setting of fires (by livestock owners) leading to uncontrolled fires; establishment of invasive, non-native vegetation; and increase in siltation of water bodies (Oliver, Irwin, & Knapp, 1994).

As a result, the Bureau of Land Management began regulating grazing on public rangelands in the 1930s. Asian grasses were introduced as stabilizing vegetation for the erosion caused by overgrazing and other practices. The reduction in the number of sheep and localized declines in grazing pressure by cattle in some areas allowed recovery of some of the rangelands (which included forestlands; (Oliver, Irwin, & Knapp, 1994)). By the 1960s and 1970s, legislation allowed for monitoring, improvements, and better stewardship of rangeland (including those in National Forests).

Grassland, rangeland, pastureland, and cropland forage resources of the conterminous United States include intensively managed pasturelands and croplands throughout the country, and the extensive management of arid and semi-arid regions in central and western United States. Rangelands, pasturelands, and meadows collectively comprise about 55% of the land surface of the United States (approximately 405 million hectares). Privately owned lands constitute about 45% of this total (approximately 260 million hectares). These lands represent the largest and most diverse land resources in the United States. Rangelands and pasturelands include the following areas: the annual grasslands of California, the tundra rangelands of Alaska, the hot arid deserts of the Southwest, the temperate deserts of the Pacific Northwest, the semi-arid cold deserts of the Great Basin, the prairies of the Great Plains, the humid native grasslands of the South and East, and the pastures and meadows (natural or semi-natural grasslands often associated with the conservation of hay or silage) within all 50 states.

Effects to Natural Resources

Agricultural lands also provide some benefits for fish and wildlife species. For example, there is generally less impervious surfaces associated with agricultural lands than in urbanized or industrial areas. However, there are several other types of impacts to listed species habitats that are sometimes associated with farms and animal operations. Agricultural practices have contributed to the loss of side-channel areas and riparian vegetation in the floodplain in some areas. The effects of livestock grazing, dairy operations, and crop production often extend many miles upstream or downstream of these activities.

Agricultural operations may also result in the degradation of water quality due to contaminants, such as through introduction or runoff of excess nutrients, fertilizers, pesticides, and other chemicals. For example, livestock production often degrades water quality with the addition of excess nutrients, while pesticides applied to crops can leach into the water table and enter streams from surface water runoff (Rao & Hornsby, 2001) (Spence, Lomnicky, Hughes, & Novitzki, 1996). Several pesticides have been detected in small streams and sloughs within agricultural and urban sites tested within Puget Sound (Bortleson & Davis, 1997). In periodic reconnaissance studies of streams in nine Midwestern states, the U. S. Geological Survey has documented that large quantities of herbicides and their degradate products are flushed into streams during post-application run-off (Scribner, Battaglin, Goolsby, & Thurman, 2003). In addition, elevated nutrient concentrations from animal manures and agricultural fertilizer application can contribute to excessive growth of aquatic plants and reduced levels of dissolved oxygen, which can adversely affect fish (Embrey & Inkpen, 1998) and other aquatic organisms.

Water quality can also be affected by increases in temperature and sediment loading from agricultural operations. Irrigation systems often result in warmer water temperatures in canals and streams. Warmer temperatures can result from the clearing of shade-providing riparian areas along streams or other waterways, and from solar heating of water flowing across fields or in shallow waterways.

Effects from livestock grazing can be considerable if management practices are not sufficient to protect habitat functions (WDOE, 1998; Wissmar, et al., 1994; Belsky, Matzke, & Uselman, 1999). For example, livestock grazing is currently the primary land use in existing eastern Washington shrub-steppe habitats; this grazing, together with fire suppression, has altered the nature of the habitat in several ways (WDOE, 1998). Shrubs are more numerous because many are not eaten by livestock, while bunchgrasses are less common because they are consumed or trampled by livestock. Trampling also damages the fragile moss and lichen layer that protects the soil against erosion and non-native invasive vegetation colonization (e.g., cheatgrass) and provides nutrients to the soil. Additional impacts to water quality may result from other practices such as improper spreading of manure and increased surface runoff from overgrazed pasture and/or other areas in which large numbers of animals are confined (Green, Hashim, & Roberts, 2000).

Other impacts result from the maintenance of grazing lands. Fencing can provide environmental benefits such as keeping cattle out of sensitive areas, although there can be periodic impacts from construction, reconstruction, and maintenance activities that require transport and staging of materials, digging of holes, and stringing or re-stringing wires or fences. Chemically treated-wood posts are often used at corners with braces, with interspersed metal posts, wooden posts, or live trees. On flat terrain, power equipment may be used to auger holes and construct fencing. On steep terrain, hand tools and chain saws become more common. Rock cribs are often used when crossing areas of bedrock.

Attempts have been made to begin correcting some of the past impacts on the country's ecosystems from agricultural operations. In 1988, the U.S. Environmental Protection Agency (USEPA) began implementing the Federal Insecticide, Fungicide, and Rodenticide Act to regulate the registration and use of chemical pesticides, although some authors note challenges associated with its implementation (Edge, 2001). Additionally, State and Federal landownerassistance programs have been organized to aid landowners in voluntarily managing their properties to improve water and habitat quality (Edge, 2001).

Forestry

In 1630, at the beginning of European settlement, it is estimated that 46%, or 423 million hectares, of what would become the United States was forest lands. In 2012, forests comprised 309 million hectares (USDA, 2014). From 1850 to 1997, forest land remained relatively stable across the country. According to the USFS, the most acreage of forest lands occurs in the western United States, followed by large areas in the southern and northern parts of the country. Forest lands have been converted to other uses such as agricultural and urban uses. Reserved forest land has doubled since 1953 and now stands at 7% of all forest land in the United States. This reserved forest area includes State and Federal parks and wilderness areas, but does not include conservation easements, areas protected by nongovernmental organizations, and most urban and community parks and reserves. Significant additions to Federal forest reserves occurred after the passage of the Wilderness Act in 1964 (USFS, 2001).

Forested areas that were considered unsuitable for agriculture were frequently managed for timber harvest. Pioneers used river systems to transport logs and other goods. Trees were felled directly into streams, rivers, and saltwater and floated to their destinations, or pulled to streams and trapped behind splash dams, which were dynamited or pulled away, causing logs to sluice downstream. Roads for oxen, then railroads, followed transportation by water. In railroad logging, powerful steam-powered “donkey” engines pulled logs across great distances on the ground, crossing streams and anything else in the way. Following World War II, truck road systems replaced railroads, but smaller streams continued to be used as transportation corridors (CH2M Hill, 2000). After 1930, the introduction of motorized trucks and chainsaws allowed for substantial increases in harvest. Fueled by the demand for new housing and development after World War II, harvest increased dramatically. Initially, harvest focused on large-diameter trees; smaller trees were then harvested, ultimately reducing the number of large-diameter trees. Harvest of uneven-aged trees was practiced until 1940; by the 1950s, even-aged management was practiced.

Much of the lowlands initially harvested for timber were subsequently cleared for agriculture and residential development. While timber harvest continues to occur across the country, conversion of forest lands to other uses have become more common as the human population has grown. Comprehensive tracking of forest conversion rates began in the late 1970s, with the USFS Forest Inventory and Analysis data (Bolsinger, McKay, Gedney, & Alerich, 1997). These data, combined with limited data from the 1930s to the 1970s, indicate general trends in forest conversion. For example, in Washington state, the earliest data indicate there were approximately 26.5 million acres of forest lands during the 1930s, with 25.2 million acres available for harvest; 15.2 million (60%) acres were found in western Washington, and 10 million (40%) acres in eastern Washington.

By 2004, a net loss of approximately 3.5 million acres of forestland was reported, with 80% of this loss occurring in western Washington. The data indicated that reductions in the amount of privately-owned forestland accounted for the majority of this loss.

Effects to Forests

Forestlands have experienced effects related to many different changes, which often vary by area. These changes, which disrupt natural processes that influence forest health, are produced by direct and/or indirect human activities that have occurred in the past and present. These activities include timber harvest, grazing, fire suppression, road construction, and management practices and other influences that have resulted in increases in disease and pests. The impacts of grazing have been discussed previously and will not be addressed in this section.

Intensive forest management generally results in adverse effects such as loss of older forest habitats and habitat structures, increased fragmentation of forest age classes, loss of large contiguous and interior forest habitats, decreased water quality, degradation of riparian and aquatic habitats, and increased displacement of individual species members. Intensive forest management on most private lands generally maintain these lands in an early seral stage (e.g., 40 to 50 years of age) with relatively few structures such as snags, down logs, large trees, variable vertical layers, and endemic levels of forest “pests” and “diseases,” when compared to what was historically present prior to intensive management.

Timber Harvest

Timber harvest occurs across the nation. Patterns of timber harvesting are influenced by natural events (fire, ice, insects, and disease), management practices, public policies, and market conditions. The average size of harvest units depends on harvesting methods. Clearcutting is a common harvesting method in forests dominated by Douglas-fir in Washington State.

There are many kinds of activities associated with timber harvest, with varying degrees or types of impacts associated with each activity. Timber harvest and associated activities, such as road construction and skidding, can increase sediment delivery to streams, clogging substrate interstices, and decreasing stream channel stability and formation. Harvest in riparian areas decreases woody debris recruitment and negatively affects the stream’s response to runoff patterns. Stream temperatures may rise with decreases in the forest canopy and riparian zone shading. Runoff timing and magnitude can also change delivering more water to streams in a shorter period, which causes increased stream energy and scour and reduces base flows during summer months.

Other impacts from logging practices include modifications to forest composition. For example, prior to Euro-American settlement of Washington in early 1800s, the different forest age classes were well represented across the State (WDOE, 1998). Since that time, declines in mature growth forests have occurred on both Federal and non-Federal lands. For example, since World War II, old growth in the Olympic National Forest has declined by 76% (Morrison, 1990).

In addition, studies have shown that large trees in temperate coastal rainforests collect moisture from fog, and this collection of moisture may contribute an estimated 35% of the annual precipitation (Quinault Indian Nation & USDA - USFS, 1999). Significant reductions in large trees in these habitats may result in less moisture retention, affecting future runoff and/or precipitation patterns.

Impacts from timber-harvest management have included the removal of large trees that support in-stream habitat structure ("large woody debris"), reduction in riparian areas, increases in water temperatures, increases in erosion and simplification of stream channels (Quigley & Arbelbide, 1997). Past timber harvest practices include the use of heavy equipment in channels, skidding logs across hill slopes, splash damming to transport logs downstream to mills, and road construction (USFS, 2002). Improvements in methodologies have reduced some of the effects from these practices (Oliver, Irwin, & Knapp, 1994). In some areas harvest units have been restricted in size, and greater consideration has been given to the health and appearance of forest landscapes and the biotic communities that depend on them. In some cases, equipment is used and/or engineered in ways to minimize soil disturbance and other habitat impacts. In other cases, however, the methods used may result in increased soil disturbance and extreme fire hazards that include machine piling and burning, and accumulation of dead slash from thinning activities (Oliver, Irwin, & Knapp, 1994).

Fire Suppression

Under historical fire regimes, natural disturbance to streams from forest fires resulted in a mosaic of diverse habitats. However, forest management and fire suppression over the past century have increased the likelihood of large, intense forest fires in some areas.

Prior to European settlement, both natural and human-initiated fires are believed to have affected forests. Eastern Washington forests consisted of open, park-like areas with fire-resistant trees in the lowlands, and Douglas-fir/western larch and true fir forests in the middle and high elevations, respectively (Oliver, Irwin, & Knapp, 1994). In the lowlands, most fires were frequent, and not highly destructive, primarily burning off revegetation; at higher elevations, and in cooler areas, fires were less frequent, and highly destructive. Fire suppression began in the late 1800s when a forestry commission was convened to begin studying the conditions of Forest Reserves (precursors of national forests), which were created in 1891. Although fire suppression was viewed as necessary to protect resources and private property, some advocated the use of prescribed fire to reduce fuels and protect stands against damaging fires.

From 1930 to 1960, forest management began in earnest on National Forest System Lands, and many rural settlers moved to urban areas. Grazing occurred in previously burned areas, while other areas developed into dense stands. Fire-suppression efforts were intensified, with additional funding and crews made available to respond effectively to fight fires. The buildup of fuels likely led to larger, more-destructive fires. From the 1960s to the 1990s, fire prevention allowed the development of dense, closed stands of trees, which varies significantly from pre-management times. Oliver et al. (Oliver, Irwin, & Knapp, 1994) reported that this growth pattern makes stands increasing susceptible to disease and pests. In the 1960s, attitudes toward burning began to change, and the beneficial role of fire was recognized. The use of prescribed fire in certain environments was also encouraged, with certain precautionary measures.

Although scientists have recognized the value of prescribed burning as one of many tools to help return landscapes to natural conditions, some managers have been slow to embrace prescribed burning partially due to the issues surrounding liability. There are also other constraints upon prescribed burning including short-term expenses and air-quality regulations.

Disease and Pests

Pests and disease were present in forestlands prior to European settlement. Several kinds of defoliating insects have been documented, including, but not limited to: Tussock moths, pine butterflies, and bark beetles in Washington State (Oliver, Irwin, & Knapp, 1994). Starting in the 1930s, pest surveys and control were used to combat these pests. Pest control included selective harvesting/or salvage harvest to remove infested trees, the spraying of pesticides (e.g., ethylene dibromide, DDT, and other insecticides), and removal of host plants (e.g., currant [*Ribes spp.*], host of white pine blister rust).

Since the 1960s, integrated pest management (IPM) has been used to control insect outbreaks. With IPM, several different management and pest-control alternatives are rated against cost/benefit analyses, alternative strategies, ecological considerations, and other concerns to determine the best recourse against the target pest(s). Examples of IPM alternatives include favoring resistant stand structures and/or species in thinning and planting activities, fire prescription, selective use of pesticides, and salvage logging (Oliver, Irwin, & Knapp, 1994).

Urban and Industrial Development

In the United States, urban land acreage quadrupled from 1945 to 2007, with an estimated 61 million acres in urban areas in 2007 (Nickerson, Ebel, Borchers, & Carriazo, 2011). The Census Bureau estimated that urban area increased almost 8 million acres in the 1990s (Lubowski, Vesterby, Bucholtz, Baez, & Roberts, 2006), but despite similar increases for the last several decades, this still represents just 3% of the land area of the U.S. (Bigelow & Borchers, 2017). **Figure 14** depicts the 2010 human population density by county and serves as a coarse representation of urbanization. In general, urbanization (including impervious land uses, manufacturing and waste, housing densities, and contributions to greenhouse gas emissions) concentrates effects of water, land, and mineral use, increases loads of pollutants in waters and on the land, increases the likelihood of noise and air pollution, contributes to degradation of ecosystems and habitat for fish, wildlife and plants, lessens biodiversity, and contributes to changes in climate at varying scales.

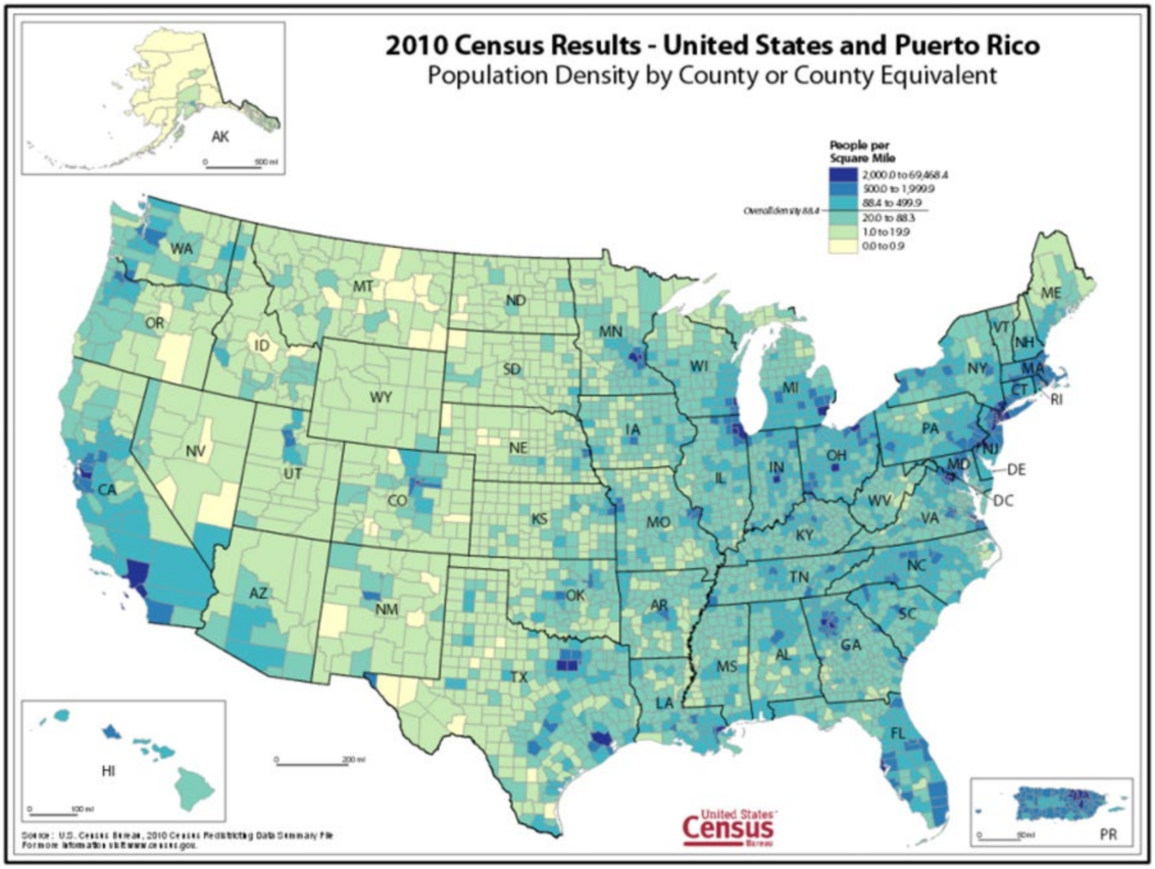

Figure 14. U. S. population density by county (USCB 2010).

Impervious Surfaces

Scientific studies indicate there is a strong relationship between the amount of forest cover, levels of impervious and compacted surfaces in a basin, and the degradation of aquatic systems (Klein, 1979) (Booth, Hartley, & Jackson, 2002). Impervious surfaces associated with residential development and urbanization create one of the most-lasting impacts to stream systems. Changes to hydrology (increased peak flows, increased flow duration, reduced base flows) as a result of loss of forest cover and increases in impervious surfaces are typically the most-common outcomes of intensive development in watersheds (May, Horner, Karr, Mar, & Welch, 1997) (Booth, Hartley, & Jackson, 2002). Increased peak flows and flow duration often lead to the need to engineer channels to address flooding, erosion, and sediment-transport concerns.

Stormwater runoff continues to be a significant contributor of non-point source water pollution in core spawning and rearing areas and foraging, migration, and overwintering habitat areas for salmonids (WSCC, 1999a; WSCC, 1999b; KCDNR and WSCC, 2000). Although not typically a direct measure of the influence of development, basin imperviousness is commonly used as an indicator of basin degradation (Booth, Hartley, & Jackson, 2002). Reduction in forest cover and conversion to impervious surfaces can change the hydrological regime of a basin by altering the duration and frequency of runoff, and by decreasing evapotranspiration and groundwater infiltration (May, Horner, Karr, Mar, & Welch, 1997; Booth, Hartley, & Jackson, 2002). Such changes can be detected when the total percentage of impervious surface in the watershed is as low as 5 to 10% (Booth, Hartley, & Jackson, 2002). Watershed degradation, however, likely occurs with incremental increases in impervious surfaces below these levels, and it is exacerbated by other factors such as reduced riparian cover and pollution (Booth, 2000; Karr & Chu, 2000; Booth, Hartley, & Jackson, 2002). Booth et al. (2002) state, "[t]he most commonly chosen thresholds, maximum 10% effective impervious area and minimum 65% forest cover, mark an observed transition in the downstream channels from minimally to severely degraded stream conditions." They further assert, "Development that minimizes the damage to aquatic resources cannot rely on structural best management practices (BMP) because there is no evidence that they can mitigate anything but the most egregious consequences of urbanization. Instead, control of watershed land cover changes, including limits to both imperviousness and clearing, must be incorporated."

The amount of new impervious surfaces has increased significantly in recent history, and this trend will likely continue into the future. Nonetheless, several entities have implemented actions to begin to counter the effects of impervious surface water and stormwater runoff on natural resources. Projects using low-impact development technologies have been planned or constructed. Projects in various areas have included the construction of swales, rain gardens, and narrower roads, and the installation of permeable pavement, among other technologies. Land use planning, zoning, and parks and natural area acquisitions are being used in many communities to incorporate Green Infrastructure into developed landscapes that can help to maintain functional floodplains, stream flows, water quality, fish and wildlife habitat, and other ecosystem functions and public benefits.

Loss of Riparian Buffers

The riparian zone along a stream is a transitional area between the stream and uplands. These areas perform a variety of functions in the ecosystem (WDOE, 2000). Trees and shrubs along the bank provide shade and cover for fish and other aquatic biota, while their roots provide bank stabilization and help to control erosion and sedimentation into the stream. The riparian zone also contributes nutrients, detritus, and fallout insects into a stream, which supports aquatic life.

Vegetation and soils in the riparian zone protect the stream against excess sediments and can sequester pollutants. The riparian zone contributes to the reduction of peak stream flows during floods, and acts as a holding area for water, which is released back into the stream during times of low flow. The trees in the riparian zone serve the ecosystem even after they fall, many of them altering flow and creating habitat features (e.g., pools, riffles, slack areas and off-channel habitats) which benefit fish and other aquatic biota at various life stages.

Many kinds of human activities have impacted riparian zones along streams across the country. These activities include, but are not limited to, urbanization, agriculture, grazing, mining, channelization and damming of streams, logging, and recreational activities (Bolton & Shellberg, 2001). It is estimated that 70% of the original area of riparian ecosystems have been cleared in the United States (Swift, 1984).

While human-related activities conducted within the riparian zone can damage the integrity of a riparian system, activities that occur outside the riparian zone can also create impacts (Kauffman, Mahrt, Mahrt, & Edge, 2001). Riparian zones are often relatively flat and/or are situated at low elevations when compared to adjacent upland topography within a watershed; as a result, sediment and soils, nutrients, water, and substances carried by these vectors from upslope or upstream activities are often deposited by gravity within riparian zones. While the riparian zone helps to buffer streams against these materials, too large a volume can impact the riparian zone's ability to properly function in either the short or long term. The buffering ability of a riparian zone can be affected by landslides, erosion, altered flow regimes, degraded water quality, contaminant inputs, or other sources. Logging, agriculture and grazing, road construction, or other activities can generate these impacts, if appropriate safeguards are not in place.

Although recent changes have been made to many regional and local development regulations to provide protection (i.e., buffers or conservation zones) for riparian areas and streams, the integrity of these areas is frequently compromised by encroachment (May, Horner, Karr, Mar, & Welch, 1997). There is no prescribed corridor size to protect a stream or other water body from all potential impacts. Different riparian widths are required depending on the characteristics of each potential pollutant and the integrity and/or quality of a particular riparian zone; therefore, unless riparian zone widths are carefully evaluated based on adjacent land use and threats, the success of the riparian zone in adequately buffering streams from pollutants is uncertain at best. For many small stream systems, riparian areas are highly degraded or no longer exist, and their restoration is precluded by existing development. Although functional riparian areas have the capacity to mitigate for some of the adverse impacts of development (Morley & Karr, 2002), they cannot effectively address significant impacts from changes to stream hydrology resulting from significant losses of forest cover (May, Horner, Karr, Mar, & Welch, 1997; Booth, Hartley, & Jackson, 2002).

Infrastructure

Construction of roads, railroads, and associated rights-of-way (ROWs) can include a variety of activities, such as clearing of vegetation and other habitat features. These activities, as well as installation of below grade utility lines, pipelines, transmission lines and other infrastructure, can promote changes to terrestrial and riparian habitats, as well as simplification and channelization of streams, which reduce the connectivity of surface water and groundwater. Construction, maintenance, and use can also result in loss or degradation of riparian and wetland areas, degradation and fragmentation of terrestrial plant and animal habitats, sedimentation, erosion and slope hazards, reduction of passage, dispersal, or migration (e. g, invertebrate, fish, amphibian, reptile, and mammalian) and increased strike hazards to many classes of animals to name but a few.

Historical methods of road construction were destructive to stream habitats (Palmisano, Ellis, & Kaczynski, 2003). Stream materials (e.g., sand, gravel and cobbles) were often used as fill, and excess excavation materials were pushed over the side of the road bank, where it frequently entered streams. Riparian vegetation and stream banks were damaged using heavy equipment adjacent to and in streams. Side channels were often cutoff or eliminated, and stream channels were confined, resulting in increased bank erosion in certain areas. Lack of adequate drainage led to saturation of roadside soils. In many parts of the action area, road and ROW siting, construction and maintenance practices have not changed significantly through time regarding conservation of fish, wildlife, and ecosystems. Constriction of floodplains resulted in increased flooding, which continues today in certain areas.

Limited specific information is available on the historical origins and use of roads in forested areas outside of the USFS lands. Within the USFS lands, most forest roads were originally constructed by harvesters for access to forested areas, who then deducted the costs of road construction from final payments to the USFS (Oliver, Irwin, & Knapp, 1994). Oliver et al. (1994) reports that less than 150 miles of road existed in Washington National Forests in 1907; by 1920, this number had increased with 176 miles of road per million acres in the Yakima River Basin (Washington), and 287 miles per million acres in the Grand Ronde River Basin (Washington and Oregon). Beginning in the 1950s, the USFS began to assert more direct control over the road network on USFS lands, and the network increased.

Mining and Mineral Extraction

The United States has a history of mining that dates to the early 17th century when iron, lead, silver, copper, and coal were discovered and mined by the early colonial settlers of New England and the Mid-Atlantic states. Today, every state (and Puerto Rico) produces mined materials or extracts minerals from below the surface (e.g., fuels - coal, oil and gas, building materials – sand, gravel, clay; rare Earth minerals; and those used for industry – aluminum and copper). From the surface loss of habitats (land and water) associated with mining to the effects on (surface and ground) water quality and chemistry, air quality, and effects related to mining waste disposal, few human endeavors have such large scale and consequential effects on the environment as mining and mineral extraction. There are no readily available summary data to illustrate the scale of the various forms of mining; however, a 1979 Corps of Engineers study on strip mining estimated 4.4 million acres and approximately 13,000 miles of rivers and tributaries had been disturbed or adversely impacted by surface coal mining (USACE, 1979). There are surely additional millions of acres, collectively, of surface impacts to land and water given the many other forms of mineral mining and extraction. Mining has resulted in physical and chemical effects on surface waters and other habitats. For example, for the duration of some mining activities, vegetation is removed and surfaces remain exposed, topography is altered and surfaces are compacted, infiltration of rainwater and uptake of water into vegetation is reduced and consequently overland runoff of water is increased.

Mining activities can also affect downstream water chemistry, which may in turn affect species, their habitat, and other resources on which they depend. Studies have shown that mining-impacted waterways often contain elevated levels of arsenic, selenium, iron, aluminum, manganese, and sulfate. These waters typically have lower alkalinity concentrations and lower pH, while specific conductivity and total suspended solids are typically higher, as compared to streams unimpacted by mining (Wangsness, Miller, Bailey, & Crawford, 1981) (Zuehls, Fitzgerald, & Peters, 1984) (Herlihy, Kaufmann, Mitch, & Brown, 1990) (Howard, Berrang, Flexner, Pond, & Call, 2001); (Stauffer & Ferreri, 2002) (Bryant, McPhilliamy, & Childers, 2002) (Hartman, Kaller, Howell, & Sweka, 2005) (Pond, Passmore, Borsuk, Reynolds, & Rose, 2008) (Petty, 2010); (U.S. Environmental Protection Agency, 2011); (Presser, 2013); (Skogerboe, Lavallee, Miller, & Dick, 1979).

Direct impacts to streams from mining and reclamation activities also occur in association with the practice of mining through ephemeral, intermittent, and perennial streams. The impacts of large-scale mining operations upon the water quality of ephemeral, intermittent, and perennial streams in Central Appalachia are highlighted in Bernhardt and Palmer (2011). Research compiled in Bernhardt and Palmer (2011) demonstrated that multiple surface mines and valley fill activity within large watersheds resulted in increases in concentrations of sulfate, bicarbonate, calcium, and magnesium ions further downstream.

Activities that involve land disturbance, such as mining and reclamation, increase the risk of erosion and, therefore have the potential to affect the quantity of sediment that reaches waterways. Excessive sediment reduces stream depth, leads to increases in water temperatures and reductions in dissolved oxygen content (Slagle, 1986).

Invasive Species

Invasive species are non-native species capable of causing great economic or ecological impacts in areas where they become established. Ecological impacts from biological invasion include predation, disease transmission, competition (for food, light, space), and hybridization. The rate of species invasion has increased over the past 40 or more years due to human population growth, alterations of the environment, and technological advances that allow for the rapid movement of people and products (Pimentel, Zuniga, & Morrison, Update on the environmental and economic costs associated with alien-invasive species in the United States, 2004). Invasive species are considered a contributing factor in the decline of 49% of the imperiled species in the United States (Wilcove, Rothstein, Dubow, Phillips, & Losos, 1998). Based on factors affecting species associated with island ecology (e.g., small populations, small ranges, high rates of endemism), the impact is often even greater. It is estimated that 75% of the world's threatened birds confined to islands face severe threats from introduced species (BirdLife International, 2008).

There are an estimated 50,000 or more non-native terrestrial and aquatic plant species established in the United States, many of which outcompete native plants for habitat (Pimentel, Zuniga, & Morrison, Update on the environmental and economic costs associated with alien-invasive species in the United States, 2004). About half of these species are plants. In some cases, non-native plants are capable of completely dominating new habitats, forming dense monocultures, and completely excluding other native plants. Approximately 97 non-native birds exist in the United States. Many of these non-native birds compete with or displace native birds, and they are vectors for avian diseases. Approximately 53 species of reptiles and amphibians have been introduced to the United States, which often prey upon native species (Pimentel, Zuniga, & Morrison, Update on the environmental and economic costs associated with alien-invasive species in the United States, 2004). More than 4,600 non-native invertebrate species inhabit the United States, some of which are well known for vast ecological impacts, including the decline or extirpation of native species (Pimentel, Zuniga, & Morrison, Update on the environmental and economic costs associated with alien-invasive species in the United States, 2004).

Pollution

In addition to direct loss and alteration of aquatic habitat, various contaminants and pollutants have impacted many aquatic ecosystems. In 2008, the Heinz Center for Science, Economics and the Environment (Heinz Center) (Heinz, 2008) published a comprehensive report on the condition of our nation's ecosystems. In their report, the Heinz Center noted the following:

- From 1992 to 2001, benchmarks for the protection of aquatic life were exceeded in 50% of streams tested nationwide – 83% of streams in urbanized areas – and 94% of streambed sediments.

- Contaminants were detected in approximately 80% of sampled freshwater fish and most of these detected contaminants exceeded wildlife benchmarks (1992 to 2001 data) (Gilliom, et al., 2006). Nearly all saltwater fish tested had at least five contaminants at detectable levels, and concentrations exceeded benchmarks for the protection of human health in one-third of fish tissue samples—most commonly DDT, PCBs, PAHs, and mercury (USEPA, 2009).

- Toxic contaminants, as noted above have, been documented in the Lower Columbia River and its tributaries (LCREP, 2007). More than 41,000 bodies of water are listed as impaired by pollutants that include mercury, pathogens, sediment, other metals, nutrient, and oxygen depletion, and other causes (USEPA, 2013a). Pennsylvania reported the greatest number of impaired waters (6,957), followed by Washington (2,420), Michigan (2,352), and Florida (2,292). These figures likely underestimate the true number of impaired water bodies in the United States. For example, EPA's National Aquatic Resource Surveys (NARS) is a probability-based survey that provides a national assessment of the nation's waters and is used to track changes in water quality over time. Through this method, EPA estimates that 50% of the nation's streams (approximately 300,000 miles) and 45% of the nation's lakes (approximately seven million acres) are in fair to poor condition for nitrogen or phosphorus levels relative to reference condition waters (USEPA, 2013b). However, data submitted by the States indicates that only about half of the NARS estimate (155,000 miles of rivers and streams and about four million acres of lakes) have been identified on EPA's 303(d) impaired waters list for nutrient related causes (USEPA, 2013b).

Water quality problems, particularly the problem of non-point sources of pollution, have resulted from changes that humans have imposed onto the landscapes of the United States for the past 100 to 200 years. The mosaic or land uses associated with urban and suburban centers are cited as the primary cause of declining environmental conditions in the United States (Flather, Knowles, & Kendall, 1998) and other areas of the world (Houghton, 1994). Most land areas covered by natural vegetation are highly porous and have limited sheet flow; precipitation falling on these landscapes infiltrates the soil, is transpired by the vegetative cover, or evaporates. The increased transformation of the landscapes of the United States into a mosaic of urban and suburban land uses has increased the area of impervious surfaces such as roads, rooftops, parking lots, driveways, sidewalks, and others. Precipitation that would normally infiltrate soils in forests, grasslands and wetlands falls on and flows over impervious surfaces. That runoff is then channeled into storm sewers and released directly into surface waters (rivers and streams), which changes the magnitude and variability of water velocity and volume in those receiving waters.

Increases in polluted runoff have been linked to a loss of aquatic species diversity and abundance, which include many important commercial and recreational fish species. Nonpoint source pollution has also contributed to coral reef degradation, fish kills, seagrass bed declines and algal blooms (including toxic algae; (NOAA, 2013)). In addition, many shellfish bed and swimming beach closures can be attributed to polluted runoff. As discussed in EPA's latest National Coastal Condition Report (NCCR), nonpoint sources have been identified as one of the stressors contributing to coastal water pollution (USEPA, 2012). Since 2001, EPA has periodically released these reports detailing condition of the nation's costal bays and estuaries and assessing trends in water quality in coastal areas. The latest NCR report indicates that coastal water conditions have remained "fair", and the trend assessment demonstrates no significant change in the water quality of United States coastal waters since the publication of the NCCR II in 2004 (USEPA, 2012).

In many estuaries, agricultural activities are major source of nutrients to the estuary and a contributor to the harmful algal blooms in summer, although according to McMahon and Woodside 1997 (USEPA, 2006) nearly one-third of the total nitrogen inputs and one-fourth of the total phosphorus input to the estuary are from atmospheric sources. The National Estuary Program Condition Report found that nationally, 37% of national estuary program estuaries are in poor condition.

Throughout the twentieth century, mining, agriculture, paper and pulp mills, and municipalities contributed large quantities of pollutants to many estuaries. For example, the Roanoke River and the Albemarle-Pamlico Estuarine Complex which receives water from 43 counties in North Carolina and 38 counties and cities in Virginia. This estuarine system supports an array of ecological and economic functions that are of regional and national importance. Both the lands and waters of the estuarine system support rich natural resources that are intertwined with regional industries including forestry, agriculture, commercial and recreational fishing, tourism, mining, energy development, and others. The critical importance of sustaining the estuarine system was reflected in its Congressional designation as an estuary of national significance in 1987. Even so, today the Albemarle-Pamlico Estuarine Complex is rated in good to fair condition in the National Estuary Program Coastal Condition Report despite that over the past 40-year period data indicate some noticeable changes in the estuary, including increased dissolved oxygen levels, increased pH, decreased levels of suspended solids, and increased chlorophyll-a levels (USEPA, 2006).

Since 1993, USEPA has compiled information on locally issued fish advisories and safe eating guidelines. This information is provided to the public to limit or avoid eating certain fish due to contamination of chemical pollutants. The EPA's 2010 National Listing of Fish Advisories database indicates that 98% of the advisories are due (in order of importance) to: mercury, PCBs, chlordane, dioxins, and DDT (USEPA, 2010). Fish advisories have been issued for 36% of the total river miles (approximately 1. 3 million river miles) and 100% of the Great Lakes and connecting waterways (USEPA, 2010). Fish advisories have been steadily increasing over the National Listing of Fish Advisories period of record (1993 to 2010), but EPA interprets these increases to reflect the increase in the number of water bodies being monitored by States and advances in analytical methods rather than an increase in levels of problematic chemicals (USEPA, 2010).

Water-quality concerns related to urban development include adequate sewage treatment and disposal, transport of contaminants to streams by storm runoff, and preservation of stream corridors. Water availability has been and will continue to be a major, long-term issue in many areas. It is now widely recognized that ground-water withdrawals can deplete streamflows (Morgan & Jones, 1999), and one of the increasing demands for surface water is the need to maintain instream flows for fish and other aquatic biota.

Harvesting

Some ESA-listed species, such as salmonids and freshwater mussels, are economically important species harvested as food. Harvesting and exploitation, often associated with the pearl industry, is identified as a contributing factor to18% of the imperiled freshwater mussels of the United States (Strayer, et al., 2004). After species are listed as threatened or endangered under the ESA, they receive protection from overharvesting since this action would require a permit issued by the Service, with permits generally limited to certain categories of activities that would benefit the conservation and recovery of the species. Although harvest is a historical threat to many ESA-listed species and illegal harvests still likely occur to some degree, it, now, rarely affects species substantially, and it is not expected to greatly affect currently listed species in the action area in the future.

Water-Related Issues

As noted above in the sections related to rivers and streams, wetlands, and estuaries, impacts to species and their habitat have occurred in these habitats due to various human activities. Stream channels in many areas have been significantly altered by dredging, channelization, and the construction of dikes and revetments for flood control and bank protection. These activities have simplified once complex stream channels. More specifically these changes are degrading and eliminating important foraging and migration, as well as overwintering habitats for salmonids and other biota. Such changes can also result in the removal of riparian vegetation, thus precluding recruitment of large woody debris. Developments such as these can also reduce or preclude options for restoration of floodplain areas important for reestablishing off-channel habitats and maintaining groundwater recharge.

The following subsections briefly describe different impacts to features or characteristics of aquatic habitats.

Water Diversion

Dikes, levees, dams, and other diversions have reduced the level of watershed connectivity in several areas of the country. Diversion projects have been implemented for several human needs, including but not limited to, flood control, conversion of wetlands to agricultural lands, bank protection, water supply, road construction, or a combination of these objectives.

Impacts to species and habitats from these actions have been significant. Palmisano et al. (Palmisano, Ellis, & Kaczynski, 2003)report that the most-severe effects to wild anadromous salmonids from dams and other fish-passage barriers have occurred in the Columbia River Basin, although there are several problem areas in other parts of the west.

Many streams have been channelized, diverted, and confined through the construction of dikes, levees, berms, revetments, embankments, and other structures. The shapes and configurations of the structures vary based on their purpose; however, the construction of each kind of structure results in physical and biological impacts to the stream morphology and community (Bolton & Shellberg, 2001). The construction of flood-control structures, tide gates, and water-diversion structures have contributed to the degradation and fragmentation of migratory corridors, and elimination of historical foraging, migration, and overwintering habitats within the region. Channelization (and often its associated bank armoring) results in simplification of the stream, and has resulted in changes in flow, velocity, and movement of water in many streams. These changes are often at least a portion of the goal of a project, which may be designed to reduce flood damage to property, exclude water, or store water for future use. While these changes may be favorable to property owners or project proponents, such actions often result in substantial changes to aquatic and terrestrial habitats and their use by biota.

Dikes and levees result in several impacts to aquatic species and habitat. Aside from loss of estuarine habitat from construction, dikes reduce tidal flushing, sometimes resulting in increased sedimentation; dikes also may have marked effects on tidal channel biota on the seaward side of the structure (Hood, 2004). The construction of dikes may result in decreased sinuosity and complexity in certain channels and prevent energy dissipation during flood events.

Florida has two large restoration projects underway to address environmental problems caused by dikes. In 1992, the Kissimmee River Restoration Program was authorized by Congress. In 1999, the U. S. Army Corps of Engineers (USACE) and the South Florida Water Management District began construction in central Florida. Upon its completion in 2020, the project will restore 20,000 acres of wetlands and 44 miles of historic river channel (USACE, 2019).

The greater Everglades ecosystem historically encompassed 18,000 sq. miles from central Florida to the Florida Keys. Water flowed south into Lake Okeechobee and then spilled over its banks into the sawgrass plains, open water sloughs, rocky glades, and marl prairies and finally into the Gulf of Mexico and Florida and Biscayne Bays. The USACE installed a massive network of canals, levees, and water conservation areas that blocked sheet flow to urban areas and provided water for dry season use. The Comprehensive Everglades Restoration Plan was authorized by Congress in 2000. The plan will "restore, preserve, and protect the south Florida ecosystem while providing for other water –related needs of the region, including water supply and flood protection" (SFNRC, 2016).

Recent restoration efforts have focused on the benefits of restoring ecosystem functions affected by diversion structures. In 2002, the Nisqually Tribe removed a portion of a dike in Red Salmon Slough, reconnecting 31 acres of former pastureland to the Nisqually River Estuary (SPSSEG, 2002) (Carlson, 2005). This action was undertaken to benefit juvenile salmonids, other fish species, and migratory birds. At Spencer Island in Snohomish County, two 250-foot-long breaches were made in an estuary dike to reconnect approximately 250 acres of estuarine marsh (Carlson, 2005).

Culverts and Other Fish-passage Barriers

Improperly installed, sized, or failed culverts have been identified as barriers for fish movement and migration. Although historically placed, fish-passage barriers continue to impede fish passage in many streams. Several groups have made efforts to inventory and remove fish barriers under their jurisdiction, often either removing barrier culverts or replacing them with a more-suitable structure (Peck, 2005). Removal of fish barriers may be achieved through several different kinds of activities (Peck, 2005). Removal of a barrier culvert is often undertaken when a crossing is no longer needed. If a crossing is necessary, other options include bridges or other specific methodologies: stream simulation, roughened-channel design, no-slope methodology, or hydraulic design.

Dams

There are currently approximately 1,025 dams obstructing the flow of water in Washington alone, with approximately 10 new dams added each year, generally small facilities on off-channel or side streams (Green, Hashim, & Roberts, 2000; WDOE, 2000). Dams are built for many purposes, including power generation, irrigation, flood control, recreation, and water supply (WDOE, 2000). These facilities have far-reaching effects on both aquatic and terrestrial habitat and biota. The controlled flow from a dam facility often slows the movement of the rivers, and changes the natural cycle of river flows, resulting in areas that are either drier than normal (because the water is being held behind the reservoir) or flooded by much higher levels of water. Changing the depth and flow of rivers also affects the water's temperature, either increasing or decreasing temperatures from the normal state. Dams affect the flow of many different materials (e.g., sediments, nutrients, and other materials such as large woody debris) carried in the river waters. Free-flowing rivers regularly flood and recede, collecting and depositing these materials both laterally and downstream. For example, rivers carry a great deal of sediment and nutrients down river, eventually depositing it in the deltas and estuaries where freshwater enters saltwater. Dams arrest this process; consequently, reservoirs eventually fill with sediments and inadequate amounts of sediment reach the downstream deltas and estuaries. Coastal beaches in turn lose the source of sand normally deposited on them by coastal currents that would ordinarily redistribute the sediments.

Dams often delay or block passage of anadromous fish to upstream reaches of the stream; such an obstacle can increase predation rates on these fish, cause injury or mortality as fish are trapped in unscreened canals or attempt to travel through turbines. In many cases, dams have likely been constructed at or near historical natural barriers to anadromous fish passage, as summarized in (USFWS, 2015). The ability of anadromous fish to access areas above man-made barriers is important not only for the survival of individuals and populations of the species, but also for the integrity of the ecosystems they support (Cederholm, et al., 2000). Anadromous fish provide organic matter and nutrients to both aquatic and terrestrial habitats via their carcasses, eggs, milt, excrement, and fry. Staging and spawning adults are also consumed as prey by aquatic and terrestrial predators. The organic matter and nutrients contributed by anadromous fish enrich macroinvertebrate and terrestrial communities, which in turn provide food for other organisms, including anadromous salmonid fry and juveniles. Scavenging and predatory fish, birds, mammals, and other animals also consume fry, juvenile, and adult salmon, their eggs, and their carcasses, often leaving remnants of carcasses in a more-accessible form for smaller scavenging fauna. Rich marine-derived nutrients from anadromous fish are transported to the reach of stream in which they die, into the lower reaches of the stream and estuary through downstream drift, and across habitat or ecosystem boundaries by mobile mammals, birds, and fish.

Certain facilities have implemented fish-passage structures or transport systems to allow upstream movement of anadromous fish; however, the risk of disease, stress, and other interference with migration and reproduction may occur as a result of these systems.

The Pacific coast has many river restoration projects to deal with problems caused by dams. California has been very active in river restoration since the 1930s. River restoration programs in California include the CALFED Bay-Delta Ecosystem Restoration Program, which has invested $500 million in projects from 1996 to 2005 (Kondolf, et al., 2007). Some of the larger ongoing projects are the Trinity River Restoration Program and the San Joaquin River Restoration Program.

Water Quantity and Use

The diversion, storage, and use of water is based on increasing demand, fueled by population and economic growth. Water availability varies based on annual weather patterns and may change in the future as climate change affects weather patterns and water supply. Year-round water withdrawals are no longer available from many lakes and streams, to protect aquatic species and existing water rights in many western states.

A significant amount of water is used for irrigation of agricultural lands, which can affect ecosystems. Irrigation is used to maintain urban irrigated lands, forest nurseries, seed orchards, and recreational areas. Water withdrawal also occurs as a source for rural domestic use, stock watering, municipal and light industrial water supply, and for industrial use; however, the dominant off-channel water use is for irrigation (Wissmar, et al., 1994).

Effects associated with irrigation-water withdrawal includes effects from water storage and drainage, increased water temperatures (which can become thermal barriers for salmonids and other aquatic species), pollutants (such as runoff containing pesticides and fertilizers), high sediment levels, and lower stream flows (Krupka, 2005; Wissmar, et al., 1994). Lower flows and associated stream dewatering affect aquatic habitat and biota (Wissmar, et al., 1994). Diversions and fish ladders associated with irrigation also have a variety of effects since not all are screened or pass all life stages of fish; irrigation systems may also divert a substantial amount of stream flow. The effects of these structures in aggregate to anadromous fish and other aquatic biota can be severe. However, through permitting and the Federal Energy Regulatory Commission relicensing processes, several efforts have been initiated to reduce existing effects. These efforts include but are not limited to: proper screening of existing diversions and other structures; reduction of temperature, sediment, and pesticide effects to waterways; reduction of the quantity of water diverted to provide access; and reduction of fish-passage barriers.

There have been several attempts to reduce impacts from dams, irrigation-water withdrawal, and other water-diversion activities. Some of the efforts to minimize effects to anadromous fish were undertaken relatively early (Palmisano, Ellis, & Kaczynski, 2003). For example, irrigation diversions were screened in the 1930s, although the screens did not protect all life stages, nor were they adequately maintained. More recently, watershed-planning units have been organized in some areas in response to the Watershed Planning Act, to address issues regarding water availability and quality, instream flow, and habitat protection (WDOE, 2000). Some projects have been proposed specifically to address flow issues. For example, between 2000 and 2004, the Salmon Recovery Funding Board (SRFB, 2005) funded projects to alter river flows over 85 acres, slowing the stream flows to enhance salmon spawning and rearing habitats. As mentioned previously, certain dams have been slated for removal (e.g., Elwha, Glines Canyon, and Condit dams) because it has been determined that they are no longer necessary. In 2006, the San Joaquin River Restoration Program was established to restore a self-sustaining Chinook salmon fishery below Friant Dam in Fresno, California. This program will restore 153 miles of river below Friant Dam which was built between 1937 and 1942 to provide irrigation water to the southern San Joaquin Valley.

Water Quality

Good water quality is essential to the health of habitats and the biotic communities that depend on them. Poor water quality affects both aquatic terrestrial species and communities through the food chain. There are many kinds of pollutants or contaminants that affect water quality in waterways, many of which are direct results of the activities described elsewhere in the baseline discussion. In addition to contaminants, such as metals or fecal coliform, water quality is also determined by abiotic (temperature, dissolved oxygen levels, pH, turbidity, etc.), and biotic (invertebrates, fish, etc.) indicators.

This analysis will look at several contaminants in aquatic habitats, and then examine water quality from the perspective of abiotic and biotic indicators associated with marine and freshwater environments. It should be noted that analyses of many pollutants that "exceed recommended levels" are based on statistics for human exposure and health. While effects to animals (e.g., fish) are often used in acute and chronic tests, such tests generally are limited to observations of mortality or relatively short-term growth and development; they are not commonly performed on listed species. Sublethal effects, such as behavior and long-term survival, are also not generally analyzed.

Contaminants

Contaminants enter waterways through a variety of pathways. Contaminants in stormwater runoff, for example, may include oil, grease, and heavy metals from roadways and other paved areas, and pesticides from residential developments. Observations of high numbers of pre-spawn mortalities in Coho salmon returning to small streams in urban and developing areas of Puget Sound have caused increasing concern over stormwater runoff (Ylitalo, Buzitis, Krahn, Scholz, & Collier, 2003). Other sources of toxic contaminants are discharges of municipal and industrial wastewater, leaching contaminants from treated wood (e.g., creosote) and other components of shoreline structures, and channel dredging, which can result in resuspension of contaminated sediments. Discharges from sewage-treatment plants may be treated prior to discharge into receiving waters. However, according to the literature, the treatment likely does not adequately remove potentially harmful compounds that are considered persistent, bio-accumulative, and toxic, or those that may have endocrine-disrupting properties (Bennie, 1999; CSTEE, 1999; Daughton & Ternes, 1999; Servos, 1999).

Many of the contaminants are associated with sediments, and they are taken up by bottom-dwelling biota and many of the organisms at the base of the food chain. Many sediment contaminants do not break down very quickly. According to studies in Puget Sound, approximately 5,700 acres of submerged habitat are considered highly contaminated, with many of these sediments present in industrial areas (Hinman, 2005); other areas covered by the survey showed 179,000 acres were of intermediate quality, while the remaining 400,000 acres of the areas surveyed were considered clean. While the areas that are considered contaminated are relatively small, the effects from these areas can be far-reaching. Animals that live in contaminated sediments can accumulate high levels of these substances, with concentrations in biota sometimes thousands of times higher than background levels in the surrounding habitat. As these animals move into other areas, or are preyed upon by more-mobile animals, the contaminants are transmitted up the food chain and may biomagnify. Consequently, predators can have very high contaminant levels, even if they have spent little or no time within the contaminated areas. For example, Chinook salmon in Puget Sound have levels of polychlorinated biphenyls (PCBs) that are three times higher than Chinook in other areas.

Contaminants (and their concentrations in the environment) vary by region and habitat type, and include inorganic (e.g., metals) and organic chemicals (e.g., certain pesticides, phthalates). Some chemicals, such as chlorinated organic compounds and their breakdown products, persist in the environment because bacteria and chemical reactions break them down slowly (PSWQAT, 2000). Although the effects from many of these chemicals have been at least partially analyzed, little is known about the synergistic effects of the chemicals; in many areas, multiple substances are present in the habitat and/or biota. The synergistic effects of these chemicals to aquatic and terrestrial biota are unpredictable at best.

Inorganic Chemicals

Inorganic chemicals include, among other substances, metals and certain pesticides. Sources of mercury, lead, and other metals in water bodies include hazardous material spills, pipes, vehicle emissions, discarded batteries, paints, dyes, and stormwater runoff and can cause neurological or reproductive damage in humans and other animals (Hinman, 2005). Metals, especially zinc, nickel, lead, and tri-butyl tins (used in some paints, for example), occur at relatively high concentrations at a few Puget Sound locations (Hinman, 2005). The presence of certain metals in marine waters have triggered fish and shellfish consumption advisories in many areas. Overall, however, levels of arsenic, copper, lead, and mercury have either declined or remained steady (as opposed to increasing) in sediments and shellfish tissues during the past decade (Hinman, 2005).

Organic chemicals

A variety of organic chemicals have been detected in waterways, including, but not limited to, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), poly-brominated diphenyl ethers (PBDEs), chlorinated pesticides (e.g., DDT [(dichloro diphenyl trichloroethane]), dioxins, certain pharmaceuticals and other emerging compounds.

PAHs are present in fossil fuels and other sources; certain types of PAHs are formed when fossil fuels and other organic materials are burned. Other sources include coal, oil spills, leaking underground fuel tanks, creosote, and asphalt. PAHs are found in urban and industrial areas, and have been associated with liver lesions in English sole in small concentrated areas of sediment or "hot spots" (Hinman, 2005). Fish and shellfish consumption advisories have been issued in some areas due to the presence of this chemical. Exposure is linked to increased risks of cancer and to impaired immune function, reproduction, and development. Concentrations of PAHs in the Sound are often quite high compared to concentrations measured elsewhere around the United States.

Another group of organic chemicals of concern are PDBEs (e.g., flame retardants), members of a class of brominated chemicals. Flame retardants are added to some products to reduce the risk of the products catching fire if exposed to high heat or flame. PDBEs have been detected in several Pacific Northwest aquatic species and their predators, including Dungeness crab (west coast of Canada), bald eagle (Lower Columbia River) and heron (British Columbia) eggs, orca (northeastern Pacific Ocean), mountain whitefish (Columbia River, Spokane River, British Columbia), rainbow trout (Spokane River), and largescale sucker (Spokane River) (Washington State Department of Ecology and Washington State Department of Health, 2006). Although there is still some debate as to the effects of these substances, the molecule is similar to the thyroid hormone, which affects growth and reproduction (Hinman, 2005). The growth and reproduction of fauna are factors that could be affected by this contaminant. WDOE and Washington State Department of Health (Washington State Department of Ecology and Washington State Department of Health, 2006) indicate that there are differences in the way species either metabolize or accumulate PDBEs; although the overall risk to different species of biota is unknown, there is enough evidence to merit concern.

Chlorinated organic compounds, such as PCBs, dioxins, and DDT are found in solvents, electrical coolants and lubricants, pesticides, herbicides, and treated wood (Hinman, 2005). These compounds and their breakdown products persist in the environment because bacteria and chemical reactions break them down slowly (PSWQAT, 2000). The use of PCBs was common until the 1970s when they were phased out in the United States and Canada. These chemicals are now banned in the United States; however, they continue to leach from landfills, other disposal sites, and contaminated sediments. PCBs enter natural environments and biota from these sources and from airborne fallout deposited after circulating across the globe from continuing sources in Asia (WDOE, 2000). PCBs are slow to degrade, float in air and water, permeate soil, and accumulate in animal fat. Generally speaking, the higher an animal is on the food chain, and the longer lived, the greater the concentrations of these toxins. In Puget Sound, concentrations of PCBs are found primarily in urban and industrial areas. The concentrations of PCBs have not appeared to be declining in recent years despite many other chemicals that were introduced historically into the waters and sediments of Puget Sound. The sources of PCBs include certain solvents, electrical coolants and lubricants, pesticides, herbicides, and some types of treated wood (Hinman, 2005).

Chemicals, such as dioxins and furans, are generated as industrial process byproducts, and they are linked to cancer, liver disease, and skin lesions in humans. Chlorinated pesticides, such as DDT, are linked to liver disease, cancer, hormone disruption, the thinning of bird eggshells, and reproductive and developmental damage. Fry (Fry, 1995) identified organochlorine compounds as a prevalent non-oil pollution threat within the range of the murrelet. Specifically, polychlorinated dibenzo-dioxins (PCDD) and polychlorinated dibenzo-furans (PCDF) which are contained in pulp-mill discharges, cause significant injury to fish, birds, and estuarine environments. PCDDs and PCDFs bio-accumulate in marine sediments, fish, and fish-eating birds and impair bird health and production. There has been no record of bio-accumulated residues or breeding impairment in marbled murrelets to date, although murrelets that feed in areas of historical or current discharge from bleached-paper mills could be at risk from eating fish with bio-accumulated organochlorine compounds.

Other chemicals include phthalates, which come from plastics, certain soaps, and other products. Much of the exposure from these chemicals to biota occurs via wastewater from treatment plants. The effects from these chemicals are not well known, but they may affect growth and development in fish (Hinman, 2005). Pharmaceuticals and personal-care products, such as oral contraceptives, antibiotics, and other prescription drugs, as well as soaps, fragrances, and other compounds, enter the aquatic environment through sewage and wastewater-treatment plants. Effects and risks to aquatic biota from these substances have not been fully analyzed; however, Daughton and Ternes (Daughton & Ternes, 1999) note that even substances that are not persistent but are frequently or continually released may impact aquatic species, which may have exposure throughout entire lifecycles and multiple generations. Daughton and Ternes (Daughton & Ternes, 1999) also note that many of these products are being released worldwide in volumes comparable to chemicals associated with agriculture.

Fecal Coliform

The presence of fecal coliform bacteria is a significant water-quality issue in some areas. Fecal waste enters waters from sources such as poorly managed septic systems, wastewater treatment facilities, stormwater (which washes fecal matter in upland areas into waterways), and animal operations, and contains bacteria and viruses that can result in the contamination of shellfish beds and other resources (WDOE, 2000) (Hinman, 2005).

This water-quality issue is being addressed through several actions to limit the amount of fecal matter and associated bacteria and viruses that affects the waterways of Washington State, including education and outreach, modifications in the amount and types of treatment at treatment facilities, fencing of livestock away from streams, and other activities. Even with these measures being used in some areas, the problem continues to exist. During the past two years, 1,655 acres of shellfish growing areas were added to the list of approved growing areas, indicating improvement; however, the growing areas that are on the list of threatened shellfish beds doubled from 1997 (nine sites) to 2004 (18 sites).

Levels of fecal coliform in streams and rivers are measured along with other water-quality parameters. The WDOE (2000) reports that 52 freshwater monitoring stations have been consistently surveyed since 1995 for fecal coliform, and that, with one exception, the stations are indicating that stream conditions regarding this parameter are either improving or there has been no change (i. e. , no significant deterioration) in stream conditions.

Members of two bacteria groups, coliforms and fecal streptococci, are used as indicators of possible sewage contamination because they are commonly found in human and animal feces. Although they are generally not harmful, they indicate the possible presence of pathogenic (disease-causing) bacteria, viruses, and protozoans that also live in human and animal digestive systems. Therefore, their presence in streams suggests that pathogenic microorganisms might also be present; swimming in water and eating shellfish are possible risks to the human and animal health. Since it is difficult, time-consuming, and expensive to test directly for the presence of a large variety of pathogens, water is usually tested for coliforms and fecal streptococci instead. Sources of fecal contamination to surface waters include wastewater treatment plants, on-site septic systems, domestic and wild animal manure, and storm runoff. In addition to this possible health risk, these pathogenic organisms can cause the occurrence of cloudy water, unpleasant odors, and an increased oxygen demand (USEPA, 2012).

Excess Nutrients

Excessive amounts of nutrients can come from many sources, including lawn fertilizers applied to yards and other areas, agricultural chemicals applied to fields, and fecal matter from septic fields and failing septic systems. Excess nutrients can affect both surface water and groundwater. For example, WDOE (2005) reports that 7% of public-water-supply wells have high nitrate-nitrogen levels, with many of the affected sites clustered in highly populated and rural farming areas. As a result of the input of excess nutrients, aquatic systems and the biota that depend on them have experienced several effects (WDOE, 2000). Excessive nutrients in water cause algae and phytoplankton to grow prolifically. This prolific growth results not only in increased photosynthesis, but also in increased respiration by algae, phytoplankton, and other aquatic plants, which depletes the oxygen necessary for aquatic fauna survival. An increase in numbers of algae and phytoplankton decreases light penetration, reducing the depth to which freshwater and marine aquatic plants (e.g., eelgrass) can grow, especially in lacustrine and marine environments. In turn, there are fewer aquatic plants to provide oxygen, and high volumes of decomposing organic matter further consume valuable oxygen. Although Puget Sound has two tidal cycles per day, marine waters in some areas of Puget Sound (e.g., Hood Canal) appear to be sensitive to water-quality problems that might be caused by excess nutrients because of the physical mixing characteristics in these areas (PSWQAT, 2000).

Toxic algae blooms are another result of excess nutrient input into aquatic systems. In the past, toxic algae blooms occurred in warm summer months, and in the northern part of Puget Sound; more recently, toxic blooms have resulted in closures during the winter months, and they have been reported in other areas of Puget Sound (WDOE, 2000). Certain types of algae cause Paralytic Shellfish Poisoning, also known as red tide, which affects organisms (including humans) that consume shellfish, although they seem to be harmless to the shellfish themselves.

Other Pollutants

In addition to the pollutants listed above, other contaminants have impacted aquatic (and terrestrial) habitats around the country. Hazardous waste is generated by a variety of sources. Large industries, which generate most of the hazardous waste, include (in order of decreasing contributions) equipment manufacturing, primary and fabricated metals, chemicals and petroleum, lumber and wood products, and other sources. Smaller businesses, such as dry cleaners, printers, and auto repair shops, also generate hazardous waste, which can pollute aquatic and terrestrial habitats if the waste is not handled properly.

Solid waste (i.e., trash) is generated in almost all aspects of society. As populations have grown, the amount of solid waste generation has also increased. Solid waste is generated primarily from municipal sources, and to a lesser degree from industrial and commercial waste and other sources. Leakages from landfills as well as unauthorized dumping of garbage and waste chemicals can be a problem whether they occur directly into waters or on land with the potential to impact aquatic and terrestrial habitats and the species that inhabit them.

Microplastics

Urban and highway runoff are potential sources of microplastics (MP) in the environment, with stormwater runoff from land sites providing an avenue for migration of these compounds into the aquatic environment. Common polymers including polypropylene, polyvinylchloride, polyester, polyethylene, and polystyrene were found as the dominant MPs in a study of urban and highway stormwater runoff in Denmark (Liu, Oleson, Borregaard, & Vollertsen, 2019). The same study examined stormwater treatment ponds for highway, residential, industrial and commercial sites and found ponds treating highway and residential sites had lower concentrations of MPs than industrial or commercial stormwater treatment ponds. While MPs are being increasingly studied and identified as contributing sources of pollutants in the environment, including arising from construction site sources in runoff from stormwater and associated activities, the relatively brief duration projects (as compared to operation and long-term maintenance of facilities) would generally limit the magnitude of effects from this source.

Abiotic Indicators

In addition to the presence of contaminants, other parameters are also indicative of water quality. These indicators include (but are not limited to) temperature, dissolved oxygen, pH, turbidity, and instream flow. Many of the activities discussed elsewhere in the Environmental Baseline section can have effects on these indicators. For example, sediment erosion may transport substances such as pesticides or fertilizers into a stream. The addition of excess nutrients from fertilizers often results in a decrease in the levels of dissolved oxygen as described above, potentially resulting in impaired function in the stream. Excess sediment introduced during an acute or chronic erosion event may also result in suspended sediment and turbidity impacts to aquatic biota, which would further stress fauna experiencing low impact levels. An increase in temperature (as a result of removal of shading riparian vegetation, for example) is another type of stressor on aquatic biota, and when such an increase occurs in concert with other impacts, the result can be devastating to aquatic biota. If conditions do not result in lethal or sublethal effects to biota, they may influence the amount of time a mobile organism spends in the affected reach of a stream.

Biotic Indicators

Certain types of organisms have been used to indicate the health of aquatic systems. The species evaluated may focus on specific concerns, such as the effects of fisheries on certain fish populations, or they may provide general information regarding water-quality trends. For example, Rockfish and Pacific herring populations have been monitored for several years by the Puget Sound Action Team (Hinman, 2005). Some rockfish populations are at less than 7 to 12% of their historical levels; the causes for their decline are not fully understood, but fishing pressure is believed to be a contributor (WDOE, 2000).

Aquatic invertebrates can also provide site-specific information on the health of aquatic systems such as streams, lakes, or estuaries. For example, protocols have been designed to assess water quality and habitats by sampling benthic invertebrates in streams (Barbour, Gerritsen, Snyder, & Stribling, 1999) and in estuarine environments (Simenstad, Tanner, Thom, & Conquest, 1991). Biological monitoring was also conducted for 31 sites throughout Washington in 2003. Biological monitoring provides better information for aquatic biota because degradation of sensitive ecosystem processes is more often detected. This type of monitoring directly measures the most sensitive at-risk resources and looks at human influence on stream characteristics over time. Of the 31 sites, data on 24 reaches were reported (Butkus, 1997). The results of this monitoring indicated that 50% of the sites were not meeting the conditions necessary for supporting the aquatic community; it was recorded that only 21% of the sites were designated as fully supportive.

Climate Change

All species discussed in this Opinion are or may be threatened by the effects of global climatic change. The Intergovernmental Panel on Climate Change (IPCC) estimated that observed global mean surface temperature for the decade 2006-2015 was 0. 87 °C (likely between 0. 75°C and 0. 99°C) higher than the average during the 1850-1900 period (IPCC, 2018). This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley & Berner, 2001). The IPCC estimates that the last 30 years were likely the warmest 30-year period of the last 1,400 years, and that global mean surface temperature change will likely increase in the range of 0. 3 to 0. 7 degrees Celsius during the next 20 years.

Warming water temperatures attributed to climate change can have significant effects on survival, reproduction, and growth rates of aquatic organisms (Staudinger, et al., 2012). For example, warmer water temperatures have been identified as a factor in the decline and disappearance of mussel and barnacle beds in the Northwest (Harley, 2011). Shifts in migration timing of pink salmon (*Oncorhynchus gorbuscha*), which may lead to high pre-spawning mortality, have also been tied to warmer water temperatures (Taylor J. A., 2008). In Yellowstone National Park climate warming has resulted in wetland desiccation which has led to declines in four amphibian species (McMenamin, Hadly, & Wright, 2008). Increasing atmospheric temperatures have already contributed to changes in the quality of freshwater, coastal, and marine ecosystems. Also, they have contributed to the decline of populations of endangered and threatened species (Karl, Melillo, & Peterson, 2009) (Littell, Elsner, Whitely-Binder, & Snover, 2009) (Mantua, Hare, Zhang, Wallace, & Francis, 1997).

Climate change is also expected to impact the timing and intensity of stream seasonal flows (Staudinger, et al., 2012). Warmer temperatures are expected to reduce snow accumulation and increase stream flows during the winter, cause spring snowmelt to occur earlier in the year, and reduced summer stream flows in rivers that depend on snow melt. As a result, seasonal stream flow timing will likely shift significantly in sensitive watersheds (Littell, Elsner, Whitely-Binder, & Snover, 2009). Warmer temperatures may also have the effect of increasing water use in agriculture, both for existing fields and the establishment of new ones in once unprofitable areas (ISAB, 2007). This means that streams, rivers, and lakes will experience additional withdrawal of water for irrigation and increasing contaminant loads from returning effluent. Changes in stream flow due to use changes and seasonal run-off patterns may alter predator-prey interactions and change species assemblages in aquatic habitats. For example, a study conducted in an Arizona stream documented the complete loss of some macroinvertebrate species as the duration of low stream flows increased (Sponseller, Grimm, Boulton, & Sabo, 2010). As it is likely that intensity and frequency of droughts will increase across the southwest (Karl, Melillo, & Peterson, 2009), similar changes in aquatic species composition in the region are likely to occur.

Warmer water also stimulates biological processes which can lead to environmental hypoxia. Oxygen depletion in aquatic ecosystems can result in anaerobic metabolism increasing, thus leading to an increase in metals and other pollutants being released into the water column (Staudinger, et al., 2012). In addition to these changes, climate change may affect agriculture and other land development as rainfall and temperature patterns shift. Aquatic nuisance species invasions are also likely to change over time, as ecosystems become less resilient to disturbances (USEPA, 2008). Invasive species that are better adapted to warmer water temperatures would outcompete native species that are physiologically geared toward lower water temperatures; such a situation currently occurs along central and northern California (Lockwood & Somero, 2011).

In summary, effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, patterns of precipitation, and sea level. Other effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Climate change is most likely to have its most pronounced effects on species whose populations are already in tenuous positions (Isaac, 2009).

Species Specific Environmental Baselines

Species specific environmental baseline information is also provided in Appendix E and F within their analysis sections.

EFFECTS OF THE ACTION

The ESA regulations define "Effects of the Action" as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the action, and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action." (50 CFR 402.02). Action means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." (50 CFR 402.02).

For this Opinion, the *Effects of the Action* section of this Opinion is divided into several sections and subsections. First, in the *General Effects* section, there is a brief description of the analysis process and overview of effects and assumptions. The second section, *Effects to Species and Critical Habitats*, includes our analysis of effects for individual species and critical habitats by taxa groups sorted broadly by the categories of terrestrial animals, aquatic animals, and plants. Within each of the three broad categories, we present the anticipated responses of individual species and their critical habitat to the stressors. Finally, we consider whether or to what degree the USFS has structured the Action to ensure the Action is not likely to jeopardize listed and proposed species or destroy or adversely modify their critical habitats[21], by determining whether the USFS: (1) understands the scope of its action; (2) reliably estimates the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of the Action; (3) reliably estimates the exposure of ESA-listed resources (species and designated critical habitat) to these stressors; (4) collects and monitors information on authorized activities throughout the life of the Action; (5) evaluates the information to assess how its actions have affected listed resources; (6) monitors and enforces compliance; and (7) modifies its action if new information (including inadequate protection for species or low levels of compliance) becomes available.

General Effects

In this Opinion, we have analyzed effects to listed species and their critical habitats largely on a nationwide, programmatic scale. Our analysis is generally not quantitative, because we cannot predict when, where, in what habitat type, or how large or long-lasting a wildfire event will happen, nor can we predict when, where, or how much aerial fire retardant may be used on a specific wildfire incident. As described in the BA, USFS evaluated effects to species and their critical habitats through the screening processes as described previously in the *Description of the Proposed Action* section of this Opinion and we briefly describe how we use some of the information generated in the screening exercises as reported in the BA. The BA and this Opinion organizes species and their CH into the overarching groups: Wildlife (i.e., terrestrial animals), Aquatic (i.e., aquatic animals), and Plants. Within the Wildlife and Aquatic groups, species and CH are further divided into guilds.[22]

Use of National and Wildlife Screening Processes

As part of the analysis framework established for the 2011 BA (USDA - USFS, 2011)a National Effects Screening Process (as described in the *Description of the Proposed Action* section of this document) was developed for all threatened, endangered, proposed, and candidate species, and designated or proposed critical habitat. The National Screens represent a coarse filter for consideration of species distribution, habitat, and probability of retardant application where species occur, while the Wildlife screens create a finer resolution scale look at the likelihood of effects as the USFS considered a NLAA vs. LAA effect determination. This process allowed the USFS to establish a standardized method on their approach to determining *no effect*, or *may affect* calls for species and critical habitat, although the USFS also sometimes used additional analysis to arrive at determinations, as described for each species group or individual species in the BA and Appendix F.

Although the USFS developed the screening process to provide a consistent approach to considering the potential impacts of aerial retardant on a wide variety of wildlife species and habitats, we are also able to use the information included in the species and critical habitat

[21] As noted previously, only species and critical habitats for which the USFS has made a "may affect, likely to adversely affect" determination are considered in this Opinion.
[22] The groupings and guilds are used for organizational purposes and to reduce redundancy in narratives and descriptions of our analyses. However, each species and critical habitat has been analyzed independently and assigned individual conclusions in this Opinion.

screens results (see Appendix F) to better understand the anticipated effects of the Action on listed species and their critical habitats.

Types of Anticipated Effects

We anticipate that the Action may affect listed species and critical habitats through either exposure to the fire retardant chemicals, disturbance from aircraft transporting and deploying the retardant, and from operations of a mobile or permanent airtanker base or retardant jettison protocols. We discuss each of these stressors broadly below, and in greater detail as necessary for each species within the taxa groups found later in this section after outlining our assumptions related to implementation of the Action. For the general effects description, we rely largely on information from the BA, and much of the information below in the following subsections is taken directly or indirectly from the BA.

Assumptions

We made a number of assumptions related to the overall effects of the Action, all of which are similar to the assumptions related to the wildlife screening tools. First, we anticipate that future use of aerial fire retardant use will most likely be similar to uses in the recent past (e.g., from 2012 through 2019). While we recognize that recent fire activity in some areas may have been more frequent or extensive than in the more distant past, we anticipate that the activity in the recent past serves as a reasonable approximation of likely future fire conditions as need for aerial fire retardant applications. Secondly, we assume that aerial retardant drops will generally not be allowed in avoidance areas, except where human life or public safety is threatened, and that retardant use in the avoidance area could be reasonably expected to mitigate that threat.

We expect that the use of avoidance areas reduces the likelihood that aerial retardant use will impact species or habitats, but the degree to which potential impacts might still occur will vary based on the species or critical habitat and the type of effect being considered. We also assume that the rate of intrusions will remain low, similar to the rate observed from 2012 through 2019. Finally, we assume that annual coordination will occur between local units of the USFS and the Service, or at the headquarters level, as needed. We expect that these efforts will reduce impacts to species and habitats by discussing, prior to each fire season, changes to designated critical habitats, monitoring needs, and any new information.

We also made assumptions about patterns of aerial fire retardant applications, as described in the BA. For example, retardant applications are based on factors including fuel type, application rates, variability in delivery systems, and other fire-fighting tactics. Application rates range between 1 to 8 GPC with most applications being between 4 to 8 GPC (Johnson C. , 2010). Usually, the width and length of a retardant drop swath varies based on the type of aircraft used for delivery. An average drop is 50 to 75 feet wide by up to 800 feet long. For forests using these chemicals, aerial retardant is applied to between one and 2,046 acres per National Forest, or between 0.0001 and 0.2 percent of the land base of each National Forest. Depending on fire-fighting tactics, retardant drop width or length might be strung together creating a continuous path of retardant on the ground.

In addition, we do not anticipate a significant amount of exposure will result from drift from retardant applications. As previously discussed, fire retardants include a gum thickening agent which raises the viscosity and creates larger and more cohesive droplets to reduce drift. There are guidelines for the use of aircraft during suppression activities to ensure that operations can be conducted in a safe and effective manner, and aircraft will suspend flights if there is poor visibility and when wind conditions result in unsafe or ineffective operations.

General Effects from Exposure

Potential direct impacts of aerial retardant application vary based on ecoregion, because of differing vegetation types and other factors. For example, some wildlife species might have a greater risk of direct exposure due to body size (small birds and mammals) or based on the toxicity of the ammonia in an aquatic environment (aquatic amphibians, fish, and aquatic invertebrates). There were no data to support a risk profile for terrestrial invertebrates such as insects. However, based on our assumptions for risks to terrestrial invertebrates, we expect that there is likely to be a risk of mortality from the physical impacts of a large retardant drop as well as ingestion of plant or nectar material that would also result in mortality of individuals. Some wildlife species might have a risk of negative effects resulting from direct ingestion of aerial retardant chemicals in some areas (Auxilio Management Services, 2021). Where exposure occurs, risks are generally higher for aquatic species than for terrestrial species, some of which could also be affected by direct physical contact with chemicals (e.g., amphibians, small mammals, and small birds). We describe several categories of general effects to species and their critical habitats from the proposed activities in the paragraphs below.

Ingestion of Contaminated Food Resources

In addition to toxicity effects as described above, other factors also influence the degree to which exposed individuals would be affected by contaminated food items. As described in the BA, Labat Environmental (2017) noted that the effects of ingestion of vegetation or insects coated or covered with fire retardant on a species depends on the amount of retardant used (the amount of coverage by vegetation/eco-region type), timing of ingestion after application, ability of the animal to avoid feeding on chemicals, and availability of alternate food supplies in the immediate area. These parameters were included in the assessment done by Auxilio Management Services (2021), which used representative wildlife species to determine potential risk of effects from retardant ingestion.

Effects to Aquatic Species and Habitats

Effects to aquatic species and their habitats, including their critical habitats, were evaluated to include impacts from runoff and spills from program activities, as well as the application of fire retardants into low flowing water bodies and lentic systems such as ponds and lakes (which would more likely be the result of an intrusion as all water bodies are buffered by 300-feet). The ecological assessment (Auxilio Management Services, 2021) looked at potential concentrations of retardant ingredients that would result from contaminated runoff or as a result of a retardant drop or an accidental spill directly into a stream. Concentrations of chemicals that could occur in streams were modelled, using information from the fifteen ecoregions (Bailey 1995) representative of areas where retardants are applied. Each assessed retardant posed a potential risk to certain aquatic species, including tadpoles, if dropped directly into a stream. The risk assessment also indicated potential risk to some bivalves as a result of long-term exposure if retardant chemicals persist or accumulate in waterbodies such as ponds.

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

In general, the application of retardants composed of inorganic fertilizers is likely to temporarily degrade water quality (Rehmann, Jackson, & Puglis, 2021) impair light penetration, decrease dissolved oxygen, increase nonnative vegetation, and increase the rate of eutrophication. The severity of the effect will differ depending on the amount of retardant that enters the unit and the environmental characteristics at the time of delivery: wind speed, topography and vegetation. These effects could occur both in the short-term due to immediate ammonia toxicity, and in the long-term if residence time of retardant compounds, and their consequences for eutrophication, lasts through multiple seasons. (Rehmann, Jackson, & Puglis, 2021) developed a model (spill calculator; see *Description of the Proposed Action* Section in this Opinion) to help the USFS collect the necessary information on the impacts of fire retardant into aquatic systems and estimated the effects of each as it occurs based on the intrusion location on the landscape. The results indicated that from the 1,152 hypothetical exposures in the model, most intrusions into a stream may only affect a stream in terms of ammonia toxicity between 1.5 hours and five hours. Because of this short exposure time, 96-hour LC_{50} tests may over-estimate expected exposures and likely overestimate expected responses. When nitrogen-based fire retardants enter a stream, an initial spike in ammonia occurs, however, it immediately begins to form a chemical equilibrium between un-ionized ammonia, which is the more toxic form, and ionized ammonia, eventually breaking down into nitrates through the natural nitrogen cycle within that 1.5 to 5 hour time frame discussed above. In most flowing systems, the pH is sufficiently low that ionized ammonia predominates. The potential for downstream effects to occur can be within 6.2 miles downstream of where retardant is dropped (the distance to which ammonia levels, depending on stream characteristics and the size of the retardant load, and thus effects of retardant can remain at lethal levels (Norris & Webb, 1989).

Effects to Terrestrial Species and Habitats

The potential risks or impacts to terrestrial species and their habitats, including critical habitats, from the use of fire retardants are largely expected be minimal or minor. Additionally, aerially delivered fire retardant is water soluble, so it is expected to wash off of vegetation into the soil during the first wet weather event where it will bind with the organic matter. Risks to terrestrial wildlife are likely to be:

- Small in scale, and they are not likely to affect more than a few individuals or a portion of a population or habitat at any one time (for most species).

- Small in quantity, as most drops are less than 3,000 gallons and the chance of all gallons from the drop landing within an avoidance area is low (per recorded intrusion data).
- Short in duration, as the retardant is not likely to have a lasting effect on most of the species. These effects are temporary or short-term in nature (less than 30 days as compounds break down).

Small, endemic (or localized) populations with limited mobility or a specialized habitat may be affected by the aerial application of fire retardant if directly hit. However, given the mobility of most species and their instinct to avoid a fire, direct application of retardants on wildlife species is expected to be rare. Direct impacts from the application of retardant may occur where nest trees or breeding sites are occupied at the time of aerial retardant application or if the mobility of the individual species is such that it cannot avoid the area of application, such as with nestlings, fledglings and juvenile individuals.

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

Effects from Disturbance

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

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

Other Effects

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

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

In aquatic environments, retardant salts have been demonstrated in experimental conditions to decrease pH and reduce zooplankton abundance. If these conditions were to persist, impacts could occur through the food chain. However retardant chemicals become diluted and dispersed through streamflow in flowing waterbodies, limiting the risk of this effect. This effect would be less in non-flowing systems such as ponds, lakes or pools, although we generally expect that larger waterbodies would allow for greater dilution and dispersal than smaller waterbodies.

Effects to Listed Species and Critical Habitats

Because of the national scale of this analysis and the need to address many species and associated critical habitats that occur on National Forest System Lands, our analysis was organized into several taxonomic groupings and subgroupings. The major taxonomic group types include: *Amphibians, Birds, Fish, Invertebrates, Mammals, and Plants*. Each group is then further divided into similar taxonomic species, such as *frogs, small mammals, insects,* etc. We relied on the available information for these species summarized in Appendix E and F of this Opinion.

Because this is a national, programmatic action and we are evaluating effects both at the individual and species level, we consider effects to species throughout the action area rather than only by individual National Forest. We use a similar approach when considering both PBFs of critical habitat and the designation in its entirety (or critical habitat proposal, as appropriate).

Summary of Effects and Determinations

In their BA, the USFS determined that 114 species and 21 critical habitats may experience adverse effects due to impacts expected from either changes in habitat, disturbance, or toxicity expected from the use of aerial application of fire retardants. Two listed species with USFS LAA determinations have NEPs that occur on National Forest System Lands. We consider these NEPs when discussing effects to the applicable species below. We also consider effects to the critical habitats. The following sections provide an overview of the types of effects we anticipate may occur for each main taxa group.

Amphibians

Data on the toxicity of retardants to amphibian species is limited; however, as a group, amphibians are sensitive to these chemicals in their environment. For example, the ecological risk assessment (Auxilio Management Services, 2021) indicated risk (mortality) to threatened or endangered amphibian species from exposure to the PhosChek MVP-Fx product based on an accidental application of 6 GPC in a small stream. Risks were not identified for other retardants accidently applied to a small stream, accidental application of any retardant to a large stream, or applications made outside of the related 300-foot avoidance area. There are limited toxicity data on the MgCl based retardants in the aquatic environment, but this chemical is assumed to be detrimental to the reproduction, growth and survival of aquatic life stages of threatened and endangered amphibians. We anticipate that other future allowable chemicals used as aerial fire retardant products would have a similar or lower level mortality or sub-lethal risk to amphibians should exposure occur, based on the requirements described in the *Description of the Proposed Actio*n Section "*Retardant Components and Testing Requirements*" in this Opinion for USFS methodology on products added to the QPL.

However, we anticipate that all aquatic habitat will be included in avoidance areas, avoiding or greatly reducing the likelihood of exposure for aquatic life history phases or amphibians closely associated with aquatic habitat at all life stages. There is a minimum 300-foot buffer (avoidance area) from the edge of the aquatic habitat, where aerial fire retardant is unlikely to be applied. For some amphibian species, the buffer is larger (600-ft) due to the steep drainage areas in which the amphibians are found (Sierra Nevada amphibians, for example). As previously discussed, from 2012 through 2019, intrusions of retardant into avoidance areas occurred on 0.46 percent of all fires. Intrusions into the water, both accidental and due to an exception, were rare, and occurred at a rate of 0.43 percent of all retardant drops. The intrusion rate into the buffer area around aquatic habitat, where it did not enter the water, was also rare, at 0.29 percent of all retardant drops. We assume that units with a greater application potential may have a higher probability of intrusions. We also assume that increased retardant use will result in an increase in number of intrusions, but this would not alter the intrusion rates[23].

The amphibian species considered in this Opinion include two toads, six frogs, and two salamanders (**Table 19**). Critical habitat is designated for each of these species; however, the USFS made NLAA determinations for each of these critical habitat designations, as described in the *Concurrence* section of this document.

Table 19. Amphibians with LAA determinations.

Taxa Group	**Species Groupings**	**Common Name**	***Scientific Name***
Amphibians	Frogs and Toads	Arroyo toad	*Anaxyrus californicus*
Amphibians	Frogs and Toads	Yosemite toad	*Anaxyrus canorus*
Amphibians	Frogs and Toads	California red-legged frog	*Rana draytonii*

[23] According to the USFS, Intrusion numbers will always be in proportion to the retardant loads, so the rate does not change.

Taxa Group	**Species Groupings**	**Common Name**	***Scientific Name***
Amphibians	Frogs and Toads	Chiricahua leopard frog	*Rana chiracahuensis*
Amphibians	Frogs and Toads	Mountain yellow-legged frog – northern California DPS and southern California DPS	*Rana muscosa*
Amphibians	Frogs and Toads	Oregon spotted frog	*Rana pretiosa*
Amphibians	Frogs and Toads	Sierra Nevada yellow-legged frog	*Rana sierra*
Amphibians	Frogs and Toads	Foothill yellow-legged frog – South Sierra DPS, South Coast DPS, and North Feather DPS	*Rana boylii*
Amphibians	Salamanders	Sonora tiger salamander	*Ambystoma tigrinum stebbinsi*
Amphibians	Salamanders	California tiger salamander – Central Valley DPS, Santa Barbara County DPS, and Sonoma County DPS	*Ambystoma californiense*

All of these species have life history phases associated with aquatic habitats, with some species (e.g., the toads) also occurring in terrestrial habitats.

Arroyo toad

This toad breeds in stream channels and uses stream terraces and uplands for foraging in eleven counties in southern California (Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Bernardino, Riverside, Imperial, San Gabriel, and San Diego Counties). It occurs on the Cleveland, Angeles, San Bernardino and Los Padres National Forests, all of which have high aerial retardant application potential. Since 2012, there have been several intrusions, resulting in incidental take of arroyo toads on each national forest where it occurs, though anticipated incidental take (from prior consultations) has not been exceeded. Most, if not all of the intrusions reported in arroyo toad habitat mapped avoidance areas are the result of using the exception for public and fire fighter safety in southern California. The Pilot Fire (2016) on the San Bernardino National Forest is an example of the exception being used. The result was retardant being dropped in the outer 50-foot edge of the avoidance area buffer for arroyo toad and there were no known impacts to species or habitat.

As noted previously, amphibian species are susceptible to the toxic effects of aerially applied fire retardant. Because the arroyo toad occurs on units with high application potential, and the larvae (aquatic juveniles/tadpoles) would not be able to avoid retardant should applications occur in or adjacent to their habitat, these types of effects are anticipated to occur at low levels over the duration of the Action, resulting in impacts to only small numbers of individuals. Such impacts would likely be limited to adults who might escape exposure while in underground burrows, but who would be more susceptible to exposure in upland habitats (e.g., ingestion of contaminated prey, physical effects of injury such as crushing if directly in the path of a retardant drop). The 600-foot buffers on aquatic habitat occupied sites for this species will reduce the likelihood that the retardant would enter waterways and upland areas occupied by the species. Although airtanker bases in California primarily use PhosChek MVP-Fx, which is the retardant identified in the risk assessment (Auxilio Management Services, 2021) as having a risk to tadpoles, we anticipate the numbers of exposed individuals would be very small, based on the use of these aquatic habitat buffers. In some cases, the use of retardant may reduce the likelihood of other, more invasive and lethal, fire-fighting activities (e.g., bulldozing fuel breaks and safety zones), particularly within the fire season when use of aerial retardant would be less likely to impact toads that are taking refuge in underground burrows.

Adult arroyo toads prey on arthropods, mostly ants and beetles and probably including spiders, caterpillars and the larvae of multiple insect species. Tadpoles consume loose organic material from the bottom and margins of natal aquatic sites, but are generally less at risk from exposure than adults as the preferred perennial nature of breeding sites and aquatic avoidance would limit the likelihood of exposure to a very small number of sites (e.g., intrusions). Metamorphosed juveniles are also at reduced risk of exposure to aerial retardant as they tend to remain close to their natal aquatic sites for several months following emergence. Adults of the species, from the end of the breeding season (July) through the fire season are at greater risk of consuming prey items contaminated by retardant chemicals as they are wider ranging and utilize and disperse into upland habitats at distances of more than a mile from breeding sites. The mobility of this species, which allows them to move away from the affected areas, may reduce the potential for effects from localized reductions in prey. They may still experience physiological effects similar to those of ingesting contaminated prey if they are also susceptible to the effects from a dermal exposure. While consumption of contaminated prey is anticipated to affect arroyo toads where exposure occurs, particularly adults during the peak of fire season, we expect that the rarity of intrusion events will minimize these effects such that very few individuals will be adversely affected either through exposure or impacts to prey resources.

Based on existing information from intrusion monitoring, we anticipate that potential effects from direct physical impacts, dermal exposure, or contaminated prey would be uncommon. These effects would affect only a small number of individuals including very low numbers of juvenile and larval stages, despite the efforts to minimize effects through the use of 600-foot buffers from aquatic habitats. We anticipate that for a very small number of individuals, the adverse effects of infrequent exposure from fire retardant chemicals will include mortality.

Yosemite toad

Habitat for the Yosemite toad includes moist mountain meadows and borders of forests at high elevations (4,800 to 12,000 feet). Individuals shelter in rodent burrows as well as in dense vegetation. Breeding occurs in shallow edges of snow melt pools and ponds or in shallows or along edges of lakes and slow-moving streams and typically before fire season. Some breeding sites dry up before tadpoles are able to metamorphose. This species occurs on the Humboldt-Toiyabe National Forest in USFS Region 4, which has high use retardant application potential; and on the Lake Tahoe Basin Management Unit with very low application potential, and the Inyo, Eldorado, Stanislaus and Sierra National Forests in Region 5, all with high retardant application potential for use of aerial fire retardant.

There have been no intrusions of retardant into Yosemite toad habitat since 2012. We anticipate the avoidance areas (300 feet for critical habitat and 600 feet for occupied sites) will reduce the probability of retardant entering occupied habitat. Where exposure occurs, we anticipate this amphibian would be susceptible to the toxic effects of retardant, including ingestion of contaminated prey items that include a wide variety of arthropods and localized or small reductions in prey resources. Site fidelity and small home ranges limit their ability to avoid areas of retardant drops, but adults are capable of traversing in excess of one quarter of a mile (494m) within an active season and most retardant drops are localized in aerial extent (800 feet by 50-75 feet, or about an acre). Thus, we anticipate that effects to individuals are most likely to affect sub-adult and adult stages of the species moving from breeding sites to summer foraging areas and refugia. However, with the low likelihood of intrusions, higher elevation distribution (where aerial retardant is less likely to be used) and requirement of avoidance areas (i.e., buffers for aquatic habitats), we anticipate that, at most, only very low numbers of individual Yosemite toads would be affected by exposure to retardant or through effects to their prey.

California red-legged frog

The California red-legged frog requires a variety of habitat elements. Breeding sites of the California red-legged frog are in aquatic habitats including pools and backwaters within streams and creeks, ponds, marshes, springs, sag ponds, dune ponds, and lagoons. Additionally, California red-legged frogs frequently breed in artificial impoundments, such as stock ponds. The species also requires that breeding areas be embedded in a matrix of riparian and upland dispersal habitats. This species may occur on the Angeles, Cleveland, Eldorado, Los Padres, Mendocino, Plumas, San Bernardino, Shasta-Trinity, Sierra, Stanislaus and Tahoe National Forests. The Mendocino National Forest has moderate application potential, while the remaining forest have high application potential of aerial retardant.

California red-legged frog diets are highly variable, but can include invertebrates (arthropods) and vertebrates such as other anurans (i.e., frogs and toads) and mice. The foraging ecology of the larval stages of the species is not well studied, but they are believed to be algal grazers. Exposure through ingestion of contaminated prey is anticipated to represent a very low risk given the low likelihood of application (i.e., avoidance area mapping) and intrusions. The expanded aquatic buffer area (600 feet for occupied areas) also reduces the likelihood of adverse effects from small or localized reductions in prey and as the retardant drop sites are generally small (800 feet by 50-75 feet), but affected individuals in upland or intrusion areas are also at risk of ingesting retardant if exposed directly (e.g., dermal exposure).

The species exists on USFS lands broadly but at low numbers and with low numbers of breeding individuals. The preferred breeding habitat for the species includes ponds and slow-moving, low-gradient streams such that retardant would not be readily dispersed or diluted in the event of an intrusion. However, aquatic avoidance areas have been expanded to 600 feet in California red-legged frog habitat and retardant drop sites are generally small (800 feet by 50-75 feet). Thus, the likelihood of exposure and intrusions is anticipated to be greatly reduced and limited to small and localized areas where we anticipate reductions in prey, and effects to a small number of individuals in upland or intrusion areas where they are exposed from the ingestion of retardant on prey or through direct dermal exposure. We anticipate that, at most, very low numbers of California red-legged frogs would be adversely affected by exposure to retardant or through effects to their prey.

Chiricahua leopard frog

The Chiricahua leopard frog is historically an inhabitant of cienegas, pools, livestock tanks/cattle ponds, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet in ten counties in central, east-central, and southeastern Arizona, and in six counties in west-central and southwestern New Mexico. The species occurs in Region 3 in Arizona on the Apache–Sitgreaves National Forest, which has low potential for aerial retardant application; on the Coconino National Forest, which has moderate retardant application potential; and on the Coronado and Tonto National Forests, both of which have high retardant application potential. In New Mexico, it occurs on the Cibola and Gila National Forests, both of which have moderate aerial retardant application potential.

The Chiricahua leopard frog primarily consumes invertebrates including beetles, true bugs, and flies, but fish and snails are also eaten. Tadpoles are herbivorous. Toxicity from ingestion of contaminated prey is anticipated as is the risk of localized reduction of invertebrate prey, but the risk of such exposure is expected to be very low given the preference for permanent to semi-permanent water bodies, lack of intrusions, and implementation of aquatic avoidance areas. The extent of sites exposed to retardant is also generally limited in scope (800 feet by 50-75 feet).

The Chiricahua leopard frog has a limited mobility but is somewhat widely distributed. It can be very susceptible to localized applications of fire retardant. The sensitive aquatic habitats occupied by the Chiricahua leopard frog are often very small and may not be recognized as "waterbodies" or important aquatic sites (e.g. stock tanks/cattle ponds, springs) and may receive direct applications of fire retardants, though we are not aware of any intrusions affecting this species and again, incidents of intrusions across the entirety of USFS lands is very low. While the aquatic habitats of the Chiricahua leopard frog are more difficult to identify due to their small size (e.g., springs) and sometimes anthropogenic (manmade) genesis (e.g, stock tanks), we anticipate a very low likelihood of exposure to retardant chemicals for individuals of this species. Thus, we expect that, at most, very low number of individuals would be affected by exposure to retardant or through effects to their prey, taking into account the aquatic habitat avoidance areas and prior lack of intrusion incidents.

Mountain yellow-legged frog – northern California DPS and southern California DPS

The mountain yellow-legged frog (southern California DPS) occurs at only a few sites in high elevation, fast-moving cold-water streams on the San Bernardino and Angeles National Forests. Both of those Forests have high aerial retardant application potential. The northern California DPS occurs on the Inyo, Sierra, and Sequoia National Forests, all of which have high retardant application potential.

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

Mountain yellow-legged frogs are generally insectivorous as juveniles and adults, consuming a variety of insects including beetles, ants, bees, wasps, true bugs, and dragonflies, but can also prey on tadpoles of other anurans and conspecifics. Tadpoles have been observed grazing on benthic detritus and algae. Risk to aquatic life stages is anticipated to be greatly reduced given the mapped aquatic avoidance areas and tadpoles can take two seasons to metamorphose into juvenile frogs, particularly at higher elevations. Thus, dispersing juveniles/sub-adults are likely at higher risk of exposure to aerial retardant from direct exposure where they move through upland habitats, through consumption of contaminated prey or localized reduction of invertebrate prey. However, the sites exposed are generally limited in scope (800 feet by 50-75 feet) and the species exhibits high degrees of site fidelity that would tend to limit their exposure from contaminated prey or reductions in prey as, generally, they are highly aquatic.

However, the USFS has extended avoidance areas for mountain yellow-legged frogs in southern California and the northern California DPS as well to 600-feet from the edge of the waterway for occupied sites. On the San Bernardino National Forest intermittent tributaries upstream of occupied habitat is included in avoidance areas. We expect that these expanded avoidance areas will minimize the likelihood of retardant entering habitat, greatly limiting exposure to this species and its prey. Thus, we expect that, at most, very low number of individuals would be affected by exposure to retardant or through effects to their prey.

Oregon spotted frog

The Oregon spotted frog life cycle requires shallow water areas for breeding, oviposition, and egg and tadpole survival. It requires perennial water with moderately vegetated pools for adult and juvenile survival in the dry season, and perennial water for protecting all age classes during cold, wet weather.

The Oregon spotted frog occurs in USFS Region 6 on the Mt. Baker-Snoqualmie National Forest, which does not use retardant; the Mt. Hood National Forest, which has very low retardant application potential; the Gifford Pinchot and Willamette National Forests, which have low retardant application potential; the Fremont-Winema National Forest, which has moderate application potential; and the Deschutes National Forest, which has high application potential. In Region 5, there currently are no known occupied sites but there are historic records at sites that have not been recently surveyed. Therefore, the species may occur on the Modoc and Klamath National Forests, which have high retardant application potential. Since there are populations of Oregon spotted frog in the Klamath Basin, this species is being analyzed as occurring on the Modoc and Klamath National Forests in this consultation.

Oregon spotted frogs are opportunistic feeders, primarily on insects, but are also known to eat adult Pacific tree frogs, small red-legged frogs, and recently metamorphosed (juvenile) red-legged frogs and juvenile western toads as well as conspecific tadpoles. Tadpole stages of the Oregon spotted frog are believed to primarily consume algae and detritus. Risk to dispersing juveniles and adults from consumption of prey items contaminated by retardant or from localized reduction of prey availability is anticipated to be generally very low given the infrequency of intrusions. However, ranid frogs are generally known to be capable of moving across broader geographies and upwards of 5km or more. Thus, there is a risk of direct exposure, including ingestion of contaminated prey. This risk is anticipated to be greatly mitigated through the incorporation of avoidance buffers, as described below.

As a result of a 2018 consultation (reinitiation) for Oregon spotted frog, the USFS committed to 600-foot buffers of the following critical habitat units:

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

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

While the expanded buffers in habitat described above would greatly reduce the probability of retardant entering the species habitat, there is still a small potential for retardant to be applied in the water or uplands where they occur. Oregon spotted frog juveniles are not highly mobile and would not be able to avoid retardant drops. Where exposure occurs, we anticipate effects to individuals or small or localized reductions in prey may affect a few individuals. Thus, we anticipate that small numbers of individual tadpoles, juveniles, and adults would be affected from exposure to the retardant chemicals and effects to prey through very infrequent intrusions of retardant use in occupied habitat of the Oregon spotted frog.

Sierra Nevada yellow-legged frog

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

Sierra Nevada yellow-legged frogs are generally insectivorous as juveniles and adults, consuming a variety of insects including beetles, ants, bees, wasps, true bugs, and dragonflies, but can also prey on tadpoles of other anurans and conspecifics. Tadpoles have been observed grazing on benthic detritus and algae. Risk to aquatic life stages is anticipated to be greatly reduced given the mapped aquatic avoidance areas and tadpoles can take two to three years to metamorphose into sub-adults, particularly at higher elevations (Bradford, 1983) and (Zweifel, 1955). Thus, dispersing juveniles/sub-adults are likely at higher risk of exposure to aerial retardant from direct exposure where they move through upland habitats, through consumption of contaminated prey or from localized reduction of available prey. However, the species exhibits high degrees of site fidelity that would tend to limit their exposure from contaminated prey or localized reductions in prey availability as, generally, they are highly aquatic.

Although Sierra Nevada yellow-legged-frog is widespread, occurring on nine separate units, its numbers are low. Adults are rarely found more than a few feet from water, and tadpoles take two to three years to metamorphose. Food resources include terrestrial insects and adult forms of aquatic insects for adults and algae and diatoms for tadpoles. Any retardant entering the aquatic habitat has the potential to impact individuals and their prey resources. However, we anticipate the species utilization of perennial bodies of water with required aquatic habitat buffer areas would make the likelihood of exposure and effects to individuals of the species very low.

Foothill yellow-legged frog – South Sierra DPS, South Coast DPS, and North Feather DPS

Foothill yellow-legged frogs occur at elevations of 100 to 3280 feet in partly shaded streams in areas of chaparral, open woodland, and forest. They prefer small perennial streams with some cobble-sized rocks, riffle areas, and depths rarely greater than 3.3 feet, but also use intermittent, small rocky streams with seasonal riffle habitat or larger perennial streams with rocky or bedrock habitat.

The species consumes algae in the larval tadpole stage and invertebrates, primarily insects, in metamorphosed juvenile to adult stages. Ingestion of invertebrate prey and localized reductions of prey availability are anticipated to represent very low risks of exposure to retardant or effects from prey exposure to retardant given the heavily aquatic life history of the foothill yellow-legged frog and avoidance area mapping.

The foothill yellow-legged frog is found from the upper reaches of the Willamette River system, Oregon south to the upper San Gabriel River, Los Angeles County, California, including the coast ranges and Sierra Nevada foothills. The South Sierra Distinct Population Segment occurs on the Sierra, Sequoia, Stanislaus, Eldorado, and Tahoe National Forests. The South Coast Distinct Population Segment occurs on the Los Padres National Forest. The North Feather Distinct Population Segment occurs on the Plumas National Forest. These forests all have high retardant application potential.

The Distinct Population Segments of foothill yellow-legged-frog occur in limited numbers on seven separate units. Adults are rarely found far from water and tadpoles are unable to avoid retardant if it enters the water when they are present. Any retardant entering the aquatic habitat has the potential to impact individuals. However, required aquatic buffers are anticipated to provide for avoidance of impacts to habitat and individuals of the species except in the rare occurrence of an intrusion. In these rare instances, it anticipated that very low numbers of foothill yellow-legged frogs would be affected.

Sonora tiger salamander

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

Larvae feed primarily on zooplankton (daphnids, copepods, bosminids, ostracods), but incorporate larger aquatic macroinvertebrates (chironomids, trichopterans, molluscs, zygopterans) into their diet as they grow. Branchiate (fully aquatic) adults stay in their natal aquatic site throughout their lives and it is anticipated that they would only extremely rarely be subject to retardant exposure in fully aquatic phases. Terrestrial adult forms consume aquatic macroinvertebrates and terrestrial insects. While Sonora tiger salamanders can disperse over distances of several kilometers, it is not known what percentage of terrestrial individuals disperse and persistent aquatic sites (ponds, stock tanks) can be good breeding sites, except when they hold introduced fish or bullfrogs, which prey upon the salamanders. It is anticipated that ingestion of contaminated invertebrate prey and localized reduction of prey availability are an exposure risk or an effect from exposure of prey to retardant, respectively, but that very low numbers of individuals would be affected given the low rate of intrusions.

The Coronado National Forest has high aerial fire retardant application potential. Because of the high retardant potential and likelihood of a pilot not seeing the breeding habitat from the air, there is some likelihood of retardant entering the breeding pools. Retardant could kill the food source or the larval salamanders if dropped on a breeding (cattle) pond, but we anticipate that this is likely to be a very infrequent event given the low incidence of intrusions and the avoidance requirement utilizing a 300-foot habitat buffer. Thus, we anticipate that very low numbers of Sonora tiger salamanders would be adversely affected through exposure or impacts to food resources.

California tiger salamander

We anticipate any effects to the California tiger salamander could include effects from airtanker bases and related jettison areas (Central Valley, Sonoma, and Santa Barbara DPS) and the Central Valley DPS may also occur on the Los Padres National Forest or on the San Joaquin Experimental Range Station (the part of which on the Sierra National Forest that occurs in the Central Valley of California). If the California tiger salamander is found within the Los Padres or San Joaquin Epxeriemental Range Station, their locations would be buffered by 600 feet. Known locations at airtanker bases would not be buffered. Thus, our discussion of the California tiger salamander included here is limited to those effects where buffering does not occur; on the airtanker bases or jettison areas in proximity to them. California tiger salamanders have three DPSs that occur in California: a Central Valley DPS, a Santa Barbara County DPS, and a Sonoma County DPS. The DPSs of the California tiger salamander occur in populations consisting of relatively small numbers of breeding adults; breeding populations in the range of a few pairs up to a few dozen pairs are common, and numbers above 100 breeding individuals are rare (California Department of Fish and Game, 2010). Any retardant entering the aquatic habitat where the species resides may impact individuals, most likely near jettison areas for the various airtanker bases. In these rare instances, it is anticipated that, at most, very low numbers of California tiger salamander would be affected.

All of the individuals within California tiger salamander DPSs breed in vernal pools during the winter season when rains inundate the pools. They spend the remainder of the year and the majority of their life in the burrow systems of small mammals. They primarily inhabit annual grasslands and open woodlands with large tracts of upland habitat and multiple breeding ponds. California tiger salamander larvae typically feed on invertebrate prey such as zooplankton, small crustaceans, snails, and aquatic insects until they grow large enough to switch to larger prey. The most common types of prey for adults are crane flies (*Tipula spp.*), beetles (*Carabidae spp.*), moth larvae (*Noctuidae spp*.), and springtails (Collembola). We anticipate ingestion of exposed invertebrate prey and localized reductions of prey availability will represent very low risks of exposure to retardant or effects from prey losses, given the common and varied food resources used during the aquatic life stage as larvae and the fossorial behavior of adult California tiger salamander DPSs.

Impacts to the vegetation in the vernal pools or impacts to the water quality are possible. Effects to vegetation may include:

- fertilization that results in higher growth of or increases in established plant species
- higher growth of or increases in other species and changes to plant species composition

- higher growth of or increased presence of invasive non-native plant species that may be present in the area
- direct physical effects to plants (leaf loss, plants physically knocked down)
- negative effects on plant health as a result of over-fertilization or toxicity

We do not expect that fertilization resulting in increased growth or increases in non-native species will impact reproductive success of the California tiger salamander. However, where exposure occurs, alterations in the abundance or health of the vegetation within vernal pools may impact the stability of the egg masses laid as the salamander relies on twigs, grasses, or stems in the water to which they attach their eggs and if less available or less sturdy, egg masses may not survive (USFWS, 2017).

In addition, retardant entering these pools may alter water quality by increasing the un-ionized ammonia content, which is lethal to amphibians at all stages and can alter the nitrogen cycle. Given the limited extent of the potential for fire retardant to enter the vernal pools within the airtanker bases where this species is found, we do not anticipate over-fertilization, toxicity, or impacts to water quality adversely affecting the habitat, reproductive success, or feeding of the California tiger salamander.

The Fresno, Hollister, McClellan, Paso Robles, Santa Maria, and Sonoma airtanker bases, and the Hollister jettison areas, are within the range of California tiger salamander DPSs. Santa Maria and Paso Robles have identified jettison areas within their respective airport perimeters. The species is known to occur in vernal pool habitat within the perimeter of Santa Maria airport. The Forest Service tanker base contract specifies that the Santa Maria airtanker base is open from May 15 to November 15. Therefore, the base would not be operational during the majority of the breeding season, although salamanders can emerge with the onset of the first significant rain events which can occur before mid-November. The base would be operational during the peak period of metamorphs (juveniles) leaving their natal ponds (May to July, *see* Central California DPS Recovery Plan, 2017 (USFWS, 2017)). There is potential for retardant from jettisoned loads to drift into or otherwise enter vernal pool habitats or other habitats that may be used by the species (e.g., stock ponds without predatory fish species), we are unaware of other such habitats located on the airtanker bases found within the range of the species). In any case, we anticipate such loads would be unlikely to enter these habitats when they have water and are being used by adult tiger salamanders. Furthermore, weathering is likely to reduce the amount and characteristics of retardant residue in those sites prior to the next breeding season. In addition, we anticipate that dispersing juveniles would undertake movements primarily at night and not during daylight hours when the likelihood of a conflict with jettison area operations is greatest. Lastly, we understand that airtanker base and jettison area personnel at these locations are aware of the presence of the California tiger salamander as well as its vernal pool habitat, and actively work to delineate and maintain jettison sites as designated areas and limit potential conflict with the species and its habitat (Conway, 2022). Thus, we anticipate that, at most, very low numbers of California tiger salamander Central Valley DPS, Sonoma County DPS, and Santa Barbara County DPS would be adversely affected through direct exposure, impacts to food resources, or impacts to vegetative structures within their vernal pool habitat.

Critical Habitat

Critical habitat for the California tiger salamander Central Valley DPS, Santa Barbara County DPS, and Sonoma County DPS include the following PBFs:

- Standing bodies of fresh water, including natural and man-made (e.g., stock) ponds, vernal pools, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 12 weeks.
- Upland habitats adjacent and accessible to and from breeding ponds that contain small mammal burrows or other underground habitat that adult California tiger salamanders depend upon for food, shelter, and protection from the elements and predation.
- Accessible upland dispersal habitat between locations occupied by the species that allow for movement between such sites.

Airtanker base operations will not alter the presence of vernal pools, adjacent upland habitat, or dispersal habitat. Standard operating procedures at all airtanker bases require that specific locations be dedicated for wash-down water, and specific procedures to be followed to contain any spills so they do not run off outside of the vicinity of the dedicated area or the greater area of the airtanker base. Similarly, a dedicated area on the grounds of the airtanker base is used for jettisoning retardant loads at both the Santa Maria airtanker base and the Paso Robles air tanker base. The Paso Robles and Santa Maria jettison areas are considered light use and moderate use, respectively. For these two airtanker bases, based on mapping provided by the USFS, the location of the jettison area within the Santa Maria airtanker base is located approximately a mile from vernal pool habitat for the California tiger salamander and for the Paso Robles airtanker base, no vernal pools have been identified within the vicinity of the airtanker base. We anticipate that small amounts of retardant could enter pools closer to operation and jettison areas for the Santa Maria airtanker base. However, we do not anticipate concentrations would reach levels that would significantly impact water quality or the PBFs.

Summary

Of the amphibian species considered in this Opinion, the arroyo toad and mountain yellow-legged frog (Southern California DPS) have both experienced fires in their habitat in which previous intrusions have occurred. Our assumptions and further analysis of effects for these species are discussed in the *Toxicity Effects to Aquatic Species* below. While we anticipate intrusions in avoidance buffers for the other species could occur over the duration of the Action, based on the available data and avoidance and minimization measures, we anticipate the intrusions would be rare. Additionally, there are very strict protocols in place for all airtanker base operations when managing aerial fire retardant. These protocols are geared toward limiting exposure of these chemicals to the environment or impacting human health. However, we anticipate that due to the proximity of the vernal pool habitats to the DPS's of the California tiger salamander to respective airtanker bases within their range and critical habitat, small numbers of individuals of this species, their prey, or PBFs of critical habitat would be affected by exposure to fire retardant chemicals.

Thus, we anticipate that, at most, only very small numbers of individuals of these species, their prey, or habitat would be affected by exposure to fire retardant chemicals.

Birds

The USFS made LAA determinations for species in the following bird groups for aerial retardant use (**Table 20**): raptors or birds of prey; and woodland and upland birds. These bird groups occur in a variety of habitats including open prairie, mature and old growth forest and mixed conifer-hardwood forests. They consume a variety of food sources, which is the primary route of exposure of retardant for these species.

The avian species considered in this Opinion include two birds of prey and two woodland and upland birds. Critical habitat is designated for each of these species; however, NLAA determinations were made for each and for which the Service provided a concurrence.

Table 20. Bird species with LAA determinations.

Taxa Group	**Species Groupings**	**Common Name**	***Scientific Name***
Birds	Raptors/Birds of Prey	Mexican spotted owl	*Strix occidentalis lucida*
Birds	Raptors/Birds of Prey	Northern spotted owl	*Strix occidentalis caurina*
Birds	Woodland and Upland Birds	Coastal California gnatcatcher	*Polioptila californica californica*
Birds	Woodland and Upland Birds	Marbled murrelet	*Brachyramphus marmoratus*

The retardant salt in four retardant products was predicted to pose a risk (mortality of one-half the population via dietary ingestion where the retardant is applied) to sensitive raptors when applied at 4 GPC and greater, and to sensitive songbirds when applied at 3 GPC and greater. The risk assessment methodology uses a protection factor when determining toxicity risk that differs slightly when evaluating risk to listed species (which are considered to be “sensitive” species) as opposed to non-listed species (see Section 4.1.1 in the Auxilio Risk Assessment (2021) for more information). The oral LD_{50} values for the surrogate species’ (American kestrel, bobwhite quail, and redwing blackbird) toxicity data used for these groups are >5,000 mg/kg body weight. These values indicate these bird species would have to consume a very large amount of retardant-contaminated prey to cause the risk at the GPC coverage discussed above. We anticipate that other future allowable chemicals used as aerial fire retardant products would have a similar or lower level of mortality or sublethal risk to birds should exposure occur, based on the requirements described in the *Description of the Proposed Actio*n Section ”*Retardant Components and Testing Requirements*” in this Opinion for USFS methodology on products added to the QPL.

The avian species considered in this Opinion, which are the coastal California gnatcatcher, marbled murrelet, Mexican spotted owl, and northern spotted owl, are found in National Forests where previous applications have occurred, although in some cases, individuals may be more likely to inhabit areas within these forests where applications are less likely to occur. The USFS does not use avoidance mapping for these bird species because both the Service and the USFS agree the desire is to use aerial retardant to reduce the effects of high intensity fire within these species habitat which is the greater threat to their survival. Large scale, high-intensity wildfire is a substantial risk factor to the habitat persistence for these species. Our assumptions and further analysis of effects for these species are discussed in the *Other Effects* section below. Based on the lack of avoidance mapping and data indicating applications in their ranges have occurred in the past, the likelihood of retardant or related activities impacting these species is reasonably certain to occur. For example, the USFS indicates that three of these bird species, the marbled murrelet, northern spotted owl, and Mexican owl were subjected to noise disruption on 2.4% or less of their occupied habitat based on the 2011 Opinion discussion of impacts and during past monitoring efforts (2012 -2019 monitoring and reporting). Based on the rationales below, we anticipate that, only very small numbers of individuals of these species, their prey, or habitat would be affected by exposure to fire retardant chemicals or noise disturbance from application activities.

Mexican spotted owl

The Mexican spotted owl occurs in forested mountains and rocky-canyonlands throughout the southwestern U.S. and Mexico. Although Mexican spotted owls' nest, roost, forage, and disperse among a diverse array of biotic communities, nest and roost habitats occur in late seral forests or rocky canyon habitats. Within forested habitats, Mexican spotted owls use vertically diverse coniferous forests with a high density of large diameter trees, snags and downed logs. The breeding season for the owl is March 1 through August 31. The Mexican spotted owl eats a wide variety of prey throughout their range, varying by location within their range, but in general they eat small- and medium-sized rodents such as woodrats, deer mice, and voles (Ward and Block 1995, Ganey et al. 2011). Mexican spotted owls also consume rabbits, bats, other birds, reptiles, and insects (Block et al. 2005).

The Mexican spotted owl occurs on all national forests in USFS Region 3, with retardant application potential ranging from very low to high. In USFS Region 4, the Dixie National Forest has high application potential and the Fishlake and Manti-LaSal National Forests have low application potential. In USFS Region 2, Mexican spotted owls are known to occur on the Pike-San Isabel and San Juan National Forests, both of which have moderate retardant application potential. The Mexican spotted owl is suspected to occur but is unconfirmed on the Grande Mesa, Uncompahgre and Gunnison National Forests, which have very low application potential, the Arapaho Roosevelt National Forest, which has low application potential, and the White River National Forest, which has moderate application potential.

The peak fire season often corresponds with the breeding season for the Mexican spotted owl. However, retardant use is more likely to occur on ridgetops and forest openings, than on the mid-slope and drainage bottoms/canyons that support the late seral forests owls are most likely to use for nesting. Because nesting habitat for the Mexican spotted owl is found in more heavily forested areas, where aerially delivered retardant would not be as effective against fire and therefore is generally not used, the chance of direct application to adult females and/or young in a nest is anticipated to be low. Adult Mexican spotted owls are highly mobile, and we anticipate they would be able to escape from areas where fire retardant application activities are occurring. Thus, the likelihood of a direct exposure from aerial application to any individuals is extremely low.

Where aircraft enter areas in or near individuals of the species, we expect such flights would cause noise disturbance to birds that are nesting or roosting. These effects are anticipated to be of short duration. In some instances, flights could be repeated over several days. Due to the intensity of these activities, we anticipate adults and hatchlings would experience non-lethal stress in the cases where activities occur in the vicinity of owls. We do not anticipate collisions are likely to occur due to the limited chance of overlapping flight paths between the owls and aircraft, as owls would generally be under the forest canopy whereas airtankers would be above[24], and owls would likely seek cover or move away to escape disturbances from aircraft. Although individual owls may use other types of habitats (e.g., for foraging, dispersal) where fire retardant chemicals are more likely to be applied over the duration of the Action, we expect that some birds would be able to evade such areas when activities are occurring, and would be unlikely to experience lethal effects, outside of the breeding season. However, during the breeding season, we anticipate that if a female is sitting on eggs or tending to nestlings, she is less likely to flee, and would therefore be more susceptible to harm in the form of noise disturbance. In addition, younger, or more inexperienced adults or adults that experience a disturbance earlier on in the nesting season are more likely to flee and abandon a nest, making the nestlings more susceptible to harm. Delaney, Grubb and Pater (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.

Some effects to owls are anticipated due to prey loss and the ingestion of exposed prey. The Mexican spotted owl feeds on small mammals, particularly mice, voles, and woodrats. They will also take birds, bats, reptiles and arthropods. The Mexican spotted owl is a "perch and pounce" predator, using elevated perches to find prey items using sight and sound. They can take prey on the wing, particularly birds. Most hunting is at night, however, there are some reports of diurnal foraging. Toxicity to small mammals, birds and insects (mortality) from application of many of the current retardant products is estimated at most coverage levels (2-6 GPC; Auxilio Management Services 2021). Due to the Mexican spotted owl's preference for small mammals and known foraging on birds and arthropods, we anticipate prey losses in areas exposed to retardant. We also anticipate that some individual Mexican spotted owls will consume contaminated prey. Ingestion of large volumes of exposed prey would result in the loss of some individuals (see discussion in the introduction to the bird section above regarding toxicity), although direct exposure of the owls and prey in their foraging habitats is anticipated to be rare due to the limited overlap of preferred habitat with application areas. Finally, prey availability in

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[24] In general, airtankers do not travel below 1,500' AGL (above ground level) unless they are dropping fire retardant. If flying to a jettison area, large airtankers will be above 1,500' AGL. The very large airtankers fly at an altitude of 10, 500' to 12,500' to the jettison area. Heights may vary depending on the distance to the jettison area.

general is not likely to be significantly impacted from retardant applications within Mexican spotted owl habitat due to the limited overlap and the owl's ability to consume a variety of prey items throughout their range. While small reductions in prey may affect small numbers of individual owls, such impacts are likely to be very small, as owls can disperse to a wider area and we expect they will be able to locate prey in these other areas not impacted by retardant.

The large range of the Mexican spotted owl across several forests in USFS Regions 2, 3, and 4 makes the possibility of avoidance mapping the entire range impractical for the USFS. However, nesting/roosting areas where owls have been found can be utilized as occupied sites for protection from retardant applications. These occupied sites are known as PACs or Protected Activity Centers[25]. PACs are 600 acre areas, each containing a nest core area (located within a PAC) which are 100 acre areas within the PAC. This entire area is considered occupied; however, the nest core area is where owls are more likely to be nesting and/or roosting during the breeding season when retardant drops may occur. All PACs should contain a designated 40-ha (100 ac) nest/roost core area, designed to offer additional protection to the nest or primary roost areas. We emphasize protection of habitat used for nesting and roosting within PACs because the owls are most selective for such habitat and these forest conditions are most limited across the landscape. In summary, while some loss of prey is anticipated, we expect sufficient prey will remain available for the owl. Temporary disturbances to individual owls are anticipated from activities in their vicinity, but we do not anticipate collisions and disturbance is not expected to rise to the level of take due to the limited duration of activities and short-term behavioral response while aircraft are in the vicinity. While direct exposure of individuals and their prey is anticipated to be limited due to the low overlap of preferred habitat with application areas, direct exposure of owls and the ingestion of exposed prey are anticipated to result in the loss of few Mexican spotted owl individuals.

Northern spotted owl

Typical habitat characteristics for the northern spotted owl include moderate to high canopy closure; a multilayered, multispecies canopy dominated by large over-story trees; a high incidence of large trees with large cavities, broken tops, and other indications of decadence; numerous large snags; heavy accumulations of logs and other woody debris on the forest floor; and considerable open space within and beneath the canopy. Generally, these conditions are found in mature growth forests (at least 150 to 200 years old), but sometimes they occur in younger forests that include patches of older growth. The northern spotted owl may nest on broken treetops, cliff ledges, in natural tree cavities, or in trees on stick platforms, often the abandoned nest of hawks or mammals. The northern spotted owl occurs in mature and remnant mature Douglas-fir and mixed coniferous forest across the Pacific Northwest and into northern California. It is found on National Forests on the west side of the Cascade Range and Klamath Mountains of Washington (21 counties), Oregon (23 counties), and California (14 counties).

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[25] Protected Activity Centers (PAC) definition (USFWS 2012): An area established around an owl nest (or sometimes roost) site, for the purpose of protecting that area. Management of these areas is largely restricted to managing for forest-health objectives. PACs encompass a minimum of 600 acres surrounding known owl nest/roost sites.

Prey items for the northern spotted owl include wood rats, flying squirrels, birds, and, rarely, reptiles and amphibians.

In USFS Region 5, the northern spotted owl occurs on the Lassen and Mendocino National Forests, which have moderate retardant application potential; and the Klamath, Modoc, Shasta-Trinity and Six Rivers National Forests, which have high retardant application potential. In Forest Service Region 6, the northern spotted owl occurs on the Olympic, Mount Baker-Snoqualmie, and Siuslaw National Forests, which do not use aerial retardant; the Columbia River Gorge National Scenic Area and Mount Hood National Forests, which have very low retardant application potential; the Willamette and Gifford Pinchot National Forests, which have low retardant application potential; the Umpqua and Fremont-Winema National Forests, which have moderate retardant application potential; and the Deschutes, Okanogan-Wenatchee and Rogue River-Siskiyou National Forests, all of which have high retardant application potential.

Most use of aerial retardant is along ridges or open areas, or younger tree stands where it can penetrate to the ground and is more effective at stopping fire spread. Aerial retardant may not be effective in matureforest conditions because the retardant does not penetrate the multi-canopy structure of mature and old growth forests. Because of this, we expect that retardant is likely to be used very infrequently in northern spotted owl habitat. Additionally, adult northern spotted owls are highly mobile, and are anticipated to flush or escape from areas with fire activities. Thus, the likelihood of a direct application from aerial application is extremely low. Although we expect adults would be able to flee from areas where activities are occurring, young confined to the nest would be at risk of exposure to fire retardant chemicals in the event applications occur over active nests. The peak fire season often corresponds with the breeding and nesting season for the northern spotted owl. However, because nesting habitat for the northern spotted owl is found in mature and remnant old growth forest habitats, where aerially delivered retardant would not be effective against fire and therefore is generally not used, the chance of direct application to young in a nest is unlikely to occur. Although individual owls may use other habitats (e.g., for dispersal, roosting) where fire retardant chemicals are more likely to be applied over the duration of the Action, we expect that these highly mobile birds would be able to evade such areas when activities are occurring, and would be unlikely to experience lethal or sublethal effects from direct exposure.

Low flying aircraft may cause disturbance to nesting, perching, or roosting birds. Disturbance from a single retardant drop would last for several minutes, while multiple drops in the same area would result in longer disturbance periods that are anticipated to result in sublethal stress to a small number of adults as well as hatchlings and fledglings where activities occur in the vicinity of nest sites. Because several of the National Forests where spotted owls occur have high retardant application potential, disturbance effects from activities in the vicinity of owls are anticipated to occur. In Forest Service Region 5, the peak fire season on the forests with northern spotted owl occurs from July through September. For Forest Service Region 6, the peak fire season is from June to October. We anticipate most activities resulting in disturbance would occur during these times. Such disturbance is likely to be sporadic, mostly when aircraft would be traversing to other areas to apply retardant chemicals rather than applying retardant in the vicinity of nests, roosts and foraging habitats. We expect that owls will seek cover or remain in place while aircraft are in their vicinity, but normal behaviors would resume shortly after brief periods of activities associated with the Action have ceased. Thus, we expect disturbance will impact small numbers of individuals through stress responses and minor impacts to fitness and reproduction, we do not anticipate mortality of adults, fledgling, or nestlings from such disturbance.

The large range of the northern spotted owl across several forests in USFS Regions 5 and 6 makes the possibility of avoidance mapping the entire range impractical for the USFS. However, nesting/roosting areas where owls have been found can be utilized as occupied sites for protection from retardant applications. These occupied sites are know as known as HACs or historic activity centers. These sites are mapped features based on monitoring and survey efforts as well as habitat suitability models. They can range in size from 500 acres in size (CA forests) to 1,000 acres (WA forests).

Some effects to the owls are anticipated due to prey loss and the ingestion of exposed prey, although retardant use in foraging habitats is expected to be very limited. The northern spotted owl is a carnivore, consuming various arboreal and semi-arboreal small mammals, birds, and, rarely, reptiles and amphibians. Habitat plays an important role in resource availability and prey selection. Dense canopy closure (60 to 90 percent), access to water, a mosaic of suitable mature growth tree structure, and an absence of human disturbance are key aspects of suitable forage habitat. The northern spotted owl roosts during the day and has crepuscular feeding habits. However, it may forage opportunistically during the day, leaving its roost temporarily to feed. Toxicity to small mammals (mortality) from application of many of the current retardant products is estimated at most coverage levels (2-6 GPC; Auxilio Management Services 2021). Toxicity to birds and amphibians is also estimated (mortality to small song birds and amphibians and sublethal effects to amphibians in the form of reduced growth) at coverages of 3, 4 and 6 GPC (toxicity to reptiles was not assessed due to the lack of data for this taxonomic group, however we assume some impacts to these species based on data for other terrestrial species such as birds). It is a common approach to use data on avian toxicity to address impacts to reptiles). Ingestion of large volumes of exposed prey would result in the loss of some individuals, although direct exposure of the owls and prey in their foraging habitats is anticipated to be limited due to the limited overlap of preferred habitat with application areas. Finally, prey abundance in general is not likely to be significantly impacted from retardant applications within northern spotted owl habitat due to the limited overlap and the owl's ability to consume a variety of prey items throughout their range.

In summary, while some loss of prey is anticipated, we expect sufficient prey will remain available for the northern spotted owl. Temporary disturbances to individual owls are anticipated from aerial activities in the vicinity of the owls, but collisions with aircraft are not anticipated and disturbance is not expected to rise to the level of take due to the limited duration of activities and short-term behavioral response. While direct exposure of individuals and their prey is anticipated to be limited due to the low overlap of preferred habitat with application areas, the ingestion of exposed prey is anticipated to result in the loss of a few northern spotted owl individuals.

Coastal California gnatcatcher

The coastal California gnatcatcher is a non-migratory species that occurs in coastal sage scrub plant communities found in dry coastal slopes, washes, and mesas with areas of low plant growth in southern California. The species occurs on a variety of lands under city, county, State, and Federal lands, and is known or has the potential to occur in two National Forests. The gnatcatcher is only known to occur on the Cleveland National Forest, and off of USFS lands at least a mile from the San Bernardino National Forest in Mentone, California. However, it has the potential to occur on the San Bernardino National Forest. Both of these National Forests have high retardant application potential. Habitat for the species occurs primarily in the wildland-urban interface, where use of retardant is more prevalent and the USFS does not recommend avoidance area mapping.

On the San Bernardino National Forest, peak fire occurs from July to October, whereas on the Cleveland National Forest most fires occur in October. Gnatcatchers breed from February to mid-July, with most breeding occurring from mid-March to early April. Peak fire season does not happen during breeding season, so the potential for retardant application during breeding is low. Outside of the breeding season, gnatcatchers are a highly mobile species that would be anticipated to flush/escape from areas with wildland fire activities and avoid direct drops of retardant. Low flying aircraft would likely cause disturbance to nearby perching or roosting birds; disturbance is expected to be episodic (short duration), but potentially intense and longer-term during the fire season because retardant application potential on these units is high.

Gnatcatchers eat insects. The ecological risk assessment (Auxilio Management Services, 2021) has determined that threatened and endangered songbirds are at risk to effects from ingestion of retardant from contaminated insects, and we expect similar effects to exposed gnatcatchers. However, we do not anticipate that many individuals would consume large amounts of contaminated prey items resulting in lethal or sublethal effects, and impacts to individuals would be in localized areas where foraging on exposed insects occurs directly in application areas. We also anticipate that, where exposure occurs, there may be localized reductions in prey resources for this species, although individuals are highly mobile and would likely access unaffected food items in other areas.

Low numbers of gnatcatchers occur on USFS lands in southern California. The USFS estimates about 692 acres of occupied habitat occur on the Cleveland National Forest, although only 5 to 8 pairs were found there in previous surveys (USFWS, 2005), which represents a small portion of the estimated numbers. While standardized, rangewide population trends and occupancy estimates are not available at this time, our 2010 5-year review of the species reported an estimate of 1,324 pairs over an 111,006-acre area on lands owned by city, county, State and Federal agencies of Orange and San Diego Counties (USFWS, 2016). Overall, we anticipate the risk for exposure of coastal California gnatcatchers to retardant use is low, related primarily to the ingestion of contaminated invertebrate prey and from disturbance during applications. While applications typically occur outside of the breeding season when impacts are less likely to affect reproductive success, we anticipate the loss of a small number of individuals during the fire season from the ingestion of contaminated prey. We also anticipate disturbance to some individuals from low-flying aircraft used to deliver retardant chemicals. We anticipate that the overall risk to the species is low, given the low numbers of gnatcatchers (and thus the low likelihood of exposure) on USFS lands and the breeding phenology of the species in relation to the fire season. Thus, while a small number of individuals are anticipated to be affected over the course of the Action due to the loss or disturbance of a few individuals, these effects are anticipated to be very infrequent behavioral responses of adults (flush/escape from aircraft disturbance) primarily outside the breeding season and losses of individuals that consume contaminated prey.

Marbled murrelet

The marbled murrelet is a robin-size species that nests in coastal mature growth forests. This species ranges from Alaska to the central coast of California and is considered a pelagic or open ocean bird that uses forests for breeding. During the nesting season, individuals travel back and forth daily to their nests from the ocean where they feed on small fish and collect prey for nestlings. Murrelets occupy closed-canopy stands within mature redwood, Douglas-fir or western cedar/hemlock forests that are generally within about 35 miles of the ocean, although some individuals may travel longer or shorter distances. Most nesting occurs in large stands of mature growth trees and nest sites generally have good overhead protection from predators. Outside of the nesting season, individuals use their marine and estuarine habitats.

The marbled murrelet is an opportunistic feeder and may shift its dietary preferences depending on the season. Euphausiids, mysids, and amphipods are eaten in the winter months, and fishes such as Pacific herring, surf smelt, sand lance, sardine, and anchovy are eaten in the summer which coincides with the nestling and fledgling season (Burkett, 1995).

The marbled murrelet is found on the following National Forests: Olympic, Mt-Baker-Snoqualmie and Siuslaw National Forests, which do not use aerial retardant; Gifford Pinchot National Forest, which has low retardant application potential; and the Siskiyou, Los Padres, Six Rivers, and Okanogan-Wenatchee National Forests, which have high retardant application potential. Marbled murrelets were known to occur historically on the Shasta-Trinity National Forest.

While there is high retardant application potential in the Siskiyou, Los Padres, Six Rivers and Okanogan-Wenatchee National Forests, actual usage is expected to be less in the moist mature growth forest areas in the coastal zone where nesting occurs. Most usage of aerial retardant is along ridges or open areas, or younger tree stands where it can penetrate to the ground and is more effective at stopping the fire spread. Aerial retardant is not effective in mature growth forest conditions since the retardant does not penetrate the multi-canopy structure of mature and old growth forests. Because of this, retardant use in the mature/old growth stands preferred for nesting by marbled murrelets is anticipated to be minimal. However, some usage and disturbance in these areas is expected based on the high application potential and USFS reporting that indicates approximately 84 acres of nesting habitat was directly exposed to retardant and about 13,000 acres was exposed to aircraft disturbance in the Siskiyou and Okanogan-Wenatchee National Forests in total from the years 2014, 2015 and 2018 (USDA - USFS, 2021).

Marbled murrelets are most active in forested areas of California and Oregon from mid-April through late July during nesting. In Washington, they nest primarily from early May through early August. This corresponds to the peak of fire season, which is from June to August in California and July to August in Oregon and Washington. In general, murrelets are a highly mobile species that can escape from areas with wildland fire activities, making direct exposure unlikely, although young confined to the nest would be at higher risk of exposure to fire retardant chemicals from applications in the immediate vicinity of active nests. However, the risk of direct application to young in a nest is low because use of retardant in mature growth nesting habitat is very limited and co-occurence of an application over an active nest would be an extremely rare event. Although individual murrelets may use other habitat areas (e.g., for dispersal, travel to and from foraging sites) where fire retardant chemicals are more likely to be applied over the duration of the Action, we expect that they would be able to evade such areas when activities are occurring, and very few would experience effects from direct exposure.

The ecological risk assessment (Auxilio Management Services, 2021) has determined that fish and aquatic invertebrates (prey items for the murrelet) are both highly susceptible to the effects of the ammonia and magnesium salts in the retardant products. Risk (mortality and sublethal effects to growth and reproduction) has been identified for these taxonomic groups. However, we anticipate that effects of retardant on the prey items of the marbled murrelet are unlikely to occur. This is based on the fact that the murrelet forages in near-shore marine areas that do not receive retardant applications. Retardants are applied further inland on the National Forests where these birds do not forage, and run-off risks from retardant is not identified as an exposure route for these chemicals.

The primary risk related to retardant use for the marbled murrelet is low flying aircraft that may cause disturbance to nesting, perching, or roosting birds or birds in flight. Disturbance from a single retardant drop would last for several minutes, while multiple drops in the same area would result in longer disturbances. Because several of the National Forests where murrelet occurs have high retardant application potential, disturbance effects are anticipated that would be episodic (short duration), but potentially intense (particularly when lower flying helicopters are used for retardant drops). Exposure to this type of disturbance would be anticipated to cause a flush/escape behavioral response in roosting or nesting adults, and stress to hatchlings on very rare occasions given the anticipated low use in murrelet nesting habitat. We also anticipate adults travelling between nests and foraging areas would experience disturbance. Adult murrelets make flights from ocean feeding areas to inland nest sites at all times of the day, but most often at dusk and dawn. Chicks are fed up to eight times daily (averaging four times a day), usually getting only one fish at a time (Hammer and Cummins 1991, Singer et al 1992 and Nelson and Mamer 1995a as cited in (USFWS, 1997). Noise and activity from aircraft may cause these birds to alter their routes or seek cover for a period of time to avoid aircraft where and when activities of birds and aircraft overlap in space and time. We do not anticipate collisions are likely to occur due to the limited chance of overlapping flight paths between murrelets and aircraft both in terms of the small geographical footprint of activities and flight altitudes[26], and because murrelets would likely seek cover or move away to escape disturbances from aircraft. Given that the majority of flights involve higher altitude air tankers and not lower flying helicopters, and that activities in the vicinity of individuals are anticipated to be infrequent, effects of aircraft are expected to be limited to brief behavioral responses during the rare occasions when flights occur over marbled murrelet nests or transit areas. We anticipate a small number of individuals would experience brief periods of non-lethal stress, additional energy expenditures and occasional lost feeding opportunities for chicks from behavior responses due to fire retardant application activities. Since individuals are expected to use their marine and estuarine habitats outside of the nesting

[26] In general, airtankers do not travel below 1,500’ AGL (above ground level) unless they are dropping fire retardant. If flying to a jettison area, large airtankers will be above 1,500’ AGL. The very large airtankers fly at an altitude of 10, 500’ to 12,500’ to the jettison area. Heights may vary depending on the distance to the jettison area.

season, we anticipate exposure outside of the nesting season to any of these stressors would be extremely rare.

Overall, we anticipate effects will be limited to a small number of individuals over the course of the Action. While direct exposure of individuals is anticipated to be limited due to the low overlap of preferred habitat with application areas and mobility of adults, direct exposure is anticipated to result in the loss of a very small number of individuals. We also anticipate very infrequent behavioral responses of adults that flush or escape from aircraft disturbance, delayed or lost foraging and chick feeding opportunities on rare occasions when adult murrelets alter flight periods or pathways to and from nest sites due to aircraft noise and disturbance, as well as non-lethal stress of hatchlings or nestlings confined to active nests in the vicinity of activities during the nesting season.

Terrestrial Invertebrates

The season of use and associated life cycle of the species, canopy cover at the retardant drop site, retardant application rates, and population densities influence the effects of aerial application of fire retardant on invertebrate species. The terrestrial invertebrate species considered in this Opinion are listed in **Table 21** and include 1 bee, 2 stoneflies, 7 butterflies, 1 moth, and 1 snail. Two species, the stoneflies, are terrestrial invertebrates at the adult stage, but also have aquatic life history stages. While they are not fully terrestrial, we include these species in this section.

Table 21. Terrestrial invertebrates with LAA determinations.

Taxa Group	**Species Groupings**	**Common Name**	***Scientific Name***
Bees	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Franklin's bumble bee	*Bombas franklini*
Beetles and Stoneflies	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	meltwater lednian stonefly	*Lednia tumana*
Beetles and Stoneflies	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	western glacier stonefly	*Zapada glacier*
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Quino checkerspot butterfly	*Euphydryas editha quino*
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Laguna Mountains skipper	*Pyrgus ruralis lagunae*
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Pawnee montane skipper	*Hesperia leonardus montana*

Taxa Group	**Species Groupings**	**Common Name**	***Scientific Name***
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Smith's blue butterfly	*Euphilotes enoptes smithi*
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Kern primrose sphinx moth	*Euproserpinus euterpe*
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Hermes copper butterfly	*Hermelycaena (Lycaena) hermes*
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Mt Charleston blue butterfly	*Icaricia (Plebejus) shasta charlestonensis*
Butterflies and Skippers	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Sacramento Mountains checkerspot butterfly	*Euphydryas anicia cloudcroft*)
Terrestrial Gastropod	Invertebrates: Arachnids, Insects, and Terrestrial Mollusks	Morro shoulderband (banded dune) snail	*Helminthoglypta walkeriana*

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

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

In the following paragraphs, we describe the anticipated effects to invertebrate species from the Action. We describe risk from toxicity to species or other species based on the risk assessment provided by USFS as applicable, below. We anticipate that other future allowable chemicals used as aerial fire retardant products would have a similar or lower effects to invertebrates as described below should exposure occur, based on the requirements described in the Description of the Proposed Action Section "Retardant Components and Testing Requirements" in this Opinion for USFS methodology on products added to the QPL.

Where exposure occurs, we expect effects from retardant exposure would impact any life history stages present, to varying degrees, either through direct exposure or through food or host resources. For example, documented impacts to algae (a food source for the Morro shoulderband snail) from exposure to retardant chemicals include altered primary production rates. For aquatic macroinvertebrates (e.g., larval stages of the stoneflies), mortality and downstream displacement may occur (USFWS, 2011), resulting in a decline in macroinvertebrate species assemblage within sections of a stream. During a 30-minute dose period of fire retardant chemical, this displacement was elevated for some taxa for 30 minutes after the chemical application (Finger (ed.), 1997).

Where retardant use occurs within these species' ranges, such use could kill individuals (as discussed previously due to a retardant drop landing directly on top of these invertebrate species), or their forage or habitat types upon which they rely (e.g., host plants for butterflies, flowering plants for Franklin's bumble bee, aquatic invertebrates for the larval stage of the stoneflies, algal composition for the Morro shoulderband snail). Other impacts of direct retardant application to individual insects or snails in areas where retardant is applied may include impairing their ability to move or breathe. Whether or to what degree these outcomes may occur depend on the mobility of the species, as well as its size, morphology, physiology, point in its life cycle, location (including vegetative cover) when retardant is applied, amount of retardant applied, and the degree to which the individual is covered by retardant. We discuss effects to each of the species below.

The Franklin's bumble bee and Pawnee montane skipper are on high retardant use forests without avoidance mapping. We anticipate effects to small numbers of individuals of these species over the duration of the Action. For the Pawnee montane skipper, the Service Field Office and USFS agreed it would be preferable not to use avoidance buffers, as the risk of wildfire to this species is far greater than the potential for negative impacts from retardant use. The skipper is dependent on two host plants, namely prairie gayfeather (*Liatris punctata*) and blue grama grass (*Buteloua gracilis*), within openings in ponderosa pine (*Pinus ponderosa*) woodland habitat facilitated by fire (USFWS, 2020). For the Franklin's bumble bee, risks are estimated to be low without avoidance mapping. There are currently locations identified where the species is likely to occur based on species habitat suitability modeling and what is known about habitat preferences for this species that we anticipate will be used to identify avoidance areas within the species' range. The large range of Franklin's bumble bee across several forests in USFS Regions 5 and 6 makes the possibility of avoidance mapping the entire range impractical for the USFS. However, areas mapped for habitat, dispersal, and historical range can be utilized as occupied sites for protection from retardant applications. These occupied sites are know as HPZs or High Priority Zones. Franklin's bumble bee uses relatively protected areas such as abandoned rodent burrows or other ground holes or rock piles for breeding and shelter, which would likley protect some individuals of their populations from direct drops of fire retardant. Some individuals may be at risk of physical impacts from retardant drops although it is unlikely that applications would have significant overlap with locations where the bees would be foraging due to the limited spatial and temporal nature of the activities, and limited presence of the bees across their fairly large range. Exposure from contaminated plants, nectar, or pollen while they are foraging is also unlikely to impact these bees. Franklin's bumble bee (and other bumble bee species) are sensitive to any alterations in the smell or taste of their foraged dietary items and would avoid them and forage elsewhere (Everett, 2022).

While the skipper is dependent on specific species, bumble bees are generalist foragers, meaning that they gather pollen and nectar from a wide variety of flowering plants (USFWS, 2018). Constituents of fire retardants (ammonia salts) can create short-term (1 to 2 growing seasons) phytotoxic effects (e.g., leaf burning, shoot die-back, decrease in germination, plant death) to floral resources if retardant is applied directly on plant species that are sensitive to effects from salts in fire retardants. However, fire retardant drops as a percentage of the range of the Pawnee montane skipper and Franklin's bumble bee is likely to be small and is not anticipated to significantly impact the plant communities and floral resources upon which these species rely. Wildfire suppression through the use of fire retardant is likely to allow woody encroachment into grassland, meadow and openings in forested habitats that support the Pawnee montane skipper and Franklin's bumble bee, which is expected to indirectly affect these species by facilitating the succession of vegetative communities. In addition, Franklin's bumble bee is more likely to be found in high elevation fens, not usually prone to fire activity except during drier months (August-October). If retardant were to be dropped in the vicinity of a colony site, Franklin's bumble bee workers would avoid an area covered in retardant and adjust as necessary to more pristine sites within their 1-km foraging range (Everett, 2022). Therefore, we anticipate impacts to these species will be limited in extent across their range, as retardant use will be limited, and suitable habitats will remain within their ranges.

The meltwater lednian stonefly and western glacier stonefly are anticipated to have a very low risk of exposure given their alpine habitat (above the tree line) and largely aquatic life cycles. The risk assessment (Auxilio Management Services, 2021) indicated a risk (mortality and sub-lethal effects on reproduction) for threatened and endangered invertebrates, represented by daphnia, during an intrusion into small streams at higher retardant coverage levels. These species do not occur in those ecoregions, but the risks reported in the assessment indicate potential for toxic effects to the aquatic life cycle of these stoneflies. Both species have brief terrestrial adult phases and are found mostly on and around streamside vegetation and their occurrences on National Forests lands are limited to those with low or very low application potential. We anticipate that, at most, only very small numbers of individuals of these species, their prey, or habitat would be affected by exposure to fire retardant chemicals.

For the Morro shoulderband snail, we assume effects to exposed individuals from physical effects as those assumed for other terrestrial invertebrates as well as direct toxicity based on the ammonia and MgCl salt constituents in the retardant products. The Morro shoulderband snail may occur on the Los Padres National Forest, which is a high retardant use forest. It occurs in coastal dune and scrub communities and maritime chaparral with dominant shrub of mock heather and buckwheats, which are among the most volatile of fuel types. As discussed above, we anticipate effects to the forage base (algal communities) from retardant exposure such as altered primary production rates and mortality, which may lead to small reductions in availability of food resources, where exposure occurs. However, avoidance mapping of 300 feet is required for the Morro shoulderband snail, thus likely reducing exposure to retardant use on this forest.

Avoidance mapping around occupied areas/known locations and critical habitats (as applicable) is required for the Quino checkerspot butterfly, Laguna Mountains skipper, Smith's blue butterfly, Hermes copper butterfly, and the Mount Charleston blue butterfly, all of which are all on high retardant use forests (the San Bernardino, Cleveland, Los Padres, and Humboldt-Toiyabe). Some have standard 300-foot buffers (i.e., Smith's blue butterfly and Mount Charleston blue butterfly) but others also implement extended avoidance buffers (600-ft from known locations for the Quino checkerspot butterfly, 600-foot buffers around current ocurrences/occupied sites for the Laguna Mountains skipper and Hermes copper butterfly[27]) to minimize the anticipated effects from retardant exposure.

The Sacramento Mountains checkerspot butterfly (found on the Lincoln National Forest, a moderate retardant use forest) was recently proposed as endangered (January 2022). This butterfly inhabits high-altitude meadows within a 33-square mile area around the village of Cloudcroft on the Lincoln National Forest, a moderate retardant application potential forest. The USFS requires avoidance area mapping (with a 600-foot buffer) for all occupied habitat/sites on the Lincoln National Forest. Because this butterfly is very limited in distribution and is a narrow endemic, we anticipate that, were exposure to occur in the case of an intrusion or exception due to the proximity of a human population center and the wildland fire interface, this population is at greater risk. We anticipate that due to its habitat in such close proximity to the village of Cloudcroft, and the moderate retardant potential on the Lincoln National Forest, retardant is likely to be used over the course of the Action. However, with avoidance mapping, the likelihood of retardant impacting the butterfly or its habitat will be minimized and, we anticipate adverse effects to only small numbers of individuals.

The Action poses the risk of mortality due to a retardant drop landing directly on top of a terrestrial invertebrate species or nitrifying effects to their forage or habitat types upon which individuals of these species rely (e.g., host plants for butterflies). However, these impacts would only occur in the rare instance of an intrusion. We anticipate that the presence of the avoidance buffers would minimize the risk of retardant exposure to these species, their forage base, and their habitats. From prior USFS incident information (see **Table 13**), we are aware of rare intrusion events near or within the species' habitat for the Quino checkerspot butterfly, although we are unaware of whether any such intrusions resulted in the loss of individual of this species. However, we anticipate that, should such intrusions occur into the future at a similar rate, small numbers of individuals of the Quino checkerspot butterfly may be lost over the duration of the Action. We are unaware of any intrusions that have happened for the remaining species; however, we anticipate that, at most, only very small numbers of the Laguna Mountains skipper, Smith's blue butterfly, Hermes copper butterfly, Mount Charleston blue butterfly and Sacramento Mountains checkerspot butterfly could be affected due to rare instances of intrusion events, particularly where the species overlaps with high retardant use areas. The USFS does not

[27] The Service and USFS decided jointly on the following for the Quino checkerspot butterfly, Hermes copper butterfly, and the Laguna Mountains skipper: a 600-ft avoidance buffer for the known and historical locations and critical habitat for the Quino checkerspot butterfly, 600-ft avoidance buffer for known locations/occurrences for both the Hermes copper butterfly and Laguna Mountains skipper, all based on the latest survey data. One point of clarification for these butterfly species is that this 600-ft buffer is only from the location of current occurrences and the remaining distance from the occurrences to the extent of the standard 1-km zone for butterfly flight path and dispersal is not mapped for avoidance. However, the USFS has agreed to notify Service Field Office staff as soon as possible, but not less frequently than annual reporting, after applying fire retardant within 1 km of known locations. The USFS will also continue to make assessments of the effects of such applications on the ground, in cooperation with the Service. For the Quino checkerspot butterfly and Hermes copper butterfly, the USFS will coordinate annually with the local Service Field Office to identify and map high priority areas to attempt to avoid for these species that are outside of the previously agreed-upon avoidance areas (e.g., suitable habitat outside the mapped avoidance area but within 1-km of a known location).

require avoidance mapping for: 1) the Franklin's bumble bee, which is found on the Umpqua and Winema National Forests, a moderate retardant application potential forest, and the Klamath, Shasta-Trinity, Six Rivers, and Rogue River-Siskiyou National Forests, all of which have high application potential, and 2) the Pawnee montane skipper, occurring in the Pike-San-Isabel National Forest (a moderate use forest). We expect effects to some small numbers of individuals that are exposed over the duration of the Action. Franklin's bumble bees nest in abandoned rodent burrows or other ground holes or rock piles, which we expect may protect individuals of their populations to some extent from direct drops of fire retardant, although some individuals may be at risk from retardant drops while they are foraging. For the skipper, despite having 70% of its range on the Pike-San-Isabel National Forest, the Service Field Office and USFS agreed that no avoidance buffers were needed for this species, as the risk of wildfire to this species is far greater than the potential for negative impacts from retardant use.

Thus, for all of the invertebrate species, we expect that at most, small numbers of individuals would be exposed, if any, over the duration of the Action. They are either in habitat areas where retardant is less likely to be applied: riparian or aquatic areas that have avoidance mapping (i.e., terrestrial and aquatic stages of stoneflies, respectively); have required avoidance mapping where intrusions are rare or unlikely to occur (i.e, Hermes copper, Quino checkerspot butterfly, Kern primrose sphinx moth, Mount Charleston blue butterfly, Laguna Mountains skipper, Smith's blue butterfly, and the Morro shoulderband snail), or avoidance buffers were not required (i.e., Franklin's bumble bee, Pawnee montane skipper).

Critical habitat is designated for the Quino checkerspot butterfly, Laguna Mountains skipper, Hermes copper butterfly, and the Mount Charleston blue butterfly and the USFS made a determination of LAA for these critical habitats. Critical habitat was proposed for the Smith's blue butterfly in 1977 and for the Pawnee montane skipper in 1978. However, these critical habitats were not designated and have therefore been excluded from further review. All other species either do not have critical habitat designated or NLAA determinations were made and for which the Service provided a concurrence earlier in this document.

Critical habitat rules for the Quino checkerspot butterfly, Laguna Mountains skipper, Hermes copper butterfly, and the Mount Charleston blue butterfly generally identify PBFs that include host plants for reproduction and growth, flowering plants for feeding, open areas for mating that include vegetation, wet soil or standing water, and coastal sand dunes. Retardant may impact the vegetation-related PBFs in terms of fertilizing effects to the vegetation types (host plants, food plants, vegetation on the terrain, etc.) that may cause a short-term increase in biomass, but could also result in the increase of nonnative plants that may outcompete native species.

Avoidance mapping is required for the designated critical habitats for the Quino checkerspot butterfly and Mount Charleston blue butterfly. Retardant poses the risk of impacting the vegetation-related PBFs. While the presence of avoidance buffers will greatly reduce the likelihood of retardant reaching and impacting the PBFs for these species' critical habitats, some intrusions are anticipated due to the high use of retardant applications in these areas. Quino checkerspot butterfly areas had two intrusions over 8 years that resulted in occupied habitat and critical habitat on Forest Service lands being impacted from fire retardant drops. While some effects to vegetation and water quality in standing water used by these species are likely due to salts that enter water, phytotoxicity of exposed plants that are sensitive to retardants, and increases nutrients that may facilitate growth of invasive species, critical habitats for these species would be largely protected by avoidance areas. Intrusions are expected to be rare events in small areas with temporary effects. We do not anticipate exposure of the PBFs will be extensive, frequent or severe enough to impact the functions of the PBFs such that the Action would appreciably diminish the value of critical habitat as a whole for the conservation of the Quino checkerspot butterfly, Laguna Mountains skipper, Hermes copper butterfly or the Mount Charleston blue butterfly.

Mammals

Retardant use occurs within the range of three small rodent species (New Mexico meadow jumping mouse, Preble's meadow jumping mouse, and San Bernardino Merriam's kangaroo rat) and two large rodent species (Utah prairie dog and northern Idaho ground squirrel) (**Table 22**). Airtanker base operations occur within the range of the Columbia Basin pygmy rabbit, specifically the Moses Coulee jettison area for the Moses Lake airtanker base.

Because the small rodent species are nocturnal and retardant is aerially applied during the day, individuals would avoid direct application. However, because of their small home range sizes (2.5 acres or less), individuals would not be able to avoid retardant if it is applied within their home range. All three of these small rodents have designated critical habitat but were determined to be NLAA (and addressed in the *Concurrence* section of this document), and neither the Utah prairie dog or the northern Idaho ground squirrel have designated critical habitat. The Columbia Basin pygmy rabbit also does not have designated critical habitat.

Table 22. Mammal species for which USFS made LAA determinations.

Taxa Group	**Species Grouping**	**Common Name**	**Scientific Name**
Mammals	Rodents	New Mexico meadow jumping mouse	*Zapus hudsonius luteus*
Mammals	Rodents	Preble's meadow jumping mouse	*Zapus hudsonius preblei*
Mammals	Rodents	San Bernardino Merriam's kangaroo rat	*Dipodomys merriami parvus*
Mammals	Rodents	Utah prairie dog	*Cynomys parvidens*
Mammals	Rodents	northern Idaho ground squirrel	*Urocitellus brunneus*

Mammals	Lagomorph	Columbia Basin pygmy rabbit	*Brachylagus idahoensis*

The use of fire retardant can result in several different kinds of effects to these species. Retardant can impact vegetation on which these species rely by improving growth. This could increase or decrease seed availability for the small rodent species, depending on the response of native plants or competing plants to the fertilizing effects of retardant chemicals. There is risk to survival, growth, and reproduction of individuals from ingestion of retardant to threatened and endangered omnivores, as represented by deer mice, that reenter an area after firefighting activities have subsided based on the ecological risk assessment (Auxilio Management Services, 2021), which found this risk was present at all application rates. We anticipate that other future allowable chemicals used as aerial fire retardant products would have a similar or lower level of effects to these species should exposure occur, based on the requirements described in the *Description of the Proposed Actio*n Section "*Retardant Components and Testing Requirements*" in this Opinion for USFS methodology on products added to the QPL. Use of retardant can also have beneficial effects to small rodent habitat by helping to control wildfires and limiting loss of habitat.

New Mexico meadow jumping mouse

The New Mexico meadow jumping mouse is found on the Rio Grande National Forest in Colorado, which has very low retardant application potential, the Apache-Sitgreaves National Forest in Arizona, which has low retardant application potential, and the Gila, Lincoln, San Juan and Santa Fe National Forests in Arizona and New Mexico, all of which have moderate retardant application potential.

Risk to the New Mexico meadow jumping mouse includes effects to survival, growth, and reproduction from ingestion of retardant from contaminated plants following retardant application. There is risk to survival, growth, and reproduction of individuals from ingestion of retardant to threatened and endangered omnivores, as represented by deer mice (which have a similar size and home range), that reenter an area after firefighting activities have subsided based on the ecological risk assessment (Auxilio Management Services, 2021), and this risk was present at all application rates. The New Mexico meadow jumping mouse has a prolonged hibernation period and can hibernate from September-October until April-May, which means it is active during the peak of the summer fire season. However, the New Mexico meadow jumping mouse is an obligate riparian dweller. The species is a habitat specialist that nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 9,000 feet. The jumping mouse appears to use only two riparian community types: 1) persistent emergent herbaceous wetlands; and 2) scrub-shrub wetlands. Thus, the USFS 630-foot buffer of aquatic features for avoidance mapping for this species and its critical habitat is anticipated to ensure only very rare instances of intrusion into its habitats and we anticipate that, at most, very few individuals would be exposed over the duration of the Action.

Preble's meadow jumping mouse

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

The Preble's meadow jumping mouse occurs on the Arapaho-Roosevelt National Forest, which has low retardant application potential, and on the Medicine Bow-Routt and Pike-San Isabel National Forests, which have moderate retardant application potential.

While the 300-foot stream buffer utilization through avoidance area mapping for this species and its critical habitat is anticipated to greatly minimize effects to the Preble's meadow jumping mouse, which is predominantly found associated with riparian habitat, the species less frequently utilizes additional upland habitats (hayed field, grazed pastures, fallow agricultural fields, and urban/wildlife interface areas beyond the avoidance mapping areas that place it at risk for effects from ingestion of contaminated plant materials where retardant applications are made across upland areas of the species habitat. While there is overlap with the species habitat and USFS lands that includes some risk of exposure, we anticipate that the limited extent of this use within the range will affect only small numbers of individuals that are resident in affected areas.

The Preble's meadow jumping mouse is one of several small mammal species for which the application of fire retardant is anticipated to have adverse survival, reproduction, and growth effects to small numbers of individuals of the species, but for which the reduction of catastrophic loss of habitat (through the combined effects of wildfire and resultant erosion when these areas receive precipitation) is an even greater impact were retardant chemicals are not used. Thus, while exposure of a few individuals from retardant drops is anticipated at the periphery of habitat, in areas beyond the riparian areas that comprise the most frequently utilized habitat, the anticipated effects from a wildfire are ultimately a greater risk to the species and in these scenarios, the use of fire retardant is viewed as a "beneficial" (or less adverse, but useful) effect to the species.

San Bernardino Merriam's kangaroo rat

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

The San Bernardino Merriam's kangaroo rat occurs in several small, isolated populations on the San Bernardino National Forest: the Lytle, Cajon, and Cable Creek area, and the upper reaches of the Santa Ana River, in San Bernardino County and in the San Jacinto River and Bautista Creek area, both in Riverside County. The San Bernardino National Forest has high retardant application potential.

While the burrowing habitat of the San Bernardino Merriam's kangaroo rat is associated with alluvial features and floodplain areas, the species also utilized upland scrub habitat. The USFS implements a 300-foot buffer on mapped aquatic features and for critical habitat for the species.

The San Bernardino Merriam's kangaroo rat is one of several small mammal species for which the application of fire retardant is anticipated to have adverse survival, reproduction, and growth effects to small numbers of individuals of the species, but for which the reduction of catastrophic loss of habitat (through the combined effects of wildfire and resultant erosion when these areas receive precipitation), is an even greater impact were retardant chemicals are not used. Given its limited distribution on USFS lands, we anticipate that the avoidance mapping will greatly limit the risk of exposure to individuals of the species. Over the duration of the Action, small numbers of individuals may be affected by the application of fire retardant, but such instances are anticipated to be rare given the species habitat preferences.

Utah prairie dog

Utah prairie dogs live in colonies. Adults emerge from their underground burrow system and begin foraging mid-March to early April. Young are born late April to early May and emerge above ground from late May to early June. Adults enter dormancy from mid-July to mid-August, with juveniles following in early October to mid-November. The Utah prairie dog is an herbivore, feeding on grasses, alfalfa, flowers and seed. Their home ranges are small (3 to 20 acres). This species occurs on the Fishlake National Forest, which has high retardant application potential, and the Dixie National Forest, which has low retardant application potential. The USFS requires a 950-foot buffer for all mapped occupied habitat areas for the Utah prairie dog on the Dixie and Fishlake National Forests to provide a disturbance buffer from the potential for aircraft noise to disturb above ground prairie dogs (350-feet) plus a foraging buffer (to protect prairie dogs while actively foraging as well as to protect their food source; 600-feet).

This species occurs on units with high retardant application potential and individuals are active above ground during the fire season. Consequently, we expect individuals will continue to be active above ground when and after retardant is applied. That said, their fossorial nature minimizes their likelihood of being hit directly by a retardant drop because they retreat to burrows underground, although this represents a form of disturbance. The ecological risk assessment (Auxilio Management Services, 2021) identifies a risk to omnivores, as represented by deer mice, when reentering areas of retardant use after a fire. Given their larger body mass, we anticipate Utah prairie dogs would need to consume more contaminated dietary items to experience similar toxic effects as compared to the smaller surrogate deer mice used in the risk assessment. While we anticipate there is likely a moderate amount of risk to the Utah prairie dog from exposure to contaminated dietary items where exposure occurs, we believe the 950-foot avoidance buffer will make exposure to retardant unlikely. Retardant impacts to vegetation that this species uses may include fertilization that results in growth of plant species used for foraging, or growth of other plant species resulting in changes to vegetation composition and subsequent effects to foraging resources. These changes could result in contaminated vegetation as a food source or lead to less of the type of foraging vegetation required for the prairie dog (alfalfa, flowers, seeds). However, we anticipate the 950-foot avoidance buffer will greatly reduce the risk to the forage base for this species and significantly limit effects to individual Utah prairie dogs.

Thus, while there is a high retardant application potential on the National Forests on which this species occurs and the Utah prairie dog has limited distribution, a small home range, and the potential for ingestion of the retardant chemicals from their food source, we expect that exposure will be limited. Although aerially applied fire retardant is expected to result in exposure of and adverse effects to individual Utah prairie dogs, with implementation of the 950-foot avoidance buffer, we anticipate only small numbers of individuals will be affected.

Northern Idaho ground squirrel

The northern Idaho ground squirrel occurs in dry meadows surrounded by ponderosa pine and Douglas-fir forests at 3,500 to 7,500 foot elevations. One-third of the total population occurs on the Payette National Forest, which has high retardant application potential. The Boise National Forest contains substantial potential habitat for this species based on habitat modeling, and the Final Recovery Plan for the northern Idaho ground squirrel identifies these areas as important for recovery (USFWS, 2003) The USFS requires a 1,320-foot buffer to protect the summer breeding sites (active-season sites) plus the overwintering habitat.

Northern Idaho ground squirrels are active above ground from late March or early April until late July or early August. They hibernate up to eight months a year. This ground squirrel is active during the day, feeding on green vegetation and seeds. This species also occurs on units with high retardant application potential and individuals are active above ground during the fire season, and will likely continue to be active above ground after retardant is applied. As with Utah prairie dogs, this species is fossorial, which likely minimizes their likelihood of being hit directly by a retardant drop because they retreat to burrows underground, although this represents a form of disturbance. As noted above the ecological risk assessment (Auxilio Management Services, 2021) identifies a risk to omnivores, as represented by deer mice, when reentering areas of retardant use after a fire; ground squirrels would need to consume more contaminated dietary items to experience similar toxic effects, so we anticipate the risk to ground squirrels is likely to be less, should exposure occur. Retardant impacts to vegetation that this species uses may include fertilization that results in growth of species used for foraging, or growth of other species resulting in changes to species composition and subsequent effects to foraging resources.

Because of the high retardant application potential of the National Forests on which this species occurs, their limited distribution, small home range, and the potential for ingestion of chemicals on the food source, aerially applied fire retardant the northern Idaho ground squirrel is anticipated to be exposed to retardant chemicals and adversely affect individuals. While most of the species' range occurs on private lands, in the absence of avoidance mapping, we anticipate that small numbers of individuals will be affected on USFS lands.

Columbia Basin pygmy rabbit

This species is a sagebrush obligate. Dense stands of sagebrush provide year-round food and shelter. Native, perennial grasses and forbs are important food sources through spring, summer, and fall (Washington Department of Fish and Wildlife, 2022). Columbia Basin pygmy rabbits eat sagebrush as their primary food source, particularly in winter (NatureServe 2022). Mortality effects from retardant exposure for a small mammal like the Columbia Basin pygmy rabbit are described in the risk assessment from application of many of the current retardant products at most coverage levels (2-6 GPC) (Auxilio Management Services, 2021). The risk assessment also describes impacts to their forage base of sage brush and perennial grasses and forbs including:

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

According to the Columbia Basin pygmy rabbit Recovery Plan, efforts had been underway for reintroductions for this highly endangered rabbit. A captive breeding program was focused on reintroductions into the Sagebrush Flats Wildlife Area (SFWA) and to a lesser degree, the Beezely Hills Recovery Emphasis Area (USFWS, 2019). Recent fires in 2017 and 2020 destroyed 30,000 acres of shrub-steppe habitat within the Beezley Hills Recovery Emphasis Area and swept through the 10-acre breeding enclosure and three release pens. (Washington Department of Fish and Wildlife, 2022). Fire-related mortality claimed many rabbits from the 2017 fire and the reintroduction program was suspended at that time. Currently, reintroductions have been re-instated. However, this species continues to be vulnerable as its populations continue to be fragmented, but are still being bolstered by recovery efforts. Additionally, the threat of fire in its habitat is still present. The Moses Lake jettison area at Moses Coulee is identified as being within this species range. It is unclear how frequently retardant will impact Columbia Basin pygmy rabbit individuals and their forage base through direct exposure, as this jettison area is a secondary jettison area and has not been used in five or six years. The aerial extent of retardant drops including those for jettison areas are very limited (approximately 1-acre) such that we anticipate jettison drops will only impact a very small portion of the Columbia Basin pygmy rabbit range, its forage base, and very few individual rabbits.

Aquatic Species – Fish and Invertebrates

The fish and invertebrate species for which the USFS made a LAA determination are all fully aquatic and are discussed in this section. This group includes 28 fish, 1 crustacean, and 1 aquatic snail (**Table 23**).

Table 23. Fully aquatic fish and invertebrate species for which USFS made LAA determinations.

Taxa Group	Common Name	Scientific Name
Fish	Apache trout	*Oncorhynchus apache*
Fish	bonytail chub	*Gila elegans*
Fish	bull trout	*Salvelinus confluentus*
Fish	Chihuahua chub	*Gila nigrescens*
Fish	Colorado pikeminnow	*Ptychocheilus lucius*
Fish	desert pupfish	*Cyprinodon macularius*
Fish	Gila chub	*Gila intermedia*
Fish	Gila topminnow	*Poeciliposis occidentalis occidentalis*
Fish	Gila trout	*Oncorhynchus gilae gilae*
Fish	greenback cutthroat trout	*Oncorhynchus clarki stomias*
Fish	humpback chub	*Gila cypha*
Fish	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
Fish	Little Colorado spinedace	*Lepidomeda vittata*
Fish	Little Kern golden trout	*Oncorhynchus aguabonita whitei*
Fish	loach minnow	*Tiaroga cobitis*
Fish	Lost River sucker	*Deltistes luxatus*
Fish	Owens tui chub	*Gila (Siphateles) bicolor snyderi*
Fish	Paiute cutthroat trout	*Oncorhynchus clarki seleniris*
Fish	railroad valley springfish	*Crenichthys nevadae*
Fish	razorback sucker	*Xyrauchen texanus*
Fish	Santa Ana sucker	*Catostomus santaanae*
Fish	shortnose sucker	*Chasmistes brevirostris*
Fish	Sonora chub	*Gila ditaenia*
Fish	Spikedace	*Meda fulgida*
Fish	Unarmored 3-spine stickleback (Shay Creek stickleback)	*Gasterosteus aculeatus williamsoni*
Fish	Yaqui catfish	*Ictalurus pricei*
Fish	Yaqui chub	*Gila purpurea*
Fish	Zuni bluehead sucker	*Catostomus discobolus yarrowi*
Crustacean	Shasta crayfish	*Pacifastacus fortis*
Gastropod	Three Forks springsnail	*Pyrgulopsis trivialis*

The effects of the use of aerial fire retardant on aquatic species and associated activities are summarized here. Although the effects are described generally, they apply to each of the species listed in the table above, as discussed below.

Aquatic Avoidance Areas

Aerial retardant drops are generally not allowed in mapped avoidance areas for threatened, endangered, proposed, candidate or sensitive species or in waterways. This national direction is mandatory and would be implemented except in cases where human life or public safety is threatened and retardant use within avoidance areas could be reasonably expected to alleviate that threat (USDA USFS, 2011b) (USFS, 2020c).

Avoidance area maps reduce the possibility of retardant drops on National Forest System Lands occurring within waterways or in threatened, endangered, proposed or candidate species habitat. Some species have increased size of avoidance areas beyond the standard 300-foot buffer to waterbodies to further reduce the potential for retardant entry into waterways in areas where species distribution or habitat warrants a larger buffer or greater likelihood of protection.

While we anticipate that the avoidance mapping for aquatic species will greatly reduce the likelihood of the application of retardant into their habitats, the rare instances of intrusions or exceptions do not provide for total avoidance. For example, the 2020 Cameron Peak Fire impacted recently reintroduced greenback cutthroat trout in the East Fork Roaring Creek watershed (Fairchild, 2020). While the Arapaho National Forest is a low application retardant use forest and the use of retardant is rare, the incident included moderate to high severity wildfire impacts in addition to the application of fire retardant in efforts to combat the fire, including retardant drops into the avoidance buffer and into the stream. Therefore, we summarize the available toxicity and risk information for these species below. However, we anticipate that the rarity of these events and dilution of retardant chemicals will result in very limited exposure to very small numbers of individuals of aquatic species. We anticipate that repeated drops of fire retardant chemicals into protected waterways will place any of these species at risk and the likelihood of such a scenario is not anticipated to occur.

Toxicity Effects to Aquatic Species

The ammonium phosphate based retardants are characterized as very highly toxic to aquatic invertebrate and vertebrate species because of the ionization of the ammonia in these chemicals. The magnesium chloride based retardants are less toxic to aquatic species but are considered slightly toxic under EPA's criteria (*see* (Auxilio Management Services, 2021)). Observed effects are direct mortality under acute exposure scenarios as well as a decrease in numbers of larvae hatched or survival and decreased survival of juveniles for aquatic vertebrates under chronic exposures. For aquatic invertebrates, effects observed from the ammonia based retardants are decreases in survival and reproduction under chronic scenarios for daphnia (water flea, gammarid shrimp) and mortality for acute exposure scenarios for daphnia (water flea).

There is limited information about the effects of exposure to magnesium chloride (based on the two Fortress retardant products) to aquatic species. The best available information is based on the toxicity of deicing chemicals that are formulated in part with magnesium chloride (less than

2%). Magnesium chloride may impact fish in terms of direct lethality, sub-lethal effects as well as demands on biological oxygen demand (BOD) that can reduce dissolved oxygen (DO) in the water column. Because there are so few studies on the effects of magnesium chloride, there is limited information about its effects to all of the species considered in this assessment. (Kunz, Little, & Barandino, 2021) compared the effects of magnesium chloride to rainbow trout, freshwater mussels, crayfish, snails, and larval amphibians. They found the response of rainbow trout was similar to that of the other tested species, making rainbow trout a good surrogate for a wide range of species. The reported toxicity for rainbow trout by Kunz et al. (2021) is also similar to that reported in mosquito fish (McKee & Wolf, 1963), fathead minnow (McKee & Wolf, 1963), (Birge, et al., 1985), (Pilgrim, 2013), shiners (Wiebe, Burr, & Faubion, 1934), (Doudoroff & Katz, 1953), (Mount, Gulley, Hockett, Garrison, & Evans, 1997), bluegill (Patrick, Cairns, & Scheier, 1968), (Birge, et al., 1985), and for rainbow trout in other studies (Mueller, 2018).

Magnesium chloride is also rapidly diluted by a factor of 1-500 within a distance of approximately 20 yards from a roadway (due to the presence of meltwater) when applied as a road de-icer (Lewis, Jr, 1999) and less toxic to aquatic species than sodium chloride (Hintz & Relyea, 2017). Therefore, while there are possible lethal and sub-lethal effects should exposure occur, the area affected is much smaller than for nitrogen- and phosphorous-based fire retardants. Therefore, magnesium chloride fire retardants are not likely to be a major concern even if they are dropped within the 300-ft buffer unless such drops occur in a large concentration, which is relatively rare. Monitored intrusions between 2012 and 2019 were typically large in buffer zones but generally fewer than 60 gallons of retardant estimated to enter waterways (USDA - USFS, 2020b)

Indirect consequences of magnesium chloride such as impacts on BOD were not observed. During low flow conditions, when DO is most likely to be adversely affected, there was no significant decrease in DO levels due to magnesium chloride introduction (Lewis, Jr, 1999), (Fischel, 2001). There was also no evidence of photoenhanced toxicity under the same conditions (Kunz, Little, & Barandino, 2021). Invertebrates have a similar tolerance to magnesium chloride as rainbow trout (Kunz, Little, & Barandino, 2021) with 96-hour LC_{50} values between 140 and 548.4 mg/L (Dadashov, Loboichenko, & Kireev, 2018).

Fortress' long-term fire retardants, FR-100 and FR-200, have a 96-hour LC_{50} of 1,762 mg/L and 3,672 mg/L in rainbow trout, respectively (Auxilio Management Services, 2021). The risk assessment determined there was a risk to rainbow trout because of spilling the concentrate and the mixed product into a stream, however, applying it at a rate of 6 GPC did not rise to the level of being a lethal risk (Auxilio Management Services, 2021). We anticipate that other future allowable chemicals used as aerial fire retardant products would have a similar or lower level of effects to these species as the chemicals described above, should exposure occur, based on the requirements described in the *Description of the Proposed Actio*n Section "*Retardant Components and Testing Requirements*" in this Opinion for USFS methodology on products added to the QPL. Surface runoff can occur when retardant moves from an upslope area into a waterway, although thickeners and surfactants added to retardant mixtures increase adhesion of chemicals to vegetation and reduce the risk of runoff. None of the products evaluated in the ecological risk assessment (Auxilio Management Services, 2021) demonstrate a risk of runoff.

Effects to listed species via food base and habitat may also occur in the rare event that aerial fire retardant reaches aquatic habitats. Direct and indirect toxicity effects could occur to species that come in direct contact with retardant, or consume vegetation or prey affected by retardant. Other sub-lethal effects of chemical toxicity do not result in direct mortality, but could impact the overall health and fitness of individuals within a population of aquatic species. These effects may include impacts to individual physiology or behavior that lead to impacts on individual survival, growth or reproduction. There are no studies on these retardant salts that specifically address the impacts in this manner, but in addition to the risk of direct mortality, we expect that such effects may include:

- Increases or decreases in growth, developmental abnormalities, or physical deformities
- Changes in reproductive behavior, number of eggs or offspring produced or hatched
- Reduced ability for osmoregulation or other physiological processes,
- Reduced ability to tolerate shifts in environmental variables (temperature, dissolved oxygen etc.),
- Increased susceptibility to disease or to predation,
- Changes in migratory behavior.

Effects may also include impacts to habitat. Studies have documented a short-term (one year) reduction in species richness in areas treated with retardant. This effect was more pronounced in riparian corridors than in other habitat types. Vegetation changes in the riparian corridor could contribute to changes in stream characteristics such as water temperature, sedimentation rates, or other factors that could alter the way aquatic species are able to use those habitats. Fire retardant chemicals could also impact algal populations that serve as a food resource for these species through direct mortality of algae or, alternately, through increased algal production due to fertilization or changes in solar radiation related to changes in riparian vegetation. Changes in vegetation could also contribute to changes in availability of prey species.

The integrity of the aquatic food chain is an essential biological requirement for all aquatic species, and the possibility exists that retardant applications could alter productivity, where exposure occurs. Retardant chemicals could impact prey species through direct mortality of prey, changes in prey distribution and availability, or ingestion by aquatic species of prey that have been exposed to chemicals.

When retardant enters the aquatic environment via either direct application/intrusion, surface runoff, or accidental spills, an accidental spill would have the greatest potential to impact prey species because of the amount of chemical that a spill could introduce into the water. However, there were no spills that occurred from 2012 through 2019; we anticipate the likelihood of this occurring in the future and subsequent risks to the aquatic food chain is low.

Overall, the risks to riparian vegetation and prey base changes to listed aquatic species are low because, as described previously, intrusions are rare and risks from run-off are not a likely scenario. Multiple intrusions into the same waterbody would likely need to occur before long term effects to prey availability become apparent, and we anticipate intrusions into or near aquatic habitats would rarely occur in the same location. While the risk of spills and intrusions occurring is very low, studies indicate when they occur, habitat characteristics could change and impacts to prey species could happen. Therefore, there is a low probability that aerial fire retardant would cause effects to listed aquatic species by causing changes in riparian or aquatic habitat or prey availability.

Other Effects

Effects to aquatic species may also occur as a result of retardant aircraft flights (disturbance) or the physical impact of retardant drops. For example, fire retardant drops could negatively affect components of species spawning activities and rearing habitat by a direct hit to the species habitat. However, we anticipate such exposure would be unlikely due to the use of aquatic avoidance areas.

Finally, disturbance from low-flying aircraft is not a concern for most aquatic species because aircraft noise is muted traveling from air through to water and the amount of time an aircraft would spend directly over a waterbody would be very low.

In summary, while we anticipate that individuals of these species may be affected where exposure occurs, the use of avoidance areas for aquatic species is likely to largely preclude exposure of these individuals, their food base, and their habitats.

Effects to Aquatic Critical Habitats

Effects to critical habitat are briefly addressed above in our discussions on effects to habitat, vegetation, aquatic food chain, and prey. Here, we focus more specifically on the effects of retardant on the PBFs of designated critical habitat for those species. Designated critical habitat PBFs for the fishes listed above consist of: high quality water habitat with adequate flow free from silt, adequate substrate type needed (gravel, rubble, etc.), and proper depth (depending on the species); and adequate flowing, well oxygenated water with mesohabitat of riffles, pools, and runs with differing substrate such as gravel, pebble, sand, silt, and low turbidity. Other features include adequate riparian vegetation and structure as well as an abundant aquatic food base consisting of fine particulate organic material, filamentous algae, insect larvae, and small terrestrial insects. Sufficient water depth and a precise temperature regime are also mentioned in the descriptions of the PBFs for some species. The fish critical habitats are for the following species: Zuni bluehead sucker, Santa Ana sucker, shortnose sucker, Lost River sucker, Owens tui chub, Sonora chub, Gila chub, Little Colorado spinedace, spikedace, Little Kern golden trout, bull trout, loach minnow, and razorback sucker.

While retardant is not expected to impact water depth, temperature, flow or other physical structures of the PBFs, retardant may impact the water quality. The introduction of ammonia into the water column can result in altered dissolved oxygen levels as a function of the altered vegetation or algal growth. Altering the vegetation type and increases in algal growth can also impact the diversity or abundance of aquatic invertebrate prey items. As previously discussed, we expect that any impacts will be short–term, and will likely only temporarily alter the water quality or prey resources (such as through a temporary reduction in invertebrate food resources discussed in the *Terrestrial Invertebrates* Section of the *General Effects* in this Opinion) for these fish critical habitats.

Plants

Summary of Effects

In their BA, USFS determined that 52 plant species and no plant critical habitats were likely to be adversely affected by the Action (see **Table 25**). Plant species that are likely to be adversely affected by use of aerially delivered retardant include those known on forests that are likely to have 0.01 percent or more of its land based treated with retardant annually and occur in specific habitats where retardant application is possible (landbase percentages were rounded up in Appendix G in the BA to determine the amount of landbase impacted using the most conservative approach). Additionally, any plant species considered to be a narrow endemic[28] located on a forest with potential for retardant application, regardless of how much is used, was also determined to warrant a LAA determination. Known occurrences are protected from effects through use of avoidance areas, unless risk from fire outweighs the effects of retardant. All plant species with an LAA determination have avoidance mapping except the following species: Santa Ana River woollystar, Todsen's pennyroyal, Holy Ghost ipomopsis, and Bakersfield cactus based on the rationales below.

1) Santa Ana River woollystar - located close to but not on the San Bernardino National Forest, so avoidance mapping is not needed.
2) Todsen's pennyroyal - catastrophic fire that destroys a population is considered to be a serious threat to this species, because once a population is extirpated it has little potential for recolonization; therefore, due to the threat of fire in its habitat within the Lincoln National Forest, the USFS and the Service agrees it is not necessary to identify avoidance areas for this species.
3) Holy Ghost ipomopsis - the recovery plan for this species identified fire as a primary threat to the species. In coordination with the Service, the USFS determined that the threat of fire outweighs the potential adverse effects from the application of fire retardants. Therefore, no avoidance mapping is desired for occurrences for this species.
4) Bakersfield cactus - found in high retardant use areas with frequent fires (i.e., the Sequoia National Forest). The USFS did not identify the need for avoidance for this species as fire retardant use was found to be preferable over the lack of fire suppression. While retardant use can cause an increase in the growth of certain non-native plants (from the ammonia or magnesium chloride salts adding nitrogen and other salts to the soils), fire can also facilitate the emergence of invasive grasses, which would likely lead to greater reductions in Bakersfield cacti populations (U.S. Bureau of Reclamation, 2006). Although avoidance mapping is not used for this species, the USFS does treat nonnative species (treat indicates removal of non-natives) that would have benefitted from the fire retardant's fertilizing effects, which in turn would also benetfit this species.

We do not anticipate adverse effects to plant species that will be protected by avoidance areas except in instances where intrusions into these areas occur. We expect such intrusions would be rare based on the available data from previous years, as described in the BA. The effects described below are anticipated where intrusions occur, and in areas where retardant is used in the ranges of plant species that will not be protected by avoidance areas. For this analysis, the

[28] a small isolated population that occupies a small geographic area and is found nowhere else.

listed plants in this section occur in the following National Forests, which have 0.01 percent or more of their land based treated with retardant annually: Helena-Lewis and Clark, Lolo, Cibola, Coronado, Lincoln, Prescott, Tonto, Boise, Dixie, Payette, Uinta-Wasatch-Cache, Angeles, Cleveland, Eldorado, Inyo, Klamath, Lassen, Los Padres, Mendocino, Modoc, Plumas, San Bernardino, Sequoia, Shasta-Trinity, Sierra, Six Rivers, Stanislaus, Tahoe, Deschutes and Ochoco, Malheur, Okanogan-Wenatchee, Rogue River-Siskiyou, Umatilla, and the Wallowa-Whitman (*see also* Appendix G in the BA).

The effects of aerially applied fire retardants to plants and plant communities are not well documented in the scientific literature. Studies that do exist represent results of short-term (one to two growing seasons) scientific studies conducted in a few geographic regions and vegetation types (e.g., California grassland, California forest, North Dakota mixed grass prairie, Great Basin Shrub steppe, and Australian eucalyptus forest and heathland) using various retardant application rates and formulations (i.e., current and historical retardants used by the USFS). Effects of aerially applied retardant on plants and plant communities within the scope of this analysis depend on a number of factors, including species characteristics (habitats, physiological and morphological characteristics), soil types, timing of application (active growing season vs. dormant) and what happens to the retardant chemical after application, exposure to retardant (rates and formulations), environmental responses, and correlation of scientific results to potential geographic areas where retardant could be used in the future. Whenever possible, analysis of the effects on individual plant species or plant communities consider chemical and species-specific information.

Phytotoxicity

Based on the available studies, there may be short-term (1 to 2 growing seasons) phytotoxic effects (e.g., leaf burning, shoot die-back, decrease in germination, plant death), if retardant is applied directly on species that are more sensitive to salts within fire retardants. We anticipate avoidance mapping around known occurrences or site-specific conditions that limit aerial retardant delivery of these areas protect these species from phytotoxic effects (i.e., because no retardant would likely be applied). Potential phytotoxic effects from aerially delivered retardant could occur from an intrusion, an exception for retardant use (delivery guidelines), or application on an individual or population that has not yet been documented. Native plant communities supporting federally listed plants or habitats that have not yet been documented are not likely to experience widespread phytotoxic impacts because only a very small percentage of land is expected to have fire retardant applied to it annually. Aerial retardant application occurs on a small percentage of USFS lands annually, and is estimated to be less than 0.025 percent for individual forest and less than 0.0025 percent nationwide. Forests that apply retardant to 0.01 percent or more of their land base were considered to have a higher probability of effects (more retardant use equals higher potential for intrusion or exception for use) than forests applying less than this amount of retardant. We anticipate that other future allowable chemicals used as aerial fire retardant products would have a similar or lower level of effects to these species should exposure occur, based on the requirements described in the *Description of the Proposed Actio*n Section "*Retardant Components and Testing Requirements*" in this Opinion for USFS methodology on products added to the QPL. Areas where a narrow endemic or isolated population occurs on a forest may receive an accidental drop or retardant application from an exception and would be most vulnerable to an impact due to the localized area individuals of the species inhabits. It is impossible to predict where or when an accidentalintrusion or an exception for retardant use would occur in the future; however, with identification of avoidance areas around these specific locations, individuals within these populations will be protected and intrusions are less likely to occur. We are aware of a few cases of fire retardant applications in areas in or near populations of listed plants. In some cases, intrusions may have occurred within avoidance areas that were identified for specific plants. In other cases, no avoidance areas were identified for the plants, but applications in their vicinity were documented. These reports include:

- San Bernardino National Forest
  - One species: Slender-horned spineflower - 2016 Blue Cut and 2017 Rouse fire. No effects were observed from either incident. On the Rouse fire, the intrusion was on the outer edge of the avoidance area. Both intrusions were based on exceptions for public safety.
  - Seven species: Cushenbury oxytheca, Cushenbury milk-vetch, Parish's daisy, Cushenbury buckwheat, San Bernardino Mountains bladderpod, Bear Valley sandwort, Ash-grey paintbrush, and Southern Mountain wild buckwheat - 2017 Holcomb fire. Three intrusions occurred over 2 months. The intrusions impacted over 65 acres of habitat and were the result of exceptions for public safety. Monitoring for non-native invasive species was established post fire and non-native invasives were removed as per USFS standard operating procedures.
- Modoc National Forest – one species, slender orcutt grass - 2013 Rail fire. The application was in potential habitat. Non-native invasive species were present and treated to counteract any fertilization effects from fire retardant.

In general, retardant is applied in linear strips across the landscape (50 to 75 feet wide) and available literature indicates little or no direct phytotoxic impacts after 1 to 2 years post retardant application. It is expected that available propagule seed-bank sources or other propagule sources nearby would provide long-term revegetation potential for common native plant species that might be impacted in the short-term.

Vegetation Diversity, Fertilizing Effects of Retardant, and Non-Native Invasive Species

Retardants serve as a source of plant nutrients (specifically, nitrogen and phosphorus) in the soil whether applied directly to the ground as a retardant or deposited on the ground via rainfall. Individual and plant community responses are extremely complex and highly site-specific. The amount of retardant applied per forest/region/nationwide is small (less than 0.025 percent annually across National Forest System Lands); however, these impacts do not preclude impacts to individual species, especially threatened and endangered plant species, designated critical habitat areas, and plant species that are considered "narrow endemics". Impacts to threatened and endangered species habitats by invasive species are one of the threats facing many species nationwide (Pimentel, Zuniga, & Morrison, 2005) (Wilcove & Chen, 1998); see also *Environmental Baseline* section of this Opinion).

The use of avoidance mapping areas reduces the potential impacts from fertilizing effects of retardant to native plant diversity and non-native invasive species. By eliminating the potential for retardant application and thus removing alterations in nutrients (fertilizing components of retardant) or potential changes in soil properties, no longer-term effects (in the form of changes in diversity) are expected to occur. It is impossible to predict where or when an accidental intrusion or an exception for retardant use would occur in the future. However, with identification of avoidance areas around specific locations that take into consideration this potential (larger protection areas that may completely eliminate aircraft in the area) in combination with the amount of individual forest land base receiving fire retardant annually, the likelihood of fertilizing effects are greatly reduced.

In addition to avoidance areas identified within the action area, the USFS continues to remove non-native invasive species on each forest as directed by national policy and regional and forest level direction. These programs will continue to treat non-native invasive species as directed at the local level which include eradication and treatment of non-native invasive species threatening federally listed species and weed programs in general for all forest level activities. If an application in error of aerially applied retardant results in an increase in non-native invasive species in an avoidance area, these will be removed in compliance with existing forest or regional plans.

Effects to pollinators or seed dispersers

There were no data to support a risk profile for specific insects that could be pollinators or seed dispersers for many listed plants. We assume similar effects for listed insects as for those insects that are listed plant pollinators or seed dispersers, in that risk to these species include risk of mortality from the physical impacts of a large retardant drop as well as ingestion of plant or nectar material and direct contact from the retardant chemical that would also result in mortality of individuals. For birds or bats that are pollinators or seed dispersers, we assume similar effects as discussed in the *Concurrence* section above for listed birds or bats, in that mortality is possible for smaller songbirds and bats where large amounts of contaminated food items are consumed. However, we do not anticipate that these avian and mammalian species are likely to experience such effects, as they are highly mobile and would likely not consume large amounts of contaminated material. Furthermore, we expect that retardant use in areas where these listed plants are found would not impact a significant portion of the invertebrate, avian, or mammalian seed dispersers or pollinator populations on which a listed plant may rely and there would still be sufficient numbers to continue to pollinate or propagate the seeds for these listed plants. We do not anticipate any impacts from retardant use on physical means such as water or wind that some plants use as pollination or seed dispersing vectors.

Other Effects to plants

Other effects from the Action, such as physical damage from drops of retardant (e.g., to trees or other habitat structure) is likely to be of concern to any plant species if the retardant is dropped from a significant enough height or where coverage interferes with the plant's ability to photosynthesize or respire. However, the use of avoidance mapping will greatly lessen the probability of this occurring for listed plants.

Disturbance from aircraft noise is not anticipated to affect individual plants or their pollinators or seed dispersers.

Review of the U.S. Forest Service Aerial Fire Retardant Application Methodology

In this evaluation, we specifically ask whether or to what degree the USFS has structured the Action, the delivery of aerial fire retardant to National Forest System Lands, such that the USFS: (1) understands the scope of its action; (2) reliably estimates the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of the Action; (3) reliably estimates the exposure of ESA-listed resources (species and designated critical habitat) to these stressors; (4) collects and monitors information on authorized activities throughout the life of the Action; (5) evaluates the information to assess how its actions have affected listed resources; (6) monitors and enforces compliance; and (7) modifies its action if new information (including inadequate protection for species or low levels of compliance) becomes available.

Question 1. Scope – Has the Action been structured to reliably estimate the probable number, location and timing of actions that would be conducted by the Action?

In this section, we ask whether the USFS is aware of the scope of its Action. As described earlier, the scope of the Action includes all aspects of the aerial application of fire retardants on National Forest System Lands in the event of a fire, including effects related to toxicity of the fire retardant products, use of aircraft to deploy the products, and mobile and permanent air tanker base operations. To reliably estimate the probable individual or cumulative effects to ESA-listed resources, the USFS would need to know or reliably estimate the location, amount, type, timing, and placement of the aerial fire retardant throughout the extent of the Action, as well as other components of the operation (i.e., aircraft use, tanker bases).

While there is no way to determine the exact number, location, and timing of fires that would precipitate the use of fire retardant, the USFS has determined where application of fire retardant is most likely to occur as reflected by the level of anticipated use within each forest (i.e., high, medium, and low use forests). The USFS also collects data on volume of fire retardant deployed each year and the locations in which fire retardant has been applied. While past applications do not necessarily predict the future, this information does provide a reasonable expectation on where and when such activities are likely to occur. Additionally, the USFS compiles a yearly report that includes all of the information necessary to determine where, when, and what type of fire retardant was applied during the fire season on any National Forest System Land. These data are also provided in the 2021 BA and are the basis for many of the calculations used to determine effects to species and critical habitat. The USFS has determined that based on past data from 2012 to 2019, the fire retardant use on certain National Forest System Lands and the rate of intrusions is likely to remain relatively the same into the future as well. Furthermore, improvements in technology will continue to help avoid intrusions into avoidance mapped terrestrial and aquatic areas.

Taking all of this information into account, the USFS's Action has been structured to reliably estimate the probable number, location, and timing of activities that would be conducted by the Action.

Question 2. Stressors – Here we ask whether the USFS has reliably estimated the physical, chemical or biotic stressors that are likely to be produced as a result of implementation of the Action. We also ask whether the USFS would know or be able to reliability estimate where the stressors have occurred that resulted in adverse impacts to listed, or proposed species and their critical habitats.

In their BA, the USFS summarized the various categories of stressors that are likely to be associated with the Action and provided a brief description of the potential effects within each category (see BA *Effects Analysis* section). While a quantitative assessment of the impacts on the listed species and critical habitats is not possible due to the large scale of the Action as a nationwide program rather than a specific action (i.e., the USFS cannot predict when, where, in what habitat type, or how large or long-lasting a wildfire event will happen, nor can they predict when, where, or how much aerial fire retardant may be used on a specific wildfire incident), the details regarding analyses for species groups or individual species or critical habitats are provided as needed.

Because the Action is programmatic in nature and covers the entire National Forest system, the USFS developed a screening process to standardize the way in which species determinations are made. Effects determinations for all species are evaluated in the BA first through the National Effects screen as a coarse filter to determine how likely the use of aerial fire retardant on National Forest System Land will impact a species or critical habitat. The species or critical habitat are then classified as either No Effect; NLAA, or LAA. These criteria are outlined in Table 13 in section 5.2.2 of the BA. Additional review and analysis are described within each group or for individual species and their critical habitats as needed. All analyses use the most recent available information on fire occurrence, retardant use, species status and distribution, threats, and other information. Retardant application potential is also described as ‘very low’, ‘low’, ‘moderate’ or ‘high’ based on the average annual retardant use by forest between 2012 and 2019 (USDA - USFS, 2020a) (Appendix G) and the maximum (maximum total gallons of retardant used in any given year from 2012 through 2019). These classifications help the USFS determine if a species or critical habitat are within a forest that is more likely to receive retardant than others. Next, the USFS folds the information on cumulative effects into their analysis. The cumulative effects include future activities on adjacent lands, private or state-owned inholdings, or on rights of way across National Forest Lands “not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation.”

Next, the USFS utilizes the Wildlife screens they have developed to provide a consistent approach to considering the potential impacts of aerial retardant on a wide variety of wildlife species and habitats. Each species or critical habitat are reviewed via the species group screens (wildlife, aquatic, plants) to summarize why a particular species or critical habitat may be NLAA (avoidance mapping, mobility, life history indicates a species is not present during fire season, etc.) or how the USFS arrives at an LAA (a higher retardant use forest and a species that is more vulnerable to a fire prone habitat based on their small range and reliance on a particular area, for example). Potential impacts of aerial retardant use on wildlife species are influenced by the likelihood of exposure through direct application or ingestion, as well as through disturbance caused by the type of aircraft used to deliver retardant, or structural impacts to vegetation and other habitat components from drops of product. Direct exposure is influenced by the ability of individuals of species to avoid areas where fires are burning or where retardant may be used, as well as their ability to avoid using areas in which retardant has been applied. For example, large, mobile, wide-ranging species such as lynx, fisher, or grizzly bear are much less likely to be affected by aerial application of retardant than species such as small rodents or amphibians, many of which are dependent on localized or highly specific habitats, despite being mobile. Direct exposure is also influenced by the likelihood of an animal ingesting retardant through consumption of treated foliage or predation on other species (such as insects or small mammals) that may have retardant on them or that may have ingested retardant. Risk of ingestion is based on a species' preferred forage or prey and how widely individuals range in search of forage or prey.

The USFS also considers the effects of any new chemicals that would be added to the list of approved products to ensure that they meet all requirements of the specification (USDA - USFS, 2007) to become qualified. The company or manufacturer must always provide to the USFS each ingredient, quantity, and a supply source in the formulation as well as copies of the Safety Data Sheets for the product and for each ingredient used to prepare the retardant.

This is done to assure the product does not contain ingredients meeting the criteria for Chemicals of Concern, which is checked against the list of unacceptable ingredients as contained in the specification section 3.4.2: (National Toxicology Program, 2021); International Agency for Research on Cancer Monographs for Potential Carcinogens; Comprehensive Environmental Response, Compensation, and Liability Act List of Extremely Hazardous Substances and Their Threshold Planning Quantities) in order to determine if there are any ingredients that could pose a threat to either the environment or human populations.

Most importantly, the USFS establishes formal contracts to ensure that only products on the QPL are purchased and applied to National Forest System Lands. The QPL and retardant contracts are also used by other Federal land management agencies through their authorities and policies (see also Appendix A in the BA).

Based on these factors, the USFS has provided sufficient information to describe how the Action has been structured to reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of the activities.

Question 3. Overlap – Has the Action been structured to minimize and reliably estimate whether or to what degree specific endangered, threatened, proposed or candidate species or designated critical habitat are likely to be exposed to potentially harmful impacts that the Action addresses?

In their BA, the USFS discusses the potential impacts retardant use can have on species and critical habitats. The potential impacts of the Action are described in the *Effects Analysis* section of the BA and as described above in Question 2. Stressors. The USFS also addresses how they structure their Action to minimize and estimate to what degree listed species or critical habitat may be exposed to the harmful impacts of fire retardant application in case of a fire. The USFS aims to minimize exposure by the use of required avoidance areas for all aquatic species and aquatic critical habitat (no application of fire retardant can occur within 300 feet of any waterbody, except when human life or public safety are threatened and retardant use in the aerial retardant avoidance area could be reasonably expected to alleviate the fire threat) and for terrestrial species with required exclusion areas for their range or critical habitat. In addition, almost all of the species the USFS has determined as LAA are also required to have mapped avoidance areas where fire retardant may not be applied (except when human life or public safety are threatened and retardant use in the aerial retardant avoidance area could be reasonably expected to alleviate the fire threat). For the few species and the critical habitat for which USFS has not identified the need for an avoidance area – 13 species and one critical habitat – other considerations are taken into account. For example, certain birds would not need an avoidance area due to their high mobility and lack of aerial fire retardant use during the nesting season.

We acknowledge that in relatively rare cases – based on the exception mentioned above or an intrusion error of application dropped into a mapped avoidance area – retardant may enter into exclusion areas, and that complete avoidance of fire retardant entering a species range or critical habitat is not always feasible. In this respect, the USFS also provides information from a risk assessment (Auxilio Management Services, 2021) that informs and outlines the impacts of fire retardant. For example, impacts may be based on: the coverage level (GPC); the type of vegetation or fuel type it is applied to; and the impacts to surrogate organisms used in toxicity studies that provide context as to what the impacts could be if exposure to listed species occurred (e.g., from direct application of retardant to a taxa group such as birds, fish or mammals). The information may also include any effects from consumption of contaminated prey or other food items.

Additionally, as described in the Effects Analysis section in the BA, the methodology the USFS uses to determine effects to listed species or critical habitats were structured to estimate a potential high, medium, or low exposure rate based on retardant application by forest based on data captured from 2012-2019, see *Retardant Application Potential* in *Description of the Proposed Action* section of this Opinion. Rather than only identifying the three categories of retardant use as high, medium or low to characterize potential impacts to listed species and critical habitats, the USFS also uses the 2012-2019 data to estimate specific species or critical habitat exposure rates from intrusions based on individual Forest. With these data the USFS has identified that the rate of intrusions will continue at the currently low rate and will continue to be low and thus we use this information to determine by forest, the potential impacts to listed species. The USFS has also been able to estimate the potentially harmful impacts from the noise of the aircraft delivering the retardant. The USFS acknowledges that species with a moderate to high rate of mobility can escape the fire area or move out of the way of retardant drops but can still be affected by the aircraft flying overhead or in the vicinity. When certain species are nesting or mothers are with young the ability to be highly mobile is also reduced and thus risk from exposure to aircraft noise is increased. This information is also taken into account when take calculations are determined for certain species where needed.

Thus, we anticipate the Action has been structured to minimize and reliably estimate whether or to what degree specific endangered, threatened, proposed or candidate species or designated critical habitat are likely to be exposed to potentially harmful impacts that the Action addresses.

Question 4. Monitoring/ Feedback – Has the Action been structured to identify, collect, and analyze information about authorized actions that may have exposed endangered, threatened, proposed, or candidate species or their critical habitats to stressors at intensities, durations, or frequencies that are known or suspected to produce physical, physiological, behavioral, or ecological responses that have the potential to cause individual or cumulative adverse consequences for individual organisms or physical or biological features of critical habitat?

The Action has a monitoring and reporting requirement as briefly described above and in the *Description of the Proposed Action*, *Conservation Measures* section in this Opinion. The USFS collects data on volume of fire retardant deployed each year and the locations in which fire retardant has been applied. The USFS has also identified where listed, proposed, and candidate species and their critical habitats are expected on USFS lands, and is able to determine where aerial fire retardant deployment occurs, where flights occur, and other information related to these activities (e.g., operation of permanent and mobile air tanker bases, discharge of excess retardant before landing). This information is collected each year, although the USFS relies on other entities for some of this information (e.g., activities at permanent air tanker bases not on USFS lands), and recognizes the information may not be currently collected consistently or at the same frequency in all cases (especially where other entities are involved). In many cases, the monitoring of specific impacts to individuals of a species or to various aspects of their habitat is not possible due to their life histories, behavior, size or other factors, and there is sometimes difficulty with determining the specifics of how fire impacts habitat and species within it, as well as documenting effects from the fire versus the fire retardant usage, or a combination of these. However, the monitoring data that is collected (e.g., volume of fire retardant, location of operations, location and frequency of intrusions) help inform the USFS's understanding of likely effects to species and their critical habitats and provide a feedback mechanism to allow for additional measures or reporting to be implemented.

In addition, the USFS monitors areas after retardant has been dropped to acquire information on where the fire retardant landed, what type of habitat/terrain has been affected, and what impacts are observed. This allows the USFS to determine whether an intrusion has happened and to what extent, if any, take has occurred. This information also allows the USFS to estimate what stressors species and their critical habitats have been exposed to, as well as the intensity, duration, and frequency of any exposures, and, finally, whether such exposure would have produced individual or cumulative adverse consequences. For example, between 2012 and 2019, of the 53 species with exclusion areas discussed in this opinion, USFS documented three species where intrusions occurred within the avoidance areas. The intrusion rate into the buffer area around aquatic habitat, where it did not enter the water, was 0.29 percent of all retardant drops.

If assessment or monitoring at an intrusion site determines that effects are likely to have occurred to threatened, endangered, proposed or candidate species or critical habitat, this monitoring and feedback will allow the USFS the opportunity to consider whether additional restrictions to aerial retardant use or other operational changes are needed. All retardant intrusion locations are reported to the Forest resource specialist and/or the assigned Burned Area Emergency Rehabilitation team. The potential for non-native invasive plant species issues is assessed by these entities, and additional measures identified in forest plans would be implemented as needed.

Question 5. Responses of Listed Resources – Does the Action have an analytical methodology that considers:

- the status and trends of endangered or threatened species or designated critical habitat;
- the demographic and ecological status of populations and individuals of those species given their exposure to pre-existing stressors;

- the direct and indirect pathways by which endangered or threatened species or designated critical habitat might be affected by the Action activities; and
- the physical, physiological, behavior, sociobiological, and ecological consequences of exposing endangered or threatened species or designated critical habitat to stressors of the Action at intensities, durations, or frequencies that could produce physical, physiological, behavioral, or ecological responses, given their pre-existing demographic and ecological condition?

The Action uses the information provided in the status of the species documentations to inform the analysis of the population, status, vulnerabilities, current stressors, and resiliency of the species or critical habitat as a whole. The USFS also employs two different screening processes as discussed above in section 2. Stressors. The USFS uses a National Screen to describe if their Action is to have no effect, may affect, is likely to adversely affect or may affect, is not likely to adversely affect species and critical habitats. After the National Screen has been applied, the USFS then reviews each species or critical habitat with the Wildlife screens depending on applicability to the species (wildlife, aquatics, plants) to determine the impacts the fire retardant will have on species via direct exposure (contact, etc.). The USFS reviews other potential effects such as noise disturbance from the aircraft delivering the retardant, intrusions into aquatic waterbodies, fertilizing effects to listed plants or vegetative components of critical habitat, or the effects of retardant being dropped directly onto listed plants or smaller immobile species. The USFS also considers the indirect impacts of fire retardant application into species ranges or critical habitat areas in terms of increases in invasive plant species due to increased nitrogenous compounds entering into soils, altered water quality with the introduction of nitrogenous compounds into aquatic ecosystems, or secondary contamination due to ingestion of prey items that have retardant on them.

To address the above concerns in the bulleted items above, species specific and critical habitat environmental baseline and biology, and PBFs are also reviewed and considered when the USFS applies this methodology to their effects determination process. Thus, we expect the USFS has an analytical methodology that considers these elements.

Question 6. Compliance – Does the Action have a mechanism to reliably determine whether or to what degree the USFS has complied with the conditions, restrictions or mitigation measures required?

The USFS has been collecting fire retardant drop data since 2012 and will continue with this mechanism of the Action. The USFS maintains accurate and intensive records of fire retardant use on National Forest System Lands reflecting their ability to adhere to avoiding exclusions areas. Records and monitoring of measures such as implementation of any best practices (e.g., flight activities, maintenance and spill response at airbases, etc.), the use of avoidance areas (and any intrusions and related circumstances), and ongoing coordination with Service biologists as described above are also ways in which the USFS can reliably determine compliance with these requirements. The USFS continues to monitor many different aspects of the fire retardant program with respect to reviewing potential new products for use, to the amount used for each fire incident for each forest. The USFS keeps records and data on where the retardant has been dropped to ensure it is being dropped in the correct place and avoidance of aquatic systems is adhered to. When this is not feasible due to exceptions or other intrusions, the USFS has all of the information on that event to review the information and make the necessary corrections or confirm the intrusion has occurred and estimate or determine the likelihood and extent of any effects to species or critical habitats.

In addition, the USFS meets regularly with the Service headquarters staff and as needed with Service Field Office staff to discuss any anticipated changes to the Action or re-initiation triggers. The USFS and Service Field Office staff are anticipated to communicate openly and directly when there is need for avoidance mapping updates for species ranges or critical habitat maps. These are then finalized and provided to the headquarters staff of the respective agencies in November of each year prior to the following year fire season. The USFS also regularly complies with the conservation measures and terms and conditions outlined in the original 2011 BiOp such as monitoring water quality for waterbodies in the event of a misapplication (now termed intrusions; and this approach as was previously mentioned in item 4 above), or by compiling the number and approximate locations (pre-drop GPS coordinates of fire) of each aerial application of fire retardant drops by Forest as is mentioned in items number 3 and 4 above. This indicates they will continue to do so in the future.

Thus, we anticipate Action has a mechanism to reliably determine whether or to what degree the USFS has complied with the conditions, restrictions or mitigation measures.

Question 7. Adequacy of Controls - Does the Action have a mechanism to prevent or minimize endangered or threatened species or designated critical habitat from being exposed to stressors from the activities addressed under the Action:

- at durations, or frequencies that are potentially harmful to individual listed organisms, populations, or the species?
- to ecological consequences that are potentially harmful to individual listed organisms, populations, the species or physical and biological features of designated critical habitat?

The Action includes required exclusion areas (mapped avoidance areas) for 53 species and 19 critical habitats that were determined to be adversely affected by the Action. Any and all aquatic species or aquatic dependent species (species that rely on riparian areas for nesting and foraging for example) also have standardized mapped avoidance areas of 300 feet on either side of an aquatic waterbody indicating many more species beyond the 53 and 19 critical habitats mentioned above also have avoidance mapping required. This is a very effective aspect of the USFS fire retardant program to help avoid applying retardant into species ranges or critical habitat areas, and its effectiveness is supported by the very low national intrusion rate. One way the USFS ensures the avoidance mapping is implemented is that instruction for mapping of avoidance areas includes reminders to use the most up-to-date maps of designated critical habitat and species occurrence/habitat maps from the Service. Requirements for coordination meetings with local offices ensure that updated current species information is used and that discussion of any proposed changes to buffer widths occurs.

There are also several aspects of the USFS fire retardant program as described in the *Description of the Proposed Action* section of this Opinion that address the requirement of a mechanism to prevent or minimize endangered or threatened species or designated critical habitat from being exposed to stressors from the activities. One such part of the process is the USFS only utilizes fire retardant products that pass a rigorous testing regimen to ensure safety, adequacy, and minimal toxicity. As specifically stipulated in the *Description of the Proposed Action*, section, effects of the new products, to species under the jurisdiction of the Service (termed sensitive for purposes of the risk assessment analysis) are not to exceed the effects of products already in use by the USFS.

The USFS ensures the amount of retardant applied is the amount needed to effectively aid in fighting the fire. For example, the USFS applies the amount of retardant a certain fuel type (vegetation type) requires to control or eliminate a fire. The USFS then applies only the GPC needed (*see also* (Auxilio Management Services, 2021)). In addition, the USFS also ensures the products that will be approved and used in the future would not be more toxic or cause more harmful effects than products previously used.

The Implementation Guide (also described in the *Description of the Proposed Action* section of this Opinion) provides forests and regions all of the information necessary to implement national direction for aerial fire retardant use. The guide provides direction for personnel, including pilots, fire management officers, incident commanders, resource advisors, and others involved in the use of aerial fire retardant and is updated as needed to include any changes or updates that are needed. The guide is also updated periodically to address changes in technology, data, methodology, retardant products, or other items as appropriate.

Additionally, every 2 years, the USFS will provide Service Headquarters with summary that evaluates the cumulative impacts of their continued use of fire retardants; similar information is to be submitted in a 5-year compliance review reporting and monitoring data compilation.

Together with the proposed implementation of the Action, the structured approach to determining the factors described above, and the regular check-ins, we anticipate the USFS has structured the program to address the question described above.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State or private activities that are reasonably certain to occur within the action area of the Federal action subject to consultation.” (50 CFR 402.02). Future Federal actions that are unrelated to the Action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Declines in the abundance or range of many threatened, endangered, proposed or candidate, and other special status species are attributable to various human activities on State, and private lands. We anticipate human population expansion and associated infrastructure, commercial, and private development will occur in the action area via various State, tribal, local and private actions. Such activities will likely include, but are not limited to:

- Water use and withdrawals (e.g., water retention, diversion, or dewatering of springs, wetlands, natural and artificial impoundments, and streams)
- Land and water development including excavation, dredging, construction of roads, housing, and commercial and industrial activities

- Agriculture activities
- Mining and mineral extraction activities
- Recreational activities
- Expansion, or changes in land use for agricultural or grazing activities, and other land uses including alteration or clearing of native habitats for domestic animals or crops
- Inadvertent introductions of non-native plant, wildlife, or fish or other aquatic species, which can alter native habitats or out-compete or prey upon native species
- Fire suppression activities
- Road deicing and dust abatement associated with waterbodies where chemicals may accumulate.

All manner of development and competing use projects and activities (as above) are likely to continue in many areas, resulting in clearing, addition of impervious surfaces, and introductions of non-native species. These activities are expected to result in various impacts to water quality, habitat quality, and other negative effects to listed species and their critical habitats. Where implemented with appropriate avoidance and minimization measures to reduce the potential for lethal, sub-lethal, and indirect effects to listed species and their critical habitats, such projects could improve habitat conditions, thereby benefitting the species. However, in the absence of specific information for such activities, or for sufficient avoidance and minimization measures for other activities described above, we anticipate listed species will continue to be impacted as described previously in the Environmental Baseline section of this Opinion.

We also anticipate that conservation actions, such as habitat enhancement and restoration activities, will be undertaken in accordance with regional plans, recovery plans, and other planned or ongoing efforts. Where implementation is undertaken and successful, these activities are likely to benefit certain listed species and their habitats, food base, hosts, pollinators and other related species to varying degrees.

Given the broad geographic extent of the action area, many of the activities mentioned in the paragraphs above are expected within the ranges of various Federally listed wildlife, fish, and plant species, and could contribute to cumulative adverse, and in some cases beneficial, consequences to the species within the action area. We anticipate that species with small population sizes, high degrees of endemism or limited distributions, or slow reproductive rates will generally be more susceptible to cumulative effects than species with greater resilience and redundancy to stochastic events (i.e., via multiple stable or increasing populations). For example, narrow endemics confined to specific habitat locations may experience habitat degradation that in turn results in reductions in individuals or even localized extirpations. Where such a species is unable to recolonize or repopulate the habitat, species-level declines would be expected. Species with single or small numbers of populations may struggle to maintain sufficient numbers of individuals to persist, where cumulative effects result in loss of individuals or habitat degradation. Designated and proposed critical habitats with essential physical and biological features that are affected by these activities may also experience varying levels of degradation or improvement from these activities.

INTEGRATION AND SYNTHESIS

In this section, we consider whether the proposed activities associated with USFS lands across the United States are likely to reduce the survival and recovery of the listed resources considered in this Opinion into the future. We also consider whether the Action is likely to result in destruction or adverse modification of critical habitat. This section considers the overall effects of the Action to these species and their designated critical habitats in the context of the status of the species and critical habitats, the environmental baseline, and cumulative effects.

A significant portion of the USFS lands, including wetlands, and adjacent habitats have been impacted by anthropogenic stressors described within this Opinion. In the *Environmental Baseline*, *Status of the Species*, and *Cumulative Effects* sections of the Opinion, we established that the effects of past and ongoing activities in the action area would maintain the existing degraded habitat conditions that are prevalent. Listing documents and recovery plans for the listed species in the action area describe numerous causes of decline and threats to these species throughout their ranges.

In the *Effects of the Action* section, we built on the USFS's effects analysis from the BA, which included the screening processes. We worked closely with the USFS in the development of the BA and its addenda, and we agree with their effect determinations made for species and their critical habitats due to the exposure to fire retardant and other associated activities. In the *Effects of the Action* section, we provided an overview of the types of effects that would typically be expected from the stressors associated with the use of aerial fire retardant on National Forest System Lands. While effects differ by taxa group, species, and PBFs of critical habitat, we anticipated effects and species responses generally relate to exposure to aerial fire retardant chemicals, disturbance from aircraft and associated operations, and physical effects from the deployment of chemicals. Although not every taxa group may have the same sensitivity to the various stressors, we identified which stressor(s) are expected to result in adverse effects to individuals of the species. For example, while we do not anticipate disturbance impacts to plants or insects from operation of aircraft, we do anticipate that exposure to fire retardant chemicals would likely result in toxicity or physical effects, or, in the case of plants, impacts to insect pollinators or seed dispersers. Similarly, we anticipate that most birds considered in this Opinion are highly mobile and would be easily able to evade fire retardant chemicals or activities resulting in disturbance; individuals would also be able to find additional food resources, should there be localized reductions due to fire retardant applications. While vulnerable life history stages, such as nestlings, would not be able to escape fire retardant applications, we expect the timing or location of nesting habitats outside of likely application areas (due to fire risk) would reduce the likelihood of exposure. Likewise, we expect species such as fish and other aquatic or riparian-associated species are less likely to be exposed due to the use of avoidance areas. We briefly summarize again the anticipated effects to species and their critical habitats in the taxa sections below.

We then described how the USFS has structured the aerial fire retardant programmatic methodology to address their oversight of fire fighting activities on National Forests as it relates to effects to listed, proposed, and candidate species and their critical habitats. Additionally, we considered whether, and to what degree, the USFS structured their methodology of avoidance mapping coupled with their two-tier screening process approach to establish a method which addresses adverse effects to species and critical habitats and ensures the application of aerial fire retardant is not likely to jeopardize the continued existence of endangered or threatened species or destroy or adversely modify designated critical habitat. We addressed this by answering seven questions, as summarized below.

First, we concluded that the USFS understands the scope of their action for implementation of delivery of aerial fire retardant. The USFS has determined which forests are likely to require treatment, air tanker base locations and other associated activities. The USFS is able to do so accurately because the implementation of the Action requires the USFS and its contractors to maintain records of where, when, and how much retardant is dropped each time it is dropped. Second, we expect the USFS understands the types of stressors from the Action, as they understand the mechanism of action of the retardant chemicals and the potential toxicity to a variety of taxa groups via direct or indirect exposure, effects from the noise and visual disturbance of an approaching aircraft carrying retardant to a fire location, and other related stressors described herein. Third, the USFS has identified which and to what degree listed, proposed, and candidate species and their critical habitats are likely to be affected by the Action. The USFS reliably estimates exposure of ESA listed resources to these stressors and includes avoidance and minimization measures as standard procedures to address such exposures.

Fourth, the USFS collects and monitors information on the application of aerial fire retardant and associated activities each time it is used on a fire and it is a requirement of their program to do so. The USFS understands the potential effect of a retardant used, controls which retardants are accepted for use and that can be added to the QPL, and has the data to support assumptions about where retardants have been used in the past. Fifth, the USFS has structured their program to ensure they can determine responses of listed resources to stressors caused by the proposed activities. For example, the USFS understands the effects of retardant and the two-tier screening methodology is in place to reliably estimate the effects determinations they have made for this consultation. Sixth, the USFS program includes monitoring as a central aspect of the program. The USFS controls the criteria used to ensure retardant safety and efficacy (as defined previously in the *Effects of the Action* section) as well as ensures the program goals (safely and effectively control wildland fires on National Forest System Lands) are met with minimal impacts to listed resources through the use of avoidance mapping and the knowledge of retardant use patterns for each National Forest.

Finally, the USFS has several mechanisms in place to ensure minimal impacts occur to listed resources. Examples include required avoidance mapping as standard for all waterbodies, required avoidance mapping for several terrestrial species and critical habitats, as well as monitoring of all aspects of the program to maintain the necessary data to ascribe a low intrusion rate across all National Forests. A low intrusion rate across the action area indicates retardant applications are being placed where they should be and that there are a very small number of instances where exceptions are needed or intrusions occur. This review of the USFS aerial fire retardant application programmatic structure gives us confidence in the ability of the USFS to ensure its activities in this program are not likely to jeopardize the continued existence of endangered, threatened, proposed, and candidate species or destroy or adversely modify their critical habitats.

Summaries by Taxa Group

In the following sections, we briefly summarize our analysis for each species and critical habitat for which USFS made LAA determinations. As part of our analysis, we also looked at the risk of exposure based on recent past usage of fire retardants. Since the 2011 Opinion, the USFS has provided available data for usage and intrusions for wildlife and aquatic species using information from 2012-2019[29]. Data for usage for plants was also provided by the 2012-2019 data set however intrusions for plants were only provided using data from 2012-2018. We found that past usage fell into three categories: 1) no anticipated exposure, where species or critical habitat were present or likely present in exclusion areas (i.e., avoidance areas), and no intrusions occurred; 2) anticipated exposure from fire retardant use, where species or critical habitat were present or likely present in exclusion areas where intrusions occurred[30]; and 3) anticipated exposure from fire retardant use where species and critical habitat were not within an exclusion area (e.g., no avoidance area was identified or developed for a species or critical habitat). Based on the ability of the USFS to carry out the avoidance of fire-drops in the exclusion areas, it is primarily the last two categories of species and critical habitat that we anticipate future exposure and injurious, sublethal, and disturbance effects from the use of fire retardant and other related activities.

Amphibians

The frogs, toads and salamanders considered in this Opinion are most likely to be affected by stressors from the Action through exposure to fire retardant chemicals, physical impacts from retardant drops, and through reductions in their food resources from applications. However, we anticipate that any effects to these species would be rare over the duration of the Action, due to species life histories and the USFS's use of avoidance areas both for species and aquatic habitats. We do not expect other stressors of the Action, such as noise and visual disturbance from aircraft, are likely to result in adverse effects to these species.

Based on the available monitoring information, we anticipate intrusions into the aquatic and species-specific avoidance areas will be rare over the duration of the Action. For example, from 2012 through 2019, intrusions of retardant into water, both accidental and due to an exception, were rare, and occurred at a rate of 0.43 percent of all retardant drops. In the event retardant was dropped into a waterbody or occupied area, we expect that each of these species (as a whole) would be able to withstand the loss of a small number of individuals. Furthermore, we expect individuals of each of these species are likely to be found dispersed throughout the watershed (e.g., upstream or downstream of the retardant drop or within tributaries) or within streamside or upslope burrows (Oregon spotted frog, mountain yellow-legged frog [Northern California DPS], Yosemite Toad) where retardant drops would be less likely to impact individuals. In the case of jettison areas, we anticipate that these will be used infrequently, and that any retardant drops will be limited in geographic scope (approximately an acre), reducing the likelihood of exposure. In

[29] The USFS is continuing to compile more recent data (since 2019 and 2018 for wildlife/aquatic and plant species, respectively), although this information was not available prior to the completion of this BO. This and any additional future information will be included during preparation of subsequent reporting efforts and discussed during future coordination with the Service as part of the monitoring and reporting activities over the duration of the action.
[30] Although intrusions in this category occurred within avoidance areas (e.g., buffers adjacent to habitat or critical habitat), actual exposure of individuals was not necessarily thought to occur in all instances.

the unlikely event that all or many individuals in a localized area are killed from exposure to fire retardant chemicals or physical impacts from applications or jettisoned fire retardant, individuals from within the watershed (e.g., upstream), other populations (e.g., adjacent watersheds), or those with individuals or populations that exist outside of National Forests (e.g., the amphibians in and around the Sierra Nevada mountains, arroyo toad, Chiricahua leopard frog) would remain unaffected, and would likely recolonize the area of localized extirpation over time. We assume that forest units with a greater application potential may have a higher probability of intrusions. We also assume that increased retardant use would result in an increase in number of intrusions, but this would not alter the intrusion rates.

Based on past monitoring data related to intrusions, we anticipate that very small numbers of mountain yellow-legged frogs (southern California DPS) and arroyo toads will experience mortality or sublethal effects from the Action, but species-level effects are not expected. Small numbers of individuals of the other amphibian species considered in this Opinion may also be affected by the stressors described above, but we do not anticipate species-level effects. Therefore, we do not anticipate that the Action would appreciably reduce survival and recovery of these amphibian species.

Birds

The bird species considered in this Opinion are most likely to be affected by stressors from the Action through exposure to fire retardant chemicals, physical impacts from retardant drops, reductions in their food resources from application and noise and visual disturbance from aircraft. However, we anticipate that effects to these species would be rare over the duration of the Action. While small numbers of individuals of each of these species may be affected, we do not anticipate the Action would result in species-level effects for the Mexican spotted owl, northern spotted owl, coastal California gnatcatcher, and marbled murrelet.

The avian species considered in this Opinion are wide-ranging and highly mobile species. We assume that most individuals of these species would be able to flee an oncoming fire (thus largely avoiding impacts from retardant use), and can travel to other areas within or outside of National Forests that are not impacted by retardant where habitat is available to them. In some cases, these species do not occupy the types of habitat within these National Forests where retardant would typically be applied. For example, although marbled murrelets nest in forests and are detected inland during Spring and Summer (late March through late September), they spend the remaining portion of the year in marine habitats and nesting habitat would most likely be in areas such as mature coastal conifer forests along rocky inter-tidal shorelines (USFWS, 1997) where fire retardant would not be applied. For other individuals of these avian species, impacts from fire retardant would be rare during the breeding season because they do not nest or breed when fire season occurs, although we anticipate effects to some individuals during the non-breeding period (e.g., coastal California gnatcatcher) where exposure occurs. For species that do nest or breed during the fire season (e.g., Mexican spotted owl, northern spotted owl), the adults and/or young may not be able to flee these areas where exposure occurs. However, we anticipate that if a startle response is elicited from a passing aircraft, the owls will flush but return to their nest and there would be very little if any impact on reproductive success (Delaney, Grubb, Beier, Pater, & Reiser, 1999). In contrast however, there is still the likelihood that retardant could be dropped directly onto nesting adult and offspring or physical impacts from retardant dropping on tree limbs could also negatively impact these owls.

However, these species are wide ranging; treatment areas will not impact populations located outside of treatment areas or other National Forest System Lands. All of these species can withstand impacts to their populations from losses of small numbers of individuals as a result of retardant applications.

Individual gnatcatchers or owls may experience localized reductions of food resources, or may consume contaminated prey or other food items where these items have been exposed to fire retardant chemicals. However, such effects will likely be limited to no more than a few individuals over the duration of the Action. Where localized reductions in food resources occur, individuals of each of these species would be able to easily access other areas for foraging, and lethal or sublethal effects to a small number of individuals that consume contaminated food items is not expected to result in species-level effects. Marbled murrelets forage in marine waters, including the provisioning of young during the nesting season, and are unlikely to experience either localized reductions in food availability or consumption of prey exposed to fire retardant chemicals.

Based on the available information, including monitoring data, we anticipate that very small numbers of all four of these species will experience fatality or sublethal effects; we do not expect species-level effects. Therefore, we do not anticipate that the Action would appreciably reduce survival and recovery of these avian species.

Terrestrial Invertebrates

The terrestrial invertebrates considered in this Opinion are most likely to be affected by stressors from the Action through exposure to fire retardant chemicals, physical impacts from retardant drops, reductions in their food resources from applications, and alteration of their habitats from retardant effects to vegetation (e.g., fertilization or toxicity, promotion of invasive species, physical effects to plant structure) affecting plant growth and health. However, we anticipate that any effects to these species would be rare over the duration of the Action, due to the species' life histories and the USFS's use of avoidance areas both for species and aquatic habitats. We do not expect other stressors of the Action, such as noise and visual disturbance from aircraft, are likely to result in adverse effects to these species.

The USFS made a LAA call for the following terrestrial invertebrates: Franklin's bumble bee, meltwater lednian stonefly, western glacier stonefly, Quino checkerspot butterfly, Laguna mountains skipper, Pawnee montane skipper, Smith's blue butterfly, Kern primrose sphynx moth, Hermes copper butterfly, Mount Charleston blue butterfly, Sacramento Mountains checkerspot butterfly (proposed threatened), and the Morro shoulderband snail. Where retardant use occurs within these species' ranges, such use could have localized impacts to individuals through mortality due to a retardant drop landing directly on top of them, or to their forage or habitat types upon which individuals of these species rely (e.g., host plants for butterflies, flowering plants for Franklin's bumble bee foraging, aquatic invertebrates for the larval stage of the stoneflies, algal composition for the Morro shoulderband snail). However, most of these species are in habitats where retardant is less likely to be applied and have required avoidance mapping (e.g., the stoneflies are in high altitude habitats in riparian and aquatic areas that have required waterbody avoidance mapping) or the terrestrial species with required avoidance mapping (the Hermes copper butterfly, Quino checkerspot butterfly, Kern primrose sphinx moth, Mount Charleston blue butterfly, Laguna Mountains skipper, Smith's blue butterfly, Sacramento Mountains checkerspot butterfly and the Morro shoulderband snail). Some species do not have avoidance mapping, though in these cases, risks are low (Franklin's bumble bee), or risk of wildfire is far greater than the potential for negative impacts from retardant use (Pawnee montane skipper). In the rare event retardant was dropped into an occupied area, we expect that each of these species (as a whole) would be able to withstand the loss of those individuals. Furthermore, we expect that individuals of these species are dispersed to varying degrees throughout their range, and in many cases, would be able repopulate areas of localized extirpation from nearby areas. We anticipate the low likelihood of intrusions, or otherwise low risk of exposure for species without designated avoidance areas, will limit the number of individuals that experience mortality from the proposed activities, and that none of the species will experience species-level effects. Based on the available information, including information on past intrusions, we expect impacts will occur to the Quino checkerspot butterfly, Franklin's bumble bee, and Pawnee montane skipper due to the direct exposure to retardant chemicals, loss of some floral resources and the suppression of wildfire needed to support suitable habitats for these species. We expect that small numbers of individuals of the remaining species may experience similar effects over the duration of the Action. However, we do not expect species level effects to occur, and we do not anticipate that the Action would appreciably reduce survival and recovery of these terrestrial invertebrate species.

Terrestrial Invertebrate Critical Habitats

Although we anticipate that PBFs may be adversely affected over the duration of the Action from the use of fire retardants, we do not anticipate that these effects will diminish the value of the critical habitat for these species. The relatively short duration of effects, considered together with avoidance mapping for all but one of the critical habitats, further mitigates the effects to the critical habitats. Avoidance mapping is required for the designated critical habitats for the Quino checkerspot butterfly, Laguna Mountains skipper, Smith's blue butterfly, Hermes copper butterfly, and the Mount Charleston blue butterfly. The USFS has not identified any required avoidance mapping for the Pawnee montane skipper's proposed critical habitat.

Retardant may impact the PBFs for these critical habitats in terms of fertilizing effects to the vegetation types (host plants, feeding plants, vegetation on the terrain, etc.) and others as described above for the species. In addition, retardant salts constituents can negatively impact standing water due to the toxicity of ammonia or magnesium chloride salts. The presence of avoidance buffers will greatly reduce the likelihood of retardant impacting the PBFs for these critical habitats. For the Pawnee montane skipper's proposed critical habitat, where there is no avoidance mapping, the Service Field Office and USFS agreed that the risk of wildfire is far greater than the potential for negative impacts from retardant use. The area proposed as critical habitat contains the only known population of this butterfly species and the proposed critical habitat rule did not identify PBFs. However, we anticipate that any effects to the critical habitats for these species will be relatively short-term and will not result in long-lasting impacts to the PBFs.

Therefore, we do not anticipate that the Action would appreciably diminish the value of critical habitat as a whole for the conservation of the Quino checkerspot butterfly, Laguna Mountains skipper, Smith's blue butterfly, Pawnee montane skipper, Hermes copper butterfly, or the Mount Charleston blue butterfly.

Mammals

The mammal species considered in this Opinion – New Mexico jumping mouse, Preble's meadow jumping mouse, San Bernardino Merriam's kangaroo rat, Utah prairie dog, northern Idaho ground squirrel, and Columbia Basin pygmy rabbit – are most likely to be affected by stressors from the Action through exposure to fire retardant chemicals and physical impacts from retardant drops (on National Forest System Lands and within the Moses Coulee jettison area as described for the Columbia Basin pygmy rabbit), as well as effects to their food resources. We do not anticipate all of these species would be equally affected by noise and visual disturbance from aircraft based on behavior and life history characteristics. We anticipate that any effects to these species would be rare over the duration of the Action. While small numbers of individuals of each of these species may be affected, we do not anticipate the Action would result in species-level effects.

Based on the available information, we anticipate exposure will be rare for all of these species. Most of the species have required avoidance areas (New Mexico meadow jumping mouse, Preble's meadow jumping mouse, San Bernardino Merriam's kangaroo rat, Utah prairie dog and northern Idaho ground squirrel), and the remaining species (Columbia Basin pygmy rabbit) occurs in a secondary jettison use area where exposure will be infrequent over the duration of the action. We anticipate there is risk to survival, growth, and reproduction of omnivorous individuals (i.e., jumping mice, kangaroo rat) from ingestion of retardant, where exposure occurs, although this risk is mitigated to some degree by their close association with riparian areas that would also be included in aquatic avoidance areas for these species. Additionally, most of these species are nocturnal/crepuscular or fossorial, limiting the likelihood of direct exposure from retardant, which is aerially applied during the day. In the case of the Columbia Basin pygmy rabbit, the Moses Coulee jettison area is a secondary jettison area, and will thus be used less frequently. We anticipate that exposure will be rare, though as ongoing or future reintroductions occur, small numbers of individual rabbits may also be exposed to jettisoned retardant. For all of these species, retardant use is likely to impact the forage base or habitat types, as they all rely on vegetation for cover and foraging. In the rare event retardant was dropped into the avoidance areas or jettison areas for these species, we expect that each of these species (as a whole) would be able to withstand the loss of a small number of individuals. Furthermore, we expect individuals of each of these species are likely to be found dispersed throughout their range and would be able to recolonize areas of local extirpation. For example, populations of the New Mexico meadow jumping mouse and the San Bernardino Merriam's kangaroo rat are also found in areas not on National Forests.

Based on past monitoring data, we anticipate that very small numbers of these species may experience mortality or sublethal effects from the Action, but species-level effects are not expected. Therefore, we do not anticipate that the Action would appreciably reduce survival and recovery of the New Mexico jumping mouse, Preble's meadow jumping mouse, San Bernardino Merriam's kangaroo rat, Utah prairie dog, northern Idaho ground squirrel, and Columbia Basin pygmy rabbit.

Fully Aquatic Species (Fish and Invertebrates)

The fish and aquatic invertebrates considered in this Opinion are most likely to be affected by stressors from the Action through exposure to fire retardant chemicals, as well as effects to their food resources and habitat. However, we anticipate that any effects to these species would be rare over the duration of the Action, due to species life histories and the USFS's use of avoidance areas for aquatic habitats in which all of these species occur. We do not anticipate these species would be affected by noise and visual disturbance from aircraft or related activities. While small numbers of individuals of each of these species may be affected as described below, we do not anticipate the Action would result in species-level effects.

<u>Fish</u>

Based on the available monitoring information, we anticipate intrusions into the aquatic and species-specific avoidance areas will be rare over the duration of the Action. For example, only two fish species (bull trout, greenback cutthroat trout) have had documented intrusions into their occupied habitat based on past monitoring and reporting from the last eight years of data (2012-2020). Furthermore, from 2012 through 2019, intrusions of retardant into water as a whole, both accidental and due to an exception, were rare, and occurred at a rate of 0.43 percent of all retardant drops. In these rare events when retardant is dropped into a waterbody or occupied area, we anticipate that each of these species (as a whole) would be able to withstand the loss of a small number of individuals. This assumption is based upon the low likelihood of exposure of individuals of these species due to avoidance of application in aquatic systems, the small quantities discharged, and the dilution of toxic effects in the very rare instances where retardant chemicals enter a waterbody from an intrusion. The USFS identifies all aquatic habitat as avoidance areas (i.e., with 300-foot avoidance buffer from the edge of the stream), greatly reducing the likelihood of exposure for these species at all life stages. For some fish species, avoidance mapping is extended to 600 feet due to the steep drainage areas in which they are found (e.g., Santa Ana sucker), or to further decrease the possibility of retardant entering the waterbody in which they are found (greenback cutthroat trout, Paiute cutthroat trout, Lahontan cutthroat trout, Apache trout, Little Kern golden trout). For all fish species herein, including the bull trout, additional minimization and monitoring measures resulting from the bull trout consultation in 2019 were implemented. These minimization and monitoring measures were specifically designed to address the intrusion events into the avoidance areas for bull trout that occurred on the Lolo Forest in 2017. These include monitoring affected streams for 5 years following an intrusion resulting in death of fish, and tracking by the National Forest of the location and quantity of retardant. We assume that units with a greater application potential may have a higher probability of intrusions. We also assume that increased retardant use would result in an increase in number of intrusions, but this would not alter the intrusion rates.

Furthermore, we expect individuals of each of these species are likely to be found dispersed throughout the watershed (e.g., upstream or downstream of the retardant drop or within tributaries) where retardant drops would be less likely to impact individuals. In the unlikely event that all or many individuals in a localized area are killed from exposure to fire retardant chemicals or physical impacts from applications, individuals from within the watershed (e.g., upstream) or other populations (e.g., adjacent watersheds) would remain unaffected, and would likely recolonize the area of localized extirpation over time.

We also anticipate that the food resources of these species are not likely to be affected by fire retardant applications as the aquatic avoidance buffers will limit intrusion risk. Where there are intrusions, the small amounts of retardant and their resident time in the aquatic systems are not likely to result in measurable effects to food resources (e.g., aquatic invertebrates, other fish, or plant species). In very rare instances, small, localized reductions in availability of food items are possible.

Based on past monitoring data related to intrusions, we anticipate that very small numbers of bull trout and greenback cutthroat trout will experience mortality or sublethal effects from the Action, but species-level effects are not expected. Small numbers of individuals of the other fish species considered in this Opinion may also be affected by the stressors described above, but we do not anticipate species-level effects. Therefore, we do not anticipate that the Action would appreciably reduce survival and recovery of the Apache trout, bonytail chub, bull trout, Chihuahua chub, Colorado pikeminnow (the listed entity and its non-essential experimental population), desert pupfish, Gila chub, Gila topminnow, Gila trout, greenback cutthroat trout, humpback chub, Lahontan cutthroat trout, Little Colorado spinedace, Little Kern golden trout, loach minnow, Lost River sucker, Owens tui chub, Paiute cutthroat trout, railroad valley springfish, razorback sucker, Santa Ana sucker, shortnose sucker, Sonora chub, spikedace, unarmored three-spine stickleback, Yaqui catfish, Yaqui chub, and Zuni bluehead sucker.

Fish Critical Habitats

The USFS also made LAA determinations for critical habitat for several fish species: Zuni bluehead sucker, Santa Ana sucker, shortnose sucker, Lost River sucker, Owens tui chub, Sonora chub, Gila chub, little Colorado spinedace, spikedace, Little Kern golden trout, Gila trout, bull trout, loach minnow, or razorback sucker. The PBFs for many of these fish species' critical habitats include adequate flowing, well oxygenated water with mesohabitat of riffles, pools, and runs with differing substrate such as gravel, pebble, sand, silt, and low turbidity. Other features include adequate riparian vegetation and structure as well as an abundant aquatic food base consisting of fine particulate organic material, filamentous algae, insect larvae, and small terrestrial insects. Sufficient water depth and a precise temperature regime are also mentioned in the descriptions of the PBFs.

While retardant is not expected to impact water depth, temperature, flow or other physical structures of the PBFs, retardant is expected to impact the water quality in the rare event exposure occurs, although such effects are likely to be short-term and not result in long-lasting effects. With the introduction of ammonia into the water column, this can result in altered dissolved oxygen levels as a function of the altered vegetation or algal growth. Altering the vegetation type and increases in algal growth can also impact the diversity or abundance of aquatic invertebrate prey items. As previously discussed, we do not anticipate these impacts will be long–term, as ammonia or magnesium introductions to the water column will cause short-term toxic effects and as such will likely only temporarily alter the water quality or prey resources for these fish critical habitats. Given the geographic extent of the ranges and critical habitat for most of these species, an intrusion event affecting a limited area from a drop or series of drops is not anticipated to result in adverse modification of the critical habitat, despite the possibility of temporary impacts to water quality to localized areas. For the Zuni bluehead sucker, Sonora chub, Owens tui chub, and Little Kern golden trout, the geographic extent of designated habitat is limited and in the unlikely event of an intrusion or exception in these areas effects to the critical habitat as a whole could be more concerning. However, we anticipate such intrusions or exceptions into critical habitat for these species would be, at most, extremely rare, and unlikely to occur over the duration of the Action; the USFS aquatic avoidance area mapping has been implemented with very few drops into aquatic critical habitats, with the only known exception to be that of the bull trout critical habitat. This species has more widespread critical habitat areas designated, and any localized effects to the critical habitat from a rare intrusion or exception would not likely diminish the value of the critical habitat as a whole. Therefore, we do not anticipate that the Action would appreciably diminish the value of critical habitat as a whole for the conservation of the Zuni bluehead sucker, Santa Ana sucker, shortnose sucker, Lost River sucker, Owens tui chub, Sonora chub, Gila chub, little Colorado spinedace, spikedace, Little Kern golden trout, Gila trout, bull trout, loach minnow, or razorback sucker.

Shasta crayfish

The Shasta crayfish is most likely to be affected by stressors from the Action through direct exposure to fire retardant chemicals and through reductions in their food resources from application, which would result in mortality or reductions in fitness of exposed individuals. However, we anticipate that any effects to this species would be rare over the duration of the Action. While small numbers of individuals of Shasta crayfish may be affected, we do not anticipate the Action would result in species-level effects.

The Shasta crayfish is strictly aquatic and is known from a limited range (less than 3,200 acres) of scattered, disjunct occurrences with declining numbers of individuals. There is also declining habitat quality in headwater areas fragmented by dams. This species was historicall found on the Lassen and Shasta-Trinity National Forests, which have moderate retardant application potential, and is currently found on the Modoc National Forest, which has high retardant application potential. Risk of mortality and sub-lethal effects are likely to occur if individuals of the species are exposed. We anticipate a similar effect to their prey base (small aquatic snails), and the potential for nitrifying effects to their forage base (periphyton), resulting in small, localized reductions to food resources. However, in the rare event that retardant is applied in these areas, the impacts would be short in duration given the natural conditions of the flowing systems where these crayfish are found and recolonization of food resources from other areas.

All aquatic habitats are avoidance mapped and applications would be unlikely to occur in the areas the crayfish inhabits. In particular, the aquatic areas where the Shasta crayfish is found have extended buffers of 1,000 feet for a distance of 6.2 miles upstream of Shasta crayfish occurrences due to their limited extent and scattered populations within their range. These avoidance areas are implemented 6.2 miles upstream of known locations, and are 1000 feet wide and therefore the avoidance areas extend onto the Lassen and the Shasta-Trinity National Forests even though the species is not found on the Lassen. Thus, we anticipate that only very small numbers of individuals of may be affected over the duration of the Action, and we do not expect species-level effects to occur. Therefore, we do not anticipate that the Action would appreciably reduce survival and recovery of the Shasta crayfish.

Three Forks spring snail

We anticipate that the Action will result in exposure to, at most, very small numbers of individuals of this species, although we anticipate such exposure is extremely unlikely to occur. The Three Forks spring snail is only known in spring complexes in the White Mountains on the Apache National Forest in eastern Arizona. All aquatic habitat is included in avoidance areas, and the Apache National Forest is a low retardant use forest, greatly reducing the likelihood of exposure for this species at all life stages and well as its food resource (algae). In the extremely rare case (e.g., an intrusion or exception) where fire retardant is used in or near the species habitats, we would anticipate effects to a small number of individual snails (impairing their ability to move or breathe) and small reductions in food resources. However, we anticipate it is extremely unlikely such exposure would occur over the duration of the Action, and we do not anticipate any species-level effects.

Three Forks spring snail Critical Habitat

Critical habitat of 17.2 acres is designated for the Three Forks springsnail and it all occurs on the Apache National Forest, a low retardant use forest. The PBFs consist of clean spring water (free from contamination) emerging from the ground and flowing on the surface; a substantial food source of periphyton and decaying organic matter, adequate substrate such as cobble, gravel, pebble, sand and silt for egg laying, feeding and escaping from predators as well as lack of non-native predators such as crayfish or other snails. Aerially delivered retardant would not impact the substrate PBF, though other PBFs may be affected, should exposure occur. In the extremely unlikely case retardant chemicals were to enter the water, it would cause short term and localized contamination with the introduction of ammonia or magnesium, and could result in increased growth of algae, or killing of algae from the ammonia constituents of the retardant. However, because the Apache National Forest is a low retardant use forest, use of retardant would occur rarely, and the avoidance mapping would further reduce the likelihood of retardant impacting the PBFs. Therefore, we do not anticipate that the Action would appreciably diminish the value of critical habitat as a whole for the conservation of the Three Forks spring snail.

Plants

The plant species considered in this Opinion are most likely to be affected by stressors from the Action through exposure to fire retardant chemicals and physical impacts from retardant drops, as well as effects to their pollinators and seed dispersers, where these species are required for reproduction. We do not anticipate these species or their pollinators and seed dispersers would be generally affected by noise and visual disturbance from aircraft or related activities, although small numbers of avian or mammalian pollinators or seed dispersers may experience disturbance. However, we anticipate that any effects to these species would be rare over the duration of the Action, due to species' life histories and the USFS's use of avoidance areas as described in this

Opinion. Thus, while small numbers of individuals of each of these species may be affected as described below, we do not anticipate the Action would result in species-level effects.

Based on the available monitoring information, we anticipate intrusions will be rare over the duration of the Action. In the event retardant was dropped into area in which these species or their pollinators or seed dispersers occur, we expect that each of these species (as a whole) would be able to withstand the loss of a small number of individuals or minor reductions in reproductive success. For many plant species, the use of avoidance mapping areas reduces the potential physical impacts from retardant applications and fertilizing effects of retardant to native plant diversity and non-native invasive species. A handful of plant species do not have avoidance mapping (Santa Ana River woollystar, Todsen's pennyroyal, Holy Ghost ipomopsis, and the Bakersfield cactus) for a variety of reasons. For example, for some species, the threat of wildfire far outweighs the concern for the effects of the retardant, or the introduction of non-natives from the fire threat is also greater than the impacts anticipated from the use of fire retardant.

Impacts to pollinators or seed dispersers (most likely insects, birds, or bats) could include risk of mortality from the physical impacts of a large retardant drop, as well as ingestion of plant or nectar material and direct contact from the retardant chemical that would also result in mortality of individuals. However, we anticipate that retardant use in areas where these listed plants are found would not impact a significant portion of the seed dispersers or pollinator populations on which a listed plant may rely and there would still be sufficient numbers to continue to pollinate or propagate the seeds for these listed plants.

Based on the available information from past monitoring efforts, we anticipate that small numbers of individuals of 11 plant species will be affected through exposure to chemicals or through effects from competing nonnative plants that benefit from fertilization effects, as described in the next section. These include plants where retardant drops have occurred within the range of the species: slender-horned spineflower, Cushenbury oxytheca, Cushenbury milk-vetch, Parish's daisy, Cushenbury buckwheat, San Bernardino Mountains bladderpod, Bear Valley sandwort, ash-grey paintbrush, Southern Mountain wild buckwheat, slender orcutt grass, and Bakersfield cactus. We anticipate that small numbers of individuals of each of the remaining plants may be similarly affected over the duration of the Action. However, we do not expect species-level effects to occur for any of these species. Therefore, we do not anticipate that the Action would appreciably reduce survival and recovery of these plant species listed in **Table 25**.

CONCLUSION

After reviewing the current status and environmental baselines, the effects of the Action, and the cumulative effects, it is the Service's Opinion that the Action is not likely to jeopardize the continued existence of the species listed in **Table 24** and **Table 25**. This includes Conference Opinions on one candidate species, Wright's marsh thistle.

After reviewing the current status and environmental baselines, the effects of the Action, and the cumulative effects, it is the Service's Opinion that the Action is not likely to destroy or adversely modify the critical habitats listed in **Table 26**. This includes Conference Opinions on three proposed critical habitats: the Smith’s blue butterfly, and Pawnee montane skipper.

Table 24. Animal species considered in this Opinion.

Species Grouping	Common Name	Scientific Name
amphibian	Arroyo toad	*Anaxyrus californicus*
amphibian	California red-legged frog	*Rana draytonii*
amphibian	Chiricahua leopard frog	*Rana chiracahuensis*
amphibian	Mountain yellow-legged frog - northern California DPS	*Rana muscosa*
amphibian	Mountain yellow-legged frog - southern California DPS	*Rana muscosa*
amphibian	Oregon spotted frog	*Rana pretiosa*
amphibian	Sierra Nevada yellow-legged frog	*Rana sierrae*
amphibian	Sonora tiger salamander	*Ambystoma tigrinum stebbinsi*
amphibian	Yosemite toad	*Anaxyrus canorus*
amphibian	the South Sierra, South Coast, and North Feather distinct population segments foothill yellow-legged frog,	*Rana boylii*
amphibian	California tiger salamander Central Valley DPS, Santa Barbara County DPS, and Sonoma County DPS	*Ambyostoma californiense*
bird	coastal California gnatcatcher	*Polioptila californica californica*
bird	marbled murrelet	*Brachyramphus marmoratus*
bird	Mexican spotted owl	*Strix occidentalis lucida*
bird	northern spotted owl	*Strix occidentalis caurina*
crustacean	Shasta crayfish	*Pacifastacus fortis*
fish	Apache trout	*Oncorhynchus apache*
fish	bonytail chub	*Gila elegans*
fish	bull trout	*Salvelinus confluentus*
fish	Chihuahua chub	*Gila nigrescens*
fish	Colorado pikeminnow	*Ptychocheilus lucius*

Species Grouping	**Common Name**	**Scientific Name**
fish	desert pupfish	*Cyprinodon macularius*
fish	Gila chub	*Gila intermedia*
fish	Gila topminnow	*Poeciliposis occidentalis occidentalis*
fish	Gila trout	*Oncorhynchus gilae gilae*
fish	greenback cutthroat trout	*Oncorhynchus clarki stomias*
fish	humpback chub	*Gila cypha*
fish	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
fish	Little Colorado spinedace	*Lepidomeda vittata*
fish	Little Kern golden trout	*Oncorhynchus aguabonita whitei*
fish	loach minnow	*Tiaroga cobitis*
fish	Lost River sucker	*Deltistes luxatus*
fish	Owens tui chub	*Gila (Siphateles) bicolor snyderi*
fish	Paiute cutthroat trout	*Oncorhynchus clarki seleniris*
fish	railroad valley springfish	*Crenichthys nevadae*
fish	razorback sucker	*Xyrauchen texanus*
fish	Santa Ana sucker	*Catostomus santaanae*
fish	shortnose sucker	*Chasmistes brevirostris*
fish	Sonora chub	*Gila ditaenia*
fish	spikedace	*Meda fulgida*
fish	Unarmored 3-spine stickleback (Shay Creek stickleback)	*Gasterosteus aculeatus williamsoni*
fish	Yaqui catfish	*Ictalurus pricei*
fish	Yaqui chub	*Gila purpurea*
fish	Zuni bluehead sucker	*Catostomus discobolus yarrowi*
gastropod	Morro shoulderband (banded dune) snail	*Helminthoglypta walkeriana*
gastropod	Three Forks springsnail	*Pyrgulopsis trivialis*
insect	Franklin's bumble bee	*Bombus franklini*
insect	Hermes copper butterfly	*Hermelycaena (Lycaena) hermes*
insect	Kern primrose sphinx moth	*Euproserpinus euterpe*
insect	Laguna Mountains skipper	*Pyrgus ruralis lagunae*
insect	meltwater lednian stonefly	*Lednia tumana*
insect	Mt Charleston blue butterfly	*Icaricia shasta charlestonensis*
insect	Pawnee montane skipper	*Hesperia leonardus montana*
insect	Quino checkerspot butterfly	*Euphydryas editha quino*
insect	Smith's blue butterfly	*Euphilotes enoptes smithi*
insect	western glacier stonefly	*Zapada glacier*
insect	Sacramento Mountains checkerspot butterfly	*Euphydryas anicia cloudcrofti*

Species Grouping	Common Name	Scientific Name
mammal	New Mexico meadow jumping mouse	*Zapus hudsonius luteus*
mammal	northern Idaho ground squirrel	*Urocitellus (Spermophilus) brunneus*
mammal	Preble's meadow jumping mouse	*Zapus hudsonius preblei*
mammal	San Bernardino Merriam's kangaroo rat	*Dipodomys merriami parvus*
mammal	Utah prairie dog	*Cyonomys parvidens*
Mammal	Columbia Basin pygmy rabbit	*Brachylagus idahoensis*

Table 25. Plant species considered in this Opinion.

Common Name	Scientific Name
San Diego thornmint	*Acanthomintha ilicifolia*
Munz's onion	*Allium munzii*
McDonald's rock cress	*Arabis macdonaldiana*
Bear Valley sandwort	*Arenaria ursina*
Sacramento prickly poppy	*Argemone pleiacantha spp. Pinnatisecta*
Cushenbury milk-vetch	*Astragalus albens*
Braunton's milk-vetch	*Astragalus brauntonii*
heliotrope milkvetch	*Astragalus montii*
triple-ribbed milk-vetch	*Astragalus tricarinatus*
Encinitas baccharis	*Baccharis vanessae*
Nevin's barberry	*Berberis nevinii*
thread-leaved brodiaea	*Brodiaea filifolia*
Mariposa pussypaws	*Calyptridium (Cistanthe) pulchellum*
Stebbins' morning glory	*Calystegia stebbinsii*
ash-grey paintbrush	*Castilleja cinerea*
California jewelflower	*Caulanthus californicus*
Vail Lake ceanothus	*Ceanothus ophiochilus*
purple amole (Camatta Canyon amole)	*Chlorogalum purpureum (var. reductum)*
Sacramento Mountains thistle	*Cirsium vinaceum*
Springville clarkia	*Clarkia springvillensis*
Lee pincushion cactus	*Coryphantha sneedii var. leei*
Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*
Wright's marsh thistle	*Crisium wrightii*
slender-horned spineflower	*Dodecahema leptoceras*
Santa Ana River woolly-star	*Eriastrum densifolium ssp. sanctorum*
Parish's daisy	*Erigeron parishii*
Southern Mountain buckwheat	*Eriogonum kennedyi var. austromontanum*

Common Name	Scientific Name
Cushenbury buckwheat	*Eriogonum ovalifolium var. vineum*
Bartram's stonecrop	*Graptopetalum bartramii*
showy stickseed	*Hackelia venusta*
Todsen's pennyroyal	*Hedeoma todsenii*
Holy Ghost ipomopsis	*Ipomopsis sancti-spiritus*
Webber's ivesia	*Ivesia webberi*
San Bernardino Mountains bladderpod	*Lesquerella kingii ssp. Bernardina (Physaria kingii ssp. bernardina)*
Huachuca water umbel	*Lilaeopsis schaffneriana spp. Recurva*
Macfarlane's four-o'clock	*Mirabilis macfarlanei*
Britton's beargrass	*Nolina brittoniana*
Bakersfield cactus	*Opuntia (basilaris var.) treleaseI*
slender orcutt grass	*Orcuttia tenuis*
Cushenbury oxytheca	*Oxytheca parishii var goodmaniana (Acanthoscyphus parishii var. goodmaniana)*
clay phacelia	*Phacelia argillacea*
Yreka phlox	*Phlox hirsuta*
San Bernardino bluegrass	*Poa atropurpurea*
Layne's butterweed	*Senecio layneae*
Wenatchee Mountains checker-mallow	*Sidalcea oregana var. calva*
Pedate checker-mallow	*Sidalcea pedata*
Spalding's catchfly	*Silence spaldingii*
Canelo Hills ladies- tresses	*Spiranthes delitescens*
California taraxacum	*Taraxacum californicum*
Slender-petaled mustard	*Thelypodium stenopetalum*
last chance townsendia	*Townsendia aprica*
Greene's tuctoria (orcutt grass)	*Tuctoria greenei*

Table 26. Critical habitat considered in this Opinion.

Species Grouping	Critical Habitat for (Common Name)	(Scientific Name)
amphibian	California tiger salamander Central Valley DPS, Santa Barbara County DPS, and Sonoma County DPS	*Ambystoma californiense*
fish	bull trout	*Salvelinus confluentus*
fish	Gila chub	*Gila intermedia*
fish	Little Colorado spinedace	*Lepidomeda vittata*

Species Grouping	**Critical Habitat for (Common Name)**	**(Scientific Name)**
fish	Little Kern golden trout	*Oncorhynchus aguabonita whitei*
fish	loach minnow	*Tiaroga cobitis*
fish	Lost River sucker	*Deltistes luxatus*
fish	Owens tui chub	*Gila (Siphateles) bicolor snyderi*
fish	razorback sucker	*Xyrauchen texanus*
fish	Santa Ana sucker	*Catostomus santaanae*
fish	shortnose sucker	*Chasmistes brevirostris*
fish	Sonora chub	*Gila ditaenia*
fish	spikedace	*Meda fulgida*
fish	Zuni bluehead sucker	*Catostomus discobolus yarrowi*
gastropod	Three Forks springsnail	*Pyrgulopsis trivialis*
insect	Hermes copper butterfly	*Hermelycaena (Lycaena) hermes*
insect	Laguna Mountains skipper	*Pyrgus ruralis lagunae*
insect	Mount Charleston blue butterfly	*Icaricia shasta charlestonensis*
insect	Pawnee montane skipper	*Hesperia leonardus montana*
insect	Quino checkerspot butterfly	*Euphydryas editha quino*
insect	Smith's blue butterfly	*Euphilotes enoptes smithi*

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and regulations issued pursuant to section 4(d) of the ESA prohibit the "take" of endangered and threatened species, respectively. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by the Service as an act which kills or injures wildlife, which may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Incidental Take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA, if such taking complies with the Terms and Conditions to carry out the Reasonable and Prudent Measures of this Incidental Take Statement.

For species proposed for listing under the ESA, the prohibitions against taking endangered species under section 9 of the ESA or under a Section 4(d) rule for threatened species do not apply until the species is listed. If the conference Opinion is adopted as an Opinion following a listing or critical habitat designation under section 4 of the ESA, the Reasonable and Prudent Measures, with their implementing Terms and Conditions, will be nondiscretionary. Terms and Conditions must be undertaken by the USFS, as appropriate, for the exemption in section 7(o)(2) to apply.

For proposed activities which incidental take of ESA-listed species is reasonably certain to occur, the amount and extent of incidental take anticipated from these Actions will be evaluated by the Service on a yearly basis through the Monitoring and Reporting Process and associated documentation submitted to the Service by May 1 of each year.

Section 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

Amount or Extent of Take Anticipated

While the BA provided an analysis of impacts related to stressors to ESA-listed species, the unpredictable nature of when and where fires will occur does not allow the Service to predict fire locations, the specific use of aerial fire retardant needed to respond to those fires and that may result in take of listed species, the number of individuals that might be taken by those aerial fire retardant applications, or the proportion of populations of endangered or threatened species these might represent (i.e., the impact of such incidental taking on the species).

For the majority of the listed animal species for which we anticipate incidental take is reasonably certain to occur, which are species associated with avoidance areas (46 species), the USFS will notify the Service of intrusions as previously described in this Opinion so we may quantify incidental take. While we will also quantify incidental take for the remaining 6 animal species (i.e., Mexican spotted owl, northern spotted owl, coastal California gnatcatcher, marbled murrelet, Franklin's bumble bee, and Pawnee montane skipper) as needed, in coordination with the USFS as part of the monitoring and reporting process, we recognize such take will be difficult to quantify, and thus we have included Reasonable and Prudent Measures and Terms and Conditions to address this challenge below.

As described in our conclusion, we anticipate the USFS will implement the action as proposed, which includes appropriate measures to minimize incidental take and detrimental effects, and that these measures will ensure that use of aerial fire retardant will minimize adverse effects and thereby avoid jeopardy to ESA-listed species identified in **Table 24** and avoid destruction or adverse modification of critical habitat.

Incidental take exemption will be afforded to the USFS when their program, including its implementation process, is carried out as described in this Opinion and incidental take statement. In addition, any take incidental to the use of aerial fire retardant through the implementation process described in this Opinion will be exempt from Section 9 and Section 4(d) prohibitions if the USFS implements the action as described in this Opinion, as well as the Reasonable and Prudent Measure and Terms and Conditions of this incidental take statement.

In summary, because of the large scale and broad scope of the proposed action, even the best scientific and commercial data available are not sufficient to enable the Service to accurately estimate the specific amount of potential incidental take associated with the action that is reasonably certain to occur. Incidental take of listed species will be quantified when applications of aerial fire retardant occur. This Incidental Take Statement does not apply in the absence of any take prohibited under Section 9 or Section 4(d) of the ESA.

Effect of the Take

In this Opinion, the Service determined that anticipated take is not likely to jeopardize any of the species in this Opinion, based on the anticipated effects from the retardant discussed in the *Effects of the Action* and *Integration and Synthesis* sections of this Opinion.

REASONABLE AND PRUDENT MEASURES

As part of the RPM and Terms and Conditions described below, we anticipate monitoring and reporting will be needed to confirm our assumptions in our Opinion, as well as the assumptions outlined in the USFS's BA. We anticipate that data collection will continue to occur over the duration of the action and that we will gain information on an annual basis. For the initial annual reporting, the Service expects that the first report will be transmitted no later than May 1, 2024, and then annually on this date, as described below, for the perpetuity of this Opinion.

The following reasonable and prudent measure is necessary and appropriate to minimize impacts of incidental take to the species covered in this Opinion.

1. The USFS will use its authorities to minimize impacts to listed species pursuant to the aerial fire retardant program.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 and section 4(d) of the ESA, the USFS must comply with the following terms and conditions, which implement the reasonable and prudent measure described above.

1. To minimize the impact of aerial fire retardant on the survival and reproduction of the species in this Opinion, the USFS shall ensure the following activities are completed and documented in a timely manner:
    a. For species with avoidance areas: Ensure consistency and timely reporting when retardant applications intrude into mapped avoidance areas for species and critical habitats. To the extent practicable (i.e., taking into account human safety concerns), the USFS will also ensure complete information is compiled on where and when intrusions occurred, including:

        i. Proximity to known or assumed listed species locations or habitat within the avoidance area or buffer or other biologically significant areas,

        ii. Whether any death or injury or anticipated impacts to individuals of listed animal species was observed or was reasonably certain to have occurred, along with a description of the impact and its extent, and a description of observable or measurable adverse effects to critical habitat(s).

        iii. Any additional considerations or observations that would inform assumptions about take (e.g., observation of loss of nests, or physical damage to habitat features or habitats, and extent thereof, etc.).

    b. For the remaining six species without avoidance areas:
        i. No later than the dates described below, the USFS will work with the Service to finalize monitoring and reporting requirements for the Franklin's bumble bee, northern spotted owl, and Mexican spotted owl. The requirements will identify at minimum, the Biologically Significant Areas (BSAs) to be included for the monitoring and reporting, the retardant drop data to include (i.e., dates, volume, chemical, etc.), and any additional supporting information related to the retardant application. USFS will also work with the Service to identify other information to be included in the monitoring and reporting, including information communicated at both the local level and in annual reporting by USFS HQ. Accomplishing this task by these dates will ensure reporting requirements are identified prior to the application of aerial fire retardant in areas occupied by these species. Written confirmation of the approach

for identifying areas for reporting on the above species will be provided to the Service and USFS headquarters for implementation and to be included in the administrative record for this consultation.

a) By March 1, 2023 - Mexican spotted owl
b) By June 30, 2023 – Franklin's bumble bee and northern spotted owl

ii. To the extent practicable, taking into account human safety concerns, the USFS will also ensure sufficient information is compiled on the location, extent, and timing of retardant applications that occurred within the BSAs for the Mexican spotted owl, northern spotted owl, and Franklin's bumble bee to enable the Service to estimate incidental take for these species. Such information will be submitted as part of the following year's monitoring and reporting documentation; if additional time is needed to compile and evaluate this data, the USFS shall notify the Service of the need for an extension of no more than one year.

iii. For the Pawnee montane skipper, coastal California gnatcatcher, and marbled murrelet, the USFS will include in their annual reporting a summary of the gallons of retardant used in applications in the national forests in which the species occur, along with any available information associated with these applications. For the marbled murrelet, required reporting will include only applications that occur during the nesting season for the species, as described previously in this Opinion.

c. The USFS will ensure consistency and timely annual reporting when summarizing aerially applied fire retardant applications (e.g., acres of forest burned, intrusion summary data, gallons of retardant used, intrusion location (water/buffer area, terrestrial, etc.)) by forest and region, consistent with the "Intrusion Reporting by Year" documentation accompanying the 2021 BA. Compile retardant use data from airports and airtanker bases regarding frequency and location of jettison occurrences and areas in proximity to listed species and their critical habitats. Include this information in the annual reports. Where airports and air tanker bases are operated or managed by other entities, the USFS will work with the other entities to ensure the monitoring data if already being collected by the entity, is made available to the USFS. These monitoring data should be included in the annual report and coordination with the Service as described in Term and Condition 4 below, as well as for planning for any additional necessary measures for the following fire year.

d. The USFS will work with the Service and focus Five Year Compliance Reviews to inform the Service regarding the effects of the aerial fire retardant program on listed species and their critical habitats on National Forest System Lands. The USFS will work with the Service to determine if the assumptions of the BA and the Opinion work toward conserving listed species and critical habitats. The USFS and Service will work to make changes in gathering and reporting this information when mutually agreed to be beneficial. The USFS will use updated species and habitat information, including the most current surveys and status reviews to more accurately assess effects. Once these reviews are completed, the USFS will consider and include any relevant information in planning and coordination for the following years' activities, and include discussions of these updated reviews or status and survey reports as part of annual or semiannual coordination with the Service, as described in Term and Condition 4 below.

e. The USFS will continue to coordinate annually with the Service (at both the Field Office and Headquarters staff levels) to confirm our assumptions in our Opinion are still valid and ensure that any updates needed for retardant avoidance areas on National Forest System Lands are mapped using the most up-to-date species information, such as any new detections and any other relevant data. Such coordination can be included as part of the regular meetings with the Service Headquarters staff as described below in Term and Condition 4, and may also include periodic meetings with Field Office species leads.

f. The USFS shall set up the FireNet database (the Interagency Wildland Fire Retardant Intrusion Reporting System), or other relevant on-line database system, to alert Service Headquarters staff when an intrusion report has been finalized in the system.

g. As part of annual coordination, the USFS and Service will meet to analyze the intrusion data to determine whether the assumptions related to intrusion rates used in this Opinion remain valid. Specifically, based upon information submitted by the USFS, the average intrusion rate across all Forests between 2012 and 2021 was 0.38% into water, 0.62% into water/buffer, 0.06% into terrestrial areas. For an individual National Forest, if the total number of intrusions for any single year or cumulatively during a rolling 10-year period exceeds the total anticipated 10-year number of intrusions for the individual National Forest, (calculated using the above intrusion rates, see Appendix H.3), the USFS will coordinate with the Service to determine whether changes to our assumptions are needed. Appendix H.3 of this Opinion contains the calculations used to determine the anticipated number of intrusions per forest based on the intrusions rates for water, water/buffer, and terrestrial areas discussed above.

2. The USFS will implement the step-down coordination/technical assistance process through the following:

a. The USFS shall provide the final, reviewed intrusion report and/or Effects Determination Form (Appendix H.2) that includes all relevant information (location, timing, species/critical habitat(s) impacted, amount of retardant used and GPC level, etc.) of the intrusion or other type of retardant drop (as indicated for species discussed in items 1.b. and 1.c. within 90 days (with the exception of the species discussed in items 1.b. and 1.c. where reporting can be provided to the Service on an annual basis as is outlined in Term and Condition 4. of application within the range of listed species or designated critical habitat. (note: this timeframe may be exceeded if access to an intrusion is not permissible/safe due to fire activity).

b. For the Quino checkerspot and Hermes copper butterflies:

   i. Quino checkerspot butterfly: The USFS will notify Service Field Office staff as soon as possible, but not less frequently than with annual reporting, after applying fire retardant within 1-km of known and historical locations, as well as within critical habitat.

   ii. Hermes copper butterfly: The USFS will notify Service Field Office staff as soon as possible, but not less frequently than annual reporting, after applying fire retardant within 1-km of known locations. The USFS will also continue to make assessments of the effects of such applications on the ground, in cooperation with the Service.

   iii. For both species, the USFS will coordinate annually with the local Service Field Office to identify and map high priority areas (e.g., suitable habitat outside the mapped avoidance area but within 1-km of a known location) to attempt to avoid these species.

c. If any dead or injured listed species are observed by the USFS during any related activities, then the USFS will notify the appropriate local Service Field Office, USFS headquarters staff, and Service headquarters staff via phone, e-mail or text, ideally within 48 hours of finding a specimen, but not until it is feasible and safe to do so for personnel on the ground during the fire.

3. The USFS will coordinate during the Five-Year Compliance Review with the Service Headquarters and relevant Field Office(s) to discuss implementation of the Action including any issues that have been identified, or the need for any revisions, refinements, or modifications. Such coordination will include, but is not limited to, consideration of the need for any changes to the necessary avoidance mapping[31]

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[31] For example, activities with the potential for downstream effects to occur, including, dry, intermittent waterways, that are incorporated into the Action. These are areas such as those present in critical habitat areas or within 6.2 miles downstream of threatened or endangered species or critical habitats. This distance is based on what we currently consider to be a reasonable worst case scenario, in this case, the distance to which ammonia levels, depending on stream characteristics and the size of the retardant load, and thus effects of ammonia- based retardants can remain at lethal levels; described previously in the Opinion. This distance will be revisited at a future date during annual coordination, as needed, such as when different chemically based and less toxic retardants become available for use by the USFS.

4. The USFS will compile and provide to the Service Headquarters office an annual report submitted on or before May 1, 2024, and annually on or before May 1 thereafter.

    a. Annual reports shall include a summary of information from items 1.a., 1.b. 1.c., and any contacts made to the Service regarding any findings and newly mapped areas related to item 1.e), as described above, along with any additional information the USFS obtains that is relevant to these discussions.

    b. The USFS shall continue to meet annually with Service Headquarters staff, generally prior to July 1, to discuss the findings in the annual report(s), and any changes with operations or species information that may inform additional appropriate measures or practices[32].

[32] For example, if the alternate jettison area for the Moses Lake airtanker base is being used more frequently resulting in greater potential for exposure of individuals from ongoing or imminent reintroductions of the Columbia Basin pygmy rabbit, the USFS should continue to discuss with Service Headquarters and Field Office staff any additional measures or procedures that would warrant consideration or inclusion to protect populations of the Columbia Basin pygmy rabbit.

CONSERVATION RECOMMENDATIONS

Section 7(a)(l) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of an Action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions, which may be applicable at the national and/or local level, as appropriate:

1. The USFS should continue to work with the Service to further improve coordination and information sharing. Specifically, information regarding species occurrence data used by the agencies' Field Offices would also assist USFS and Service HQ staff in understanding avoidance buffer recommendations and improve our collaboration on appropriate protective measures.
2. The USFS should continue to work with the Service and other stakeholders to better quantify and identify aerial retardant effects on the environment. Specifically, information on residues affecting plants and pollinators would help to inform future analyses.
3. The USFS should continue to work with the Service to implement actions to protect Mexican spotted owl Protected Activity Centers (PACs; occupied sites) from high-intensity fire and improve the resiliency of fire-adapted forested habitats.
4. The USFS should continue to work with the Service to design forest thinning treatments across National Forest System Lands that protect existing nest/roost replacement habitat from high severity, stand-replacing fire and enhance existing or potential nest/roost habitat to aid in sustaining owl habitat across the landscape. PACs can be afforded substantial protection from wildland fire by emphasizing fuels reduction and forest restoration in surrounding areas outside of PACs and nest/roost recovery habitat.
5. The USFS should continue to work with the Service to conduct owl surveys to determine how Mexican spotted owls and northern spotted owls modify their territories in response to fuels treatments, forest restoration, and wildland fire. This information will aid in understanding the short- and long-term effects of these actions on the Mexican spotted owl and northern spotted owl, and their subsequent effect on the status of these species.
6. The USFS should continue to assist the Service with monitoring efforts to detect occurrences of the Sacramento Mountains checkerspot butterfly.

Conservation recommendations are suggestions of the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations listed above.

CONFERENCE REPORT/CONFERENCE NOTICE

CONFERENCING ON PROPOSED AND CANDIDATE SPECIES

The Act requires a Federal agency to conference if their action is likely to jeopardize a species proposed for listing or that is likely to destroy or adversely modify critical habitats proposed for designation (ESA 7(a)(4)). Recommendations resulting from that conference are advisory (i.e., they are not required) because the species or critical habitat is the subject of a proposed rule and the prohibition against jeopardy and adverse modification under ESA section 7(a)(2) only applies to listed species and critical habitat designations. Conferencing can be conducted informally, or can follow the format of a formal consultation under 7(a)(2). Additionally, since there is no project duration of the Action, the Agencies agreed it would be prudent to address currently proposed and candidate species and proposed critical habitats to avoid a lengthy revision or reinitiation process for any of these species that may become listed or critical habitat designation that may be finalized in the near future. The Agencies incorporated candidate and proposed species and proposed critical habitats via conferencing in this Opinion as a mechanism to streamline potential future regulatory requirements for reinitiation of section 7. By conferencing now, any future consultation required under 7(a)(2)when a species listing or critical habitat designation is finalized may be streamlined, and in some cases, conferences can satisfy the consultation requirements under 7(a)(2). Using the above approach, we determined the Action is not likely to jeopardize two candidate species, Wright's marsh thistle (proposed threatened) and foothill yellow-legged frog (proposed endangered) or destroy or adversely modify 4 proposed critical habitats (i.e., proposed critical habitats for Smith's blue butterfly, Pawnee montane skipper, foothill yellow-legged frog, and Wright's marsh thistle).

Upon completion of this consultation, USFS may elect to adopt any reasonable and prudent measures to minimize incidental take for the candidate species and proposed critical habitats. In the future, upon listing of the species or designation of critical habitat, the USFS can request the Service adopt the conference opinion as a biological opinion to satisfy the USFS's 7(a)(2) requirement.

REINITIATION NOTICE

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the Action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the Action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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Summary of avoidance areas by species from the Biological Assessment and addendums; and Biological Opinion

NFS lands (species in light blue indicate a changed determination for airtanker base operations, species in bright blue are marine)

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
amphibian	California tiger salamander - central population	*Ambystoma californiense*	T, (CH)	NLAA, na	Y	if found on forest lands occurrence would be mapped with 600' avoidance area	not on NFS lands	n/a
amphibian	Frosted Flatwoods salamander	*Ambystoma cingulatum*	T, CH	NLAA, NLAA	Y (waterway)	300'	Y	300'
amphibian	Sonora tiger salamander	*Ambystoma mavortium stebbinsi*	E	LAA	Y	300'	n/a	n/a
amphibian	Arroyo toad	*Anaxyrus californicus*	E, CH	LAA, NLAA	Y	600'	Y	300'
amphibian	Yosemite toad	*Anaxyrus canorus*	T, CH	LAA, NLAA	Y	600'	Y	300'
amphibian	Wyoming toad	*Bufo baxteri*	E	NE	N	n/a	n/a	n/a
amphibian	Ozark hellbender	*Cryptobranchus alleganiensis bishopi*	E	NLAA	Y	300'	n/a	n/a
amphibian	eastern hellbender - Missouri DPS	*Cryptobranchus alleganiensis alleganiensis*	E	NLAA	Y	300'	n/a	n/a
amphibian	black warrior waterdog	*Necturus alabamensis*	E, CH	NE, NE	N-unit does not use retardant	n/a	Y	300'
amphibian	Neuse River waterdog	*Necturus lewisi*	T	NLAA	Y	1500'	n/a	n/a
amphibian	Jemez Mountains salamander	*Plethodon neomexicanus*	E, CH	NLAA, NLAA	N	n/a	N	n/a
amphibian	Cheat Mountain salamander	*Plethodon netting*	T	NE	N	n/a	n/a	n/a
amphibian	Shenandoah salamander	*Plethodon shenandoah*	E	NE	N	n/a	n/a	n/a
amphibian	foothill yellow-legged frog	*Rana boylii*	PE/PT	LAA	Y	600'	n/a	n/a
amphibian	California red-legged frog	*Rana draytonii*	T, CH	LAA, NLAA	Y	600'	N	n/a
amphibian	Chiricahua leopard frog	*Rana chiracahuensis*	T, CH	LAA, NLAA	Y	300'	Y	300'

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
amphibian	Mountain yellow-legged frog - northern California DPS	*Rana muscosa*	E, CH	LAA, NLAA	Y	600'	Y	300'
amphibian	Mountain yellow-legged frog - southern California DPS	*Rana muscosa*	E, CH	LAA, NLAA	Y	600'	Y	300'
amphibian	Oregon spotted frog	*Rana pretiosa*	T, CH	LAA, NLAA	Y	600'	Y	600' on Gifford Pinchot, Deschutes, Willamette, and Fremont Winema. 300' to 1500' beyond Critical Habitat boundary on Mt Hood (unit 7). 12 square miles on Willammete (unit 10)
amphibian	Sierra Nevada yellow-legged frog	*Rana sierrae*	E, CH	LAA, NLAA	Y	600'	Y	300'
amphibian	dusky gopher frog	*Rana sevosa or Lithobates sevosus*	E, CH	NE, NE	N	n/a	N	n/a
arachnid	spruce-fir moss spider	*Microhexura montivaga*	E, CH	NLAA, NLAA	Y	300'	Y	300'
bird	Puerto Rican sharp-shinned hawk	*Accipiter striatus venator*	E	NE	N	n/a	n/a	n/a
bird	Puerto Rican parrot	*Amazona vittata*	E	NE	N	n/a	n/a	n/a
bird	Florida scrub-jay	*Aphelocoma coerulescens*	T	NLAA	Y	300'	n/a	n/a
bird	marbled murrelet	*Brachyramphus marmoratus*	T, CH	LAA, NLAA	N	n/a	N	n/a
bird	Puerto Rican broad-winged hawk	*Buteo platypterus brunnescens*	E	NE	N	n/a	n/a	n/a
bird	rufa red knot	*Calidris canutus rufa*	T	NE	N	n/a	n/a	n/a
bird	ivory-billed woodpecker	*Campephilus principalis*	E	NE	N	n/a	n/a	n/a
bird	Gunnison sage grouse	*Centrocercus minimus*	T, CH	NLAA, NLAA	Y	0.6 Mile buffer around Leks	Y	0.6 Mile buffer around Leks
bird	piping plover	*Charadrius melodus*	T/E, CH	NE, NE	N	n/a	N	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
bird	western snowy plover	*Charadrius nivosus nivosus*	T, CH	NE, NE	N	n/a	N	n/a
bird	western yellow-billed cuckoo	*Coccyzus americanus*	T, CH	NLAA, NLAA	Y	300' waterway, known nest locations and occupied upland habitat	Y	300' waterway and critical habitat that extends beyond the 300' waterway buffer
bird	southwestern willow flycatcher	*Empidonax trailii extimus*	E, CH	NLAA, NLAA	Y (waterway)	300'	Y	300'-critical habitat that extends beyond the 300-foot riparian buffer, into adjacent floodplains and upland in some cases, should also be included as avoidance areas.
bird	northern Aplomado falcon	*Falco femoralis septentrionalis*	XN	NLJ	N	n/a	n/a	n/a
bird	whooping crane	*Grus americana*	E	NE	N	n/a	n/a	n/a
bird	Mississippi sandhill crane	*Grus canadensis pulla or Antigone canadensis pulla*	E	NE	N	n/a	n/a	n/a
bird	California condor	*Gymnogyps californianus*	E/XN, CH	NLAA/NLJ, NE	Y	600' buffer around nesting sites and hack sites	N	n/a
bird	Mount Ranier white-tailed ptarmigan	*Lagopus leucura rainierensis*	PT	NLAA	N	n/a	n/a	n/a
bird	wood stork	*Mycteria americana*	T	NE	N	n/a	n/a	n/a
bird	red-cockaded woodpecker	*Picoides borealis*	E	NLAA	Y	300' buffer only in already mapped core areas in Mississippi	n/a	n/a
bird	Coastal California gnatcatcher	*Polioptila californica californica*	T, CH	LAA, NLAA	N	n/a	N	n/a
bird	Yuma Ridgeways rail	*Rallus obsoletus [=longirostris] yumanensis*	E	NE	N	n/a	n/a	n/a
bird	Elfin-woods warbler	*Setophaga angelae*	T	NE	N	n/a	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
bird	roseate tern	*Sterna dougallii*	E	NE	N	n/a	n/a	n/a
bird	northern spotted owl	*Strix occidentalis caurina*	T, CH	LAA, NLAA	N	n/a	N	n/a
bird	Mexican spotted owl	*Strix occidentalis lucida*	T, CH	LAA, NLAA	N	n/a	N	n/a
bird	least Bell's vireo	*Vireo bellii pusillus*	E, CH	NLAA, NLAA	Y (waterway)	300'	N	n/a
bivalve	Cumberland elktoe	*Alasmidonta atropurpurea*	E, CH	NE, NE	N	n/a	N	n/a
bivalve	Appalachian elktoe	*Alasmidonta raveneliana*	E, CH	NLAA, NLAA	Y	500' in Cherokee 1500' in NFs of North Carolina	Y	500' in Cherokee 1500' in NFs of North Carolina
bivalve	fat three-ridge mussel	*Amblema neislerii*	E, CH	NLAA, NLAA	Y (waterway)	300'	Y	300'
bivalve	Ouachita rock pocketbook	*Arcidens (Arkansia) wheeleri*	E	NLAA	Y	300' in Texas, 500' Ouachita	n/a	n/a
bivalve	spectaclecase	*Cumberlandia monodonta*	E	NLAA	Y	500' on Ozark and Ouachita, 6th field watershed on George Washington Jefferson, ridgetop to ridgetop minimum 1/4 mile on Mark Twain	n/a	n/a
bivalve	western fandshell	*Cyprogenia aberti*	PT, PCH	NLAA, NLAA	Y	ridgetop to ridgetop minimum 1/4 mile on Mark Twain	Y	ridgetop to ridgetop minimum 1/4 mile on Mark Twain
bivalve	Ouachita fanshell	*Cyprogenia c.f. aberti*	PT, PCH	NE, NE	Y	300'	Y	300'
bivalve	fanshell	*Cyprogenia stegaria*	E/XN	NE	N	n/a	n/a	n/a
bivalve	dromedary pearlymussel	*Dromus dromas*	E/XN	NE	N	n/a	n/a	n/a
bivalve	purple bankclimber	*Elliptoideus sloatianus*	T, CH	NLAA, NLAA	Y (waterway)	300'	Y	300'
bivalve	Cumberlandian combshell	*Epioblasma brevidens*	E/XN, CH	NE, NE	N	n/a	N	n/a
bivalve	oyster mussel	*Epioblasma capsaeformis*	E/XN, CH	NLAA, NE	Y	300' on Daniel Boone and Jefferson. 500' on Cherokee. 6th-field watershed on Jefferson.	N	n/a
bivalve	Curtis pearlymussel	*Epioblasma curtisii*	E	NLAA	Y (waterway)	300'	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
bivalve	tan riffleshell	*Epioblasma florentina walkeri*	E	NLAA	Y	300' on Daniel Boone and Jefferson. 500' on Cherokee	n/a	n/a
bivalve	upland combshell	*Epioblasma metastriata*	E, CH	NLAA, NE	Y	500' on Cherokee	N	n/a
bivalve	southern acornshell	*Epioblasma othcaloogensis*	E, CH	NLAA, NE	Y	500' on Cherokee and NE on NFs of AL	N	n/a
bivalve	southern combshell	*Epioblasma penita*	E	NE	N	n/a	n/a	n/a
bivalve	green-blossom pearlymussel	*Epioblasma torulosa gubernaculum*	E	NE	N	n/a	n/a	n/a
bivalve	northern riffleshell	*Epioblasma rangiana*	E	NE	N	n/a	n/a	n/a
bivalve	snuffbox mussel	*Epioblasma triquetra*	E	NLAA	Y	300' on Daniel Boone, 6th-field watershed on George Washington Jefferson, 500' on Ozark	n/a	n/a
bivalve	shiny pigtoe	*Fusconaia cor*	E/XN	NE	N	n/a	n/a	n/a
bivalve	finerayed pigtoe	*Fusconaia cuneolus*	E/XN	NLAA	Y	6th-field watershed on George Washington Jefferson, 500' on Cherokee	n/a	n/a
bivalve	Atlantic pigtoe	*Fusconaia masoni*	T, CH	NLAA, NLAA	Y	6th-field watershed on George Washington Jefferson, 1500' on NF of North Carolina	Y	6th-field watershed on George Washington Jefferson, 1500' on NF of North Carolina
bivalve	finelined pocketbook	*Hamiota altilis*	T, CH	NLAA, NLAA	Y	500' on Cherokee and 300' on NFs of AL and Chattahoochee	Y	300'
bivalve	southern sandshell	*Hamiota australis*	T	NE	N	n/a	n/a	n/a
bivalve	orangenacre mucket	*Hamiota perovalis*	T, (CH)	NE, na	N	n/a	n/a	n/a
bivalve	shinyrayed pocketbook	*Hamiota (Lampsilis) subangulata*	E, (CH)	NLAA, na	Y	300'	n/a	300'
bivalve	cracking pearlymussel	*Hemistena lata*	E/XN	NE	N	n/a	n/a	n/a

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bivalve	pink mucket	*Lampsilis abrupta*	E	NLAA	Y	300' on Daniel Boone, 6th-field watershed on George Washington Jefferson, 500' on Ozark, ridgetop to ridgetop with minimum 1/4 mile on Mark Twain	n/a	n/a
bivalve	Arkansas fatmucket	*Lampsilis powellii*	T	NE	N	n/a	n/a	n/a
bivalve	Neosho mucket	*Lampsilis rafinesqueana*	E, CH	NE, NE	N	n/a	N	n/a
bivalve	speckled pocketbook	*Lampsilis streckeri*	E	NE	N	n/a	n/a	n/a
bivalve	Carolina heelsplitter	*Lasmigona decorata*	E, CH	NE, NE	N	n/a	N	n/a
bivalve	birdwing pearlymussel	*Lemiox rimosus*	E/XN	NE	N	n/a	n/a	n/a
bivalve	scaleshell mussel	*Leptodea leptodon*	E	NLAA	Y	500' on Ouachita and Ozark, ridgetop to rridgetop minimum 1/4 mile on Mark Twain	n/a	n/a
bivalve	Louisiana pearlshell	*Margaritifera hembeli*	T	NE	N	n/a	n/a	n/a
bivalve	Alabama pearlshell	*Margaritifera marrianae*	E	NE	N	n/a	n/a	n/a
bivalve	Alabama moccasinshell	*Medionidus acutissimus*	T, CH	NLAA, NLAA	Y	500' on Cherokee, 300' on NFs of Alabama and Chattahoochee	Y	300' on NFs of Alabama and Chattahoochee
bivalve	coosa moccasinshell	*Medionidus parvulus*	E, CH	NLAA, NE	Y	500' on Cherokee, 300' on NFs of Alabama	N	n/a
bivalve	Ochlockonee moccasinshell	*Medionidus simpsonianus*	E, (CH)	NLAA, na	Y	300'	n/a	n/a
bivalve	littlewing pearlymussel	*Pegias fabula*	E	NLAA	Y	300' on Daniel Boone; 1500' on NF of North Carolina, 6th-field watershed on George Washington Jefferson	n/a	n/a
bivalve	orangefoot pimpleback	*Plethobasus cooperianus*	E	NE	N	n/a	n/a	n/a

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bivalve	sheepnose mussel	*Plethobasus cyphyus*	E	NLAA	Y	6th-field watershed on George Washington Jefferson, ridgetop to ridgetop minimum 1/4 mile on Mark Twain	n/a	n/a
bivalve	clubshell	*Pleurobema clava*	E	NE	N	n/a	n/a	n/a
bivalve	James spinymussel	*Pleurobema collina*	E	NE	N	n/a	n/a	n/a
bivalve	southern clubshell	*Pleurobema decisum*	E, CH	NLAA, NLAA	Y	300'	Y	300'
bivalve	dark pigtoe	*Pleurobema furvum*	E, CH	NE, NE	N	n/a	N	n/a
bivalve	southern pigtoe	*Pleurobema georgianum*	E, CH	NLAA, NLAA	Y	300'	Y	300'
bivalve	Georgia pigtoe	*Pleurobema hanleyianum*	E, CH	NLAA, NLAA	Y	500' on Cherokee, 300' on NFs of Alabama and Chattahoochee	Y	500' on Cherokee, 300' on NFs of Alabama and Chattahoochee
bivalve	ovate clubshell	*Pleurobema perovatum*	E, CH	NLAA, NE	Y	500' on Cherokee, 300' on NFs of Alabama	N	n/a
bivalve	rough pigtoe	*Pleurobema plenum*	E/XN	NE	N	n/a	n/a	n/a
bivalve	oval pigtoe	*Pleurobema pyriforme*	E, (CH)	NLAA, na	Y	300'	n/a	300'
bivalve	fuzzy pigtoe	*Pleurobema strodeanum*	T	NE	N	n/a	n/a	n/a
bivalve	slabside pearlymussel	*Pleuronaia dolabelloides*	E, CH	NLAA, NLAA	Y	500' on Cherokee, 6th-field watershed on George Washington Jefferson	Y	500' on Cherokee, 6th-field watershed on George Washington Jefferson
bivalve	fat pocketbook	*Potamilus capax*	E	NE	N	n/a	n/a	n/a
bivalve	inflated (Alabama) heelsplitter	*Potamilus inflatus*	T	NE	N	n/a	n/a	n/a
bivalve	triangular (rayed) kidneyshell	*Ptychobranchus greenii (P. foremanianus)*	E, CH	NLAA, NLAA	Y	500' on Cherokee, 300' on NFs of Alabama and Chattahoochee	Y	300' on NFs of Alabama and Chattahoochee
bivalve	southern kidneyshell	*Ptychobranchus jonesi*	E	NE	N	n/a	n/a	n/a
bivalve	fluted kidneyshell	*Ptychobranchus subtentum*	E, CH	NLAA, NLAA	Y	500' on Cherokee, 300' on Daniel Boone, 6th-field watershed on George Washington Jefferson	Y	500' on Cherokee, 300' on Daniel Boone, 6th-field watershed on George Washington Jefferson

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bivalve	rabbitsfoot	*Quadrula cylindrica cylindrica*	T, CH	NLAA, NLAA	Y	500 ' on Ozark and Ouachita, ridgetop to ridgetop minimum 1/4 mile on Mark Twain	Y	500' on Ouchita, ridgetop to ridgetop minimum 1/4 mile on Mark Twain
bivalve	rough rabbitsfoot	*Quadrula cylindrica strigillata*	E, (CH)	NE, na	N	n/a	n/a	n/a
bivalve	winged mapleleaf	*Quadrula fragosa*	E/XN	NE	N	n/a	n/a	n/a
bivalve	round ebonyshell	*Reginaia rotulata*	E, CH	NE, NE	Y	300'	Y	300'
bivalve	Cumberland monkeyface	*Theliderma intermedia*	E/XN	NE	N	n/a	n/a	n/a
bivalve	Appalachian monkeyface	*Theliderma sparsa*	E/XN	NE	N	n/a	n/a	n/a
bivalve	Choctaw bean	*Villosa choctawensis*	E	NE	N	n/a	n/a	n/a
bivalve	rayed bean	*Villosa fabalis*	E	NE	N	n/a	n/a	n/a
bivalve	purple bean	*Villosa perpurpurea*	E, (CH)	NE, na	N	n/a	n/a	n/a
bivalve	Cumberland bean	*Villosa trabalis*	E/XN	NLAA	Y	500' on Cherokee; 6th-field watershed on George Washington Jefferson; 300' on Daniel Boone; 1500' on NFs of North Carolina	n/a	n/a
crustacean	Madison Cave isopod	*Antrolana lira*	T	NE	N	n/a	n/a	n/a
crustacean	Conservancy fairy shrimp	*Branchinecta conservatio*	E, (CH)	NLAA, na	Y	300' around vernal pools	n/a	n/a
crustacean	vernal pool fairy shrimp	*Branchinecta lynchi*	T, CH	NLAA, NLAA	Y	300'	Y	300' around vernal pools
crustacean	San Diego fairy shrimp	*Branchinecta sandiegonensis*	E, (CH)	NLAA, na	Y	300'	n/a	n/a
crustacean	Benton County Cave crayfish	*Cambarus aculabrum*	E	NE	N	n/a	n/a	n/a
crustacean	Big Sandy crayfish	*Cambarus callainus*	T	NE	N	n/a	n/a	n/a
crustacean	Hell Creek Cave crayfish	*Cambarus zophonastes*	E	NE	N	n/a	n/a	n/a
crustacean	vernal pool tadpole shrimp	*Lepidurus packardi*	E, (CH)	NLAA, na	Y	300'	n/a	n/a

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crustacean	Shasta crayfish	*Pacifastacus fortis*	E	LAA	Y	1000' buffer for distance of 6.2 miles upstream of occurrences	n/a	n/a
crustacean	Riverside fairy shrimp	*Streptocephalus woottoni*	E, (CH)	NLAA, na	Y	300'	n/a	n/a
fish	white sturgeon - Kootenai River population	*Acipenser transmontanus*	E, (CH)	NLAA, na	Y	300'	n/a	n/a
fish	Zuni bluehead sucker	*Catostomus discobolus yarrowi*	E, CH	LAA, LAA	Y	300'	Y	300'
fish	Santa Ana sucker	*Catostomus santaanae*	T, CH	LAA, LAA	Y	600'	Y	300'
fish	Warner sucker	*Catostomus warnerensis*	T, (CH)	NLAA	Y	300'	n/a	n/a
fish	shortnose sucker	*Chasmistes brevirostris*	E, CH	LAA, LAA	Y	300'	Y	300'
fish	June sucker	*Chasmistes liorus*	E, (CH)	NLAA	Y	300'	n/a	n/a
fish	blackside dace	*Chrosomus cumberlandensis*	T	NE	N	n/a	n/a	n/a
fish	pygmy sculpin	*Cottus paulus*	T	NE	N	n/a	n/a	n/a
fish	railroad valley springfish	*Crenichthys nevadae*	T, (CH)	LAA, na	Y	300'	n/a	n/a
fish	blue shiner	*Cyprinella caerulea*	T	NLAA	Y	500' on Cherokee, 300' on Chattachoochee, Oconee and NF's of Alabama	n/a	n/a
fish	desert pupfish	*Cyprinodon macularius*	E, (CH)	LAA, na	Y	300'	n/a	n/a
fish	Lost River sucker	*Deltistes luxatus*	E, CH	LAA, LAA	Y	300'	Y	300'
fish	spotfin chub	*Erimonax monachus*	T/XN, CH	NLAA, NLAA	Y	6th-field watershed on George Washington Jefferson; 500' on Cherokee; 1500' on NFs of North Carolina	Y	1500' on NFs of North Carolina
fish	slender chub	*Erimystax cahni*	T	NE	N	n/a	n/a	n/a
fish	Etowah darter	*Etheostoma etowahae*	E	NLAA	Y	300'	n/a	n/a
fish	yellowcheek darter	*Etheostoma moorei*	E, (CH)	NE, na	N	n/a	n/a	n/a
fish	candy darter	*Etheostoma osburni*	E, CH	NE, NE	N	n/a	N	n/a

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fish	duskytail darter	*Etheostoma percnurum*	E/XN	NLAA	Y	6th-field watershed on George Washington Jefferson; 500' on Cherokee; 300' on Daniel Boone	N	n/a
fish	rush darter	*Etheostoma phytophilum*	E, (CH)	NE, na	N	n/a	n/a	n/a
fish	Kentucky Arrow darter (Cumberland Plateau darter)	*Etheostoma spilotum*	T, CH	NE, NE	N	n/a	N	n/a
fish	Cumberland darter	*Etheostoma susanae*	E, CH	NE, NE	N	n/a	N	n/a
fish	Unarmored 3-spine stickleback (Shay Creek stickleback)	*Gasterosteus aculeatus williamsoni*	E	LAA	Y	300'	n/a	n/a
fish	Owens tui chub	*Gila (Siphateles) bicolor snyderi*	E, CH	LAA, LAA	Y	300'	Y	300'
fish	humpback chub	*Gila cypha*	T, (CH)	LAA, na	Y	300'	n/a	n/a
fish	Sonora chub	*Gila ditaenia*	T, CH	LAA, LAA	Y	300'	Y	300'
fish	bonytail chub	*Gila elegans*	E, (CH)	LAA, na	Y	300'	n/a	n/a
fish	Gila chub	*Gila intermedia*	E, CH	LAA, LAA	Y	300'	Y	300'
fish	Chihuahua chub	*Gila nigrescens*	T, (CH)	LAA, na	Y	300'	n/a	n/a
fish	Yaqui chub	*Gila purpurea*	E, (CH)	LAA, na	Y	300'	n/a	n/a
fish	Rio Grande silvery minnow	*Hybognathus amarus*	E, (CH)	NLAA, na	Y	300'	n/a	n/a
fish	delta smelt	*Hypomesus transpacificus*	T, (CH)	NE, na	N	n/a	n/a	n/a
fish	Yaqui catfish	*Ictalurus pricei*	T, (CH)	LAA, na	Y	300'	n/a	n/a
fish	Little Colorado spinedace	*Lepidomeda vittata*	T, CH	LAA, LAA	Y	300'	Y	300'
fish	spikedace	*Meda fulgida*	E, CH	LAA, LAA	Y	300'	Y	300'
fish	Palezone shiner	*Notropis albizonatus*	E	NE	N	n/a	n/a	n/a
fish	Cahaba shiner	*Notropis cahabae*	E	NE	N	n/a	n/a	n/a
fish	Arkansas River shiner	*Notropis girardi*	T, (CH)	NLAA, na	Y	300'	n/a	n/a
fish	smoky madtom	*Noturus baileyi*	E, CH	NLAA, NLAA	Y	500'	Y	500'

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fish	yellowfin madtom	*Noturus flavipinnis*	T, CH	NLAA, NE	Y	500' on Cherokee and 6th-field watershed on Jefferson	N	n/a
fish	Little Kern golden trout	*Oncorhynchus aguabonita whitei*	T, CH	LAA, LAA	Y	600'	Y	600'
fish	Apache trout	*Oncorhynchus apache*	T	LAA	Y	600'	n/a	n/a
fish	Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	T	LAA	Y	600'	n/a	n/a
fish	Paiute cutthroat trout	*Oncorhynchus clarki seleniris*	T	LAA	Y	600'	n/a	n/a
fish	greenback cutthroat trout	*Oncorhynchus clarki stomias*	T	LAA	Y	600'	n/a	n/a
fish	Gila trout	*Oncorhynchus gilae gilae*	E	LAA	Y	300'	n/a	n/a
fish	amber darter	*Percina antesella*	E, (CH)	NLAA, na	Y	500' on Cherokee and 300' on Oconee and Chattahoochee	n/a	n/a
fish	goldline darter	*Percina aurolineata*	T, (PCH)	NLAA, na	Y	300'	n/a	n/a
fish	pearl darter	*Percina aurora*	T, CH	NE, NE	N	n/a	N	n/a
fish	conasauga logperch	*Percina jenkinsi*	E, CH	NLAA, NLAA	Y	500' on Cherokee and 300' on Oconee and Chattahoochee	Y	500' on Cherokee
fish	leopard darter	*Percina pantherina*	T	NE	N	n/a	n/a	n/a
fish	Roanoke logperch	*Percina rex*	E	NE	N	n/a	n/a	n/a
fish	snail darter	*Percina tanasi*	T	NLAA	Y	500'	n/a	n/a
fish	Gila topminnow	*Poeciliposis occidentalis occidentalis*	E	LAA	Y	300'	n/a	n/a
fish	Colorado pikeminnow	*Ptychocheilus lucius*	E/XN, (CH)	LAA, na	Y	300'	n/a	n/a
fish	Kendall Warm Springs dace	*Rhinichthys osculus thermalis*	E	NLAA	Y	0.50 miles	n/a	n/a
fish	bull trout	*Salvelinus confluentus*	T, CH	LAA, LAA	Y	300'	Y	300'
fish	pallid sturgeon	*Scaphirhynchus albus*	E	NLAA	Y	500' on Ozark, 300' elsewhere	n/a	n/a
fish	Alabama sturgeon	*Scaphirhynchus suttkusi*	E, CH	NE, NE	N	n/a	N	n/a

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fish	loach minnow	*Tiaroga cobitis*	E, CH	LAA, LAA	Y	300'	Y	300'
fish	razorback sucker	*Xyrauchen texanus*	E, CH	LAA, LAA	Y	300'	Y	300'
fungi	rock gnome lichen	*Gymnoderma lineare*	E	NLAA	Y	1500'	n/a	n/a
gastropod	Tumbling Creek cavesnail	*Antrobi culveri*	E, (CH)	NLAA, na	Y (Waterway)	300'	n/a	n/a
gastropod	Anthony's riversnail	*Athearnia anthonyi*	E/XN	NLAA/NLJ	Y	500'	n/a	n/a
gastropod	lacy elimia	*Elimia crenatella*	T	NE	N	n/a	n/a	n/a
gastropod	Morro shoulderband (banded dune) snail	*Helminthoglypta walkeriana*	T, (CH)	LAA, na	N (not on NFS land as of now)	If the species is found on the Los Padres National Forest avoidance area mapping (300-foot buffers) of occupied habitat is recommended.	n/a	n/a
gastropod	round rocksnail	*Leptoxis ampla*	T	NE	N	n/a	n/a	n/a
gastropod	painted rocksnail	*Leptoxis taeniata*	T	NE	N	n/a	n/a	n/a
gastropod	flat pebblesnail	*Lepyrium showalteri*	E	NE	N	n/a	n/a	n/a
gastropod	cylindrical lioplax	*Lioplax cyclostomaformis*	E	NE	N	n/a	n/a	n/a
gastropod	noonday globe	*Patera (Mesodon) clarki nantahala*	T	NLAA	Y	300'	n/a	n/a
gastropod	Three Forks springsnail	*Pyrgulopsis trivialis*	E, CH	LAA, LAA	Y	300'	Y	300'
gastropod	Alamosa springsnail	*Tryonia alamosae*	E	NLAA	N	n/a	n/a	n/a
gastropod	Tulotoma snail	*Tulotoma magnifica*	T	NE	N	n/a	n/a	n/a
insect	Uncompahgre fritillary	*Boloria acrocnema*	E	NE	N	n/a	n/a	n/a
insect	rusty-patched bumblebee	*Bombus affinis*	E	NLAA	N	n/a	n/a	n/a
insect	Franklin's bumble bee	*Bombus franklini*	E	LAA	N	n/a	n/a	n/a
insect	Hungerford's crawling water beetle	*Brychius hungerfordi*	E	NE	N	n/a	n/a	n/a
insect	valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	T	NLAA	Y (waterway)	300'	n/a	n/a

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insect	Smith’s blue butterfly	*Euphilotes enoptes smithi*	E, PCH	LAA, LAA	Y	300'	Y	300'
insect	Sacramento Mountains checkerspot butterfly	*Euphydryas anicia cloudcrofti*	E	LAA	Y	600'	n/a	n/a
insect	quino checkerspot butterfly	*Euphydryas editha quino*	E, CH	LAA, LAA	Y	600' buffer on known occurrences (note: additional reporting requirements within 1 km of known occurrences)	Y	CH mapped boundary
insect	Taylor's checkerspot	*Euphydryas editha taylori*	E, CH	NE, NE	N	n/a	N	n/a
insect	Kern primrose sphinx moth	*Euproserpinus euterpe*	T	LAA	Y	300'	n/a	n/a
insect	Hermes Copper butterfly	*Hermelycaena (Lycaena) hermes*	T, CH	LAA, LAA	Y	600'	N	n/a
insect	Dakota skipper	*Hesperia dacotae*	T, CH	NLAA, NLAA	Y	300'	Y	300'
insect	Pawnee montane skipper	*Hesperia leonardus montana*	T, PCH	LAA, LAA	N	n/a	N	n/a
insect	Mt Charleston blue butterfly	*Icaricia shasta charlestonensis*	E, CH	LAA, LAA	Y	300'	Y	300'
insect	meltwater lednian stonefly	*Lednia tumana*	T	LAA	Y (waterway)	300'	n/a	n/a
insect	Karner blue butterfly	*Lycaeides melissa samuelis*	E	NE	N	n/a	n/a	n/a
insect	Mitchell’s satyr	*Neonympha mitchellii*	E	NE	N	n/a	n/a	n/a
insect	American burying beetle	*Nicrophorus americanus*	T	NLAA	N	n/a	n/a	n/a
insect	powesheik skipperling	*Oarisma powesheik*	E, CH	NLAA, NLAA	Y	300'	Y	300'
insect	Laguna Mountains skipper	*Pyrgus ruralis lagunae*	E, CH	LAA, LAA	Y	600'	N	n/a
insect	Hine's emerald dragonfly	*Somatochlora hineana*	E, CH	NLAA, NLAA	Y (waterway)	ridgetop to ridgetop minimum 1/4 mile on Mark Twain	Y	ridgetop to ridgetop minimum 1/4 mile on Mark Twain
insect	Oregon silverspot butterfly	*Speyeria zerene hippolyta*	T, CH	NE, NE	N	n/a	N	n/a

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insect	western glacier stonefly	*Zapada glacier*	T	LAA	Y (waterway)	300'	n/a	n/a
mammal	gray wolf	*Canis lupis*	E, CH	NLAA, NE	N	n/a	n/a	n/a
mammal	Mexican wolf	*Canis lupis baileyi*	E/XN	NLAA	N	n/a	n/a	n/a
mammal	Ozark big-eared bat	*Corynorhinus townsendii ingens*	E	NLAA	N	n/a	n/a	n/a
mammal	Virginia big-eared bat	*Corynorhinus townsendii virginianus*	E, CH	NLAA, NE	N	n/a	N	n/a
mammal	Utah prairie dog	*Cyonomys parvidens*	T	LAA	Y	950'	n/a	950'
mammal	San Bernardino Merriam's kangaroo rat	*Dipodomys merriami parvus*	E, CH	LAA, NLAA	Y	known occurrences plus a 300' buffer	Y	designated critical habitat plus a 300' buffer
mammal	Stephens' kangaroo rat	*Dipodomys stephensi*	E	NLAA	N	If found on NFS lands in future avoidance area mapping wil be determined by the local unit. R5 has 300' buffer on known populations near boundaries.	n/a	n/a
mammal	southern sea otter	*Enhydra lutris nereis*	T	NLAA	Y - Los Padres only	Bixby Creek beach area plus 300' buffer	n/a	n/a
mammal	Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	E	NLAA	N	n/a	n/a	n/a
mammal	ocelot	*Leopardus pardalis*	E	NLAA	N	n/a	n/a	n/a
mammal	Mexican long-nosed bat	*Leptonycteris nivalis*	E	NLAA	N	n/a	n/a	n/a
mammal	Canada lynx	*Lynx canadensis*	T, CH	NLAA, NE	N	n/a	N	n/a
mammal	Pacific marten - coastal DPS	*Martes caurina*	T	NLAA	N	n/a	n/a	n/a
mammal	black-footed ferret	*Mustela nigripes*	E	NLAA	N	n/a	n/a	n/a
mammal	gray bat	*Myotis grisescens*	E	NLAA	N	n/a	n/a	n/a
mammal	northern long-eared bat	*Myotis septentrionalis*	T	NLAA	N	n/a	n/a	n/a
mammal	Indiana bat	*Myotis sodalis*	E, CH	NLAA, NE	N	n/a	N	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
mammal	Peñasco least chipmunk	*Neotamias minimus atristriatus*	PE, PCH	NLAA, NLAA	N	Avoidance areas are not recommended because of the threat wildfire has on this species habitat.	N	Avoidance areas are not recommended because of the threat wildfire has on this species habitat.
mammal	peninsular bighorn sheep	*Ovis canadensis nelsoni*	E, (CH)	NLAA, na	N	n/a	n/a	n/a
mammal	Sierra Nevada bighorn sheep	*Ovis canadensis sierra*	E, CH	NLAA, NE	N	n/a	N	n/a
mammal	jaguar	*Panthera onca*	E, CH	NLAA, NE	N	n/a	N	n/a
mammal	fisher - Southern Sierra Nevada DPS	*Pekania pennanti*	E	NLAA	N	n/a	n/a	n/a
mammal	Florida panther	*Puma concolor coryi*	E	NE	N	n/a	n/a	n/a
mammal	woodland caribou	*Rangifer tarandus caribou*	E, CH	NLAA, NE	N	n/a	N	n/a
mammal	northern Idaho ground squirrel	*Urocitellus (Spermophilus) brunneus*	T	LAA	Y	1320'	n/a	n/a
mammal	Mt. Graham red squirrel	*Tamisciurus fremonti grahamensis*	E, CH	NLAA, NE	N	n/a	N	n/a
mammal	West Indian manatee	*Trichechus manatus*	T, CH	NLAA, NLAA	Y (waterway)	300'	Y (waterway)	300'
mammal	grizzly bear	*Ursus arctos horribilis*	T	NLAA	N	n/a	n/a	n/a
mammal	San Joaquin kit fox	*Vulpes macrotis mutica*	E	NLAA	N	n/a	n/a	n/a
mammal	Sierra Nevada red fox - Sierra Nevada DPS	*Vulpes vulpes necator*	E	NLAA	N	n/a	n/a	n/a
mammal	New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	E, CH	LAA, NLAA	Y	known occurrences plus a 300' buffer (630')	Y	Designated critical habitat plus a 300' buffer (630')
mammal	Preble's meadow jumping mouse	*Zapus hudsonius preblei*	T, CH	LAA, NLAA	Y	known occurrences plus a 300' buffer	Y	Designated critical habitat plus a 300' buffer
plant	San Diego thornmint	*Acanthomintha ilicifolia*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	northern wild monkshood	*Aconitum novemboracense*	T	NE	N	n/a	n/a	n/a
plant	sensitive joint-vetch	*Aeschynomene virginica*	T	NE	N	n/a	n/a	n/a
plant	Munz's onion	*Allium munzii*	E, CH	LAA, NLAA	Y	300'	Y	300'

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	Price’s potato-bean	*Apios priceana*	T	NE	N	n/a	n/a	n/a
plant	McDonald's rock cress	*Arabis macdonaldiana*	E	LAA	Y	300'	n/a	n/a
plant	marsh sandwort	*Arenaria paludicola*	E	NE	N	n/a	n/a	n/a
plant	Bear Valley sandwort	*Arenaria ursina*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	Sacramento prickly poppy	*Argemone pleiacantha spp. pinnatisecta*	E	LAA	Y	300'	n/a	n/a
plant	Mead’s milkweed	*Asclepias meadii*	T	NLAA	Y - on Mark Twain	300'	n/a	n/a
plant	American hart’s-tongue fern	*Asplenium scolopendrium var. americanum*	T	NE	N	n/a	n/a	n/a
plant	Cushenbury milk-vetch	*Astragalus albens*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	Applegate's milk-vetch	*Astragalus applegatei*	E	NE	N	n/a	n/a	n/a
plant	Braunton's milk-vetch	*Astragalus brauntonii*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	Coachella Valley milk-vetch	*Astragalus lentiginosus var. coachellae*	E, CH	NE, NE	N	n/a	N	n/a
plant	heliotrope milkvetch	*Astragalus montii*	T, CH	LAA, NE	Y	300'	Y	300'
plant	Osterhout milkvetch	*Astragalus osterhoutii*	E	NLAA	Y - if found on forest	300'	n/a	n/a
plant	triple-ribbed milk-vetch	*Astragalus tricarinatus*	E	LAA	Y	300'	n/a	n/a
plant	Encinitas baccharis	*Baccharis vanessae*	T	LAA	Y	300'	n/a	n/a
plant	Nevin's barberry	*Berberis nevinii*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	Virginia round-leaf birch	*Betula uber*	T	NE	N	n/a	n/a	n/a
plant	shale barren rockcress	*Boechera (Arabis) serotina*	E	NLAA	N	n/a	n/a	n/a
plant	Florida bonamia	*Bonamia grandiflora*	T	NLAA	Y	300'	n/a	n/a
plant	thread-leaved brodiaea	*Brodiaea filifolia*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	capá rosa	*Callicarpa ampla*	E	NE	N	n/a	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	Mariposa pussypaws	*Calyptridium (Cistanthe) pulchellum*	T	LAA	Y	300'	n/a	n/a
plant	Stebbins' morning glory	*Calystegia stebbinsii*	E	LAA	Y	300'	n/a	n/a
plant	ash-grey paintbrush	*Castilleja cinerea*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	California jewelflower	*Caulanthus californicus*	E	LAA	Y	300'	n/a	n/a
plant	Vail Lake ceanothus	*Ceanothus ophiochilus*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	purple amole (Camatta Canyon amole)	*Chlorogalum purpureum (var. reductum)*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	La Graciosa thistle	*Cirsium loncholepis*	T, (CH)	NE	N	n/a	n/a	n/a
plant	Pitcher's thistle	*Cirsium pitcheri*	T	NE	N	n/a	n/a	n/a
plant	Wright's marsh thistle	*Crisium wrightii*	PT, PCH	LAA, NLAA	Y	300'	Y	300'
plant	Sacramento Mountains thistle	*Cirsium vinaceum*	T	LAA	Y	300'	n/a	n/a
plant	Springville clarkia	*Clarkia springvillensis*	T	LAA	Y	300'	n/a	n/a
plant	Alabama leather flower	*Clematis socialis*	E	NE	N	n/a	n/a	n/a
plant	small sweet-scented pigeonwings	*Clitoria fragrans*	T	NE	N	n/a	n/a	n/a
plant	Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	E	NLAA	N	n/a	n/a	n/a
plant	Lee pincushion cactus	*Coryphantha sneedii var. leei*	T	LAA	Y	300'	n/a	n/a
plant	Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*	E	LAA	Y	300'	n/a	n/a
plant	leafy prairie-clover	*Dalea foliosa*	E	NE	N	n/a	n/a	n/a
plant	slender-horned spineflower	*Dodecahema leptoceras*	E	LAA	Y	300'	n/a	n/a
plant	smooth purple coneflower	*Echinacea laevigata*	E	NLAA	N	n/a	n/a	n/a
plant	Kuenzler hedgehog cactus	*Echinocereus fendleri var. kuenzleri*	E	NLAA	Y	300'	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	Arizona hedgehog cactus	*Echinocereus arizonicus var. arizonicus*	E	NLAA	N	n/a	n/a	n/a
plant	Kern mallow	*Eremalche kernensis (Eremalche parryi* ssp. *kernensis)*	E	NE	N	n/a	n/a	n/a
plant	Santa Ana River woolly-star	*Eriastrum densifolium* ssp. *sanctorum*	E	LAA	Y	300' (in mutual aid area off forest)	n/a	n/a
plant	Parish's daisy	*Erigeron parishii*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	Zuni fleabane	*Erigeron rhizomatous*	T	NLAA	N	n/a	n/a	n/a
plant	Southern Mountain buckwheat	*Eriogonum kennedyi* var. *austromontanum*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	scrub buckwheat	*Eriogonum longifolium var. gnaphalifolium*	T	NLAA	Y	All stands with known occurrences were included in aerial retardant avoidance areas.	n/a	n/a
plant	Cushenbury buckwheat	*Eriogonum ovalifolium var. vineum*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	uvillo	*Eugenia haematocarpa*	E	NE	N	n/a	n/a	n/a
plant	Penland alpine fen mustard	*Eutrema penlandii*	T	NLAA	Y	All known populations and modeled habitat	n/a	n/a
plant	Mexican flannelbush	*Fremontodendron mexicanum*	E, CH	NE, NE	N	n/a	N	n/a
plant	Gentner mission-bells	*Fritillaria gentneri*	E	NLAA	Y	300'	n/a	n/a
plant	geocarpon	*Geocarpon minimum*	T	NE	N	n/a	n/a	n/a
plant	spreading avens (cliff avens)	*Geum radiatum*	E	NLAA	Y	1500'	n/a	n/a
plant	Bartram stonecrop	*Graptopetalum bartramii*	T	LAA	Y (waterway)	300'	n/a	n/a
plant	showy stickseed	*Hackelia venusta*	E	LAA	Y	300'	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	Harper's beauty	*Harperocallis flava*	E	NLAA	Y	All stands that have known occurrences or that have boundaries within 100 feet of known occurrences are included in aerial retardant avoidance areas. All mapped “savannah” stands across the Apalachicola National Forest were also included in avoidance areas.	n/a	n/a
plant	Todsen’s pennyroyal	*Hedeoma todsenii*	E	LAA	N	n/a	n/a	n/a
plant	Roan Mountain bluet	*Hedyotis (Houstonia) purpurea var. montana*	E	NLAA	Y	1500'	n/a	n/a
plant	Virginia sneezeweed	*Helenium virginicum*	T	NLAA	Y (Waterway)	300'	n/a	n/a
plant	Schweinitz’s sunflower	*Helianthus schweinitzii*	E	NLAA	Y	1500'	n/a	n/a
plant	swamp-pink	*Helonias bullata*	T	NLAA	Y	300' waterway buffers and known occurrences outside waterway areas with a 300' buffer	n/a	n/a
plant	dwarf-flowered heartleaf	*Hexastylis naniflora*	T	NE	N	n/a	n/a	n/a
plant	Neches River rose mallow	*Hibiscus dasycalyx*	T, CH	NLAA, NLAA	Y	300'	Y	300'
plant	mountain bluet	*Houstonia montana*	E	NLAA	Y	300'	n/a	n/a
~~plant~~	~~water howellia~~	~~*Howellia aquatilis*~~	~~T~~	~~NLAA~~	~~Y~~	~~300'~~	~~n/a~~	~~n/a~~ Delisted 6/16/21
plant	mountain golden heather	*Hudsonia montana*	T, CH	NLAA, NLAA	Y	1500'	Y	1500'
plant	Texas prairie dawn	*Hymenoxys texana*	E	NE	N	n/a	n/a	n/a
plant	Sintenis' holly (Cuero de Sapo)	*Ilex sintenisii*	E	NE	N	n/a	n/a	n/a
plant	Peter's mountain-mallow	*Iliamna corei*	E	NE	N	n/a	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	Pagosa skyrocket	*Ipomopsis polyantha*	E, CH	NLAA, NLAA	Y	if found on forest lands occurrence would be mapped with avoidance area	Y	300'
plant	Holy Ghost ipomopsis	*Ipomopsis sancti-spiritus*	E	LAA	N	n/a	n/a	n/a
plant	Dwarf Lake iris	*Iris lacustris*	T	NE	N	n/a	n/a	n/a
plant	Louisiana quillwort	*Isoetes louisianensis*	E	NE	N	n/a	n/a	n/a
plant	small whorled pogonia	*Isotria medeoloides*	T	NLAA	Y	300' waterway and known locations on Francis Marion and Sumter	n/a	n/a
plant	Webber ivesia	*Ivesia webberi*	T, CH	LAA, NLAA	Y	300'	Y	300'
plant	fleshy-fruit gladecress	*Leavenworthia crassa*	E	NE	N	n/a	n/a	n/a
plant	Luquillo Mountain babyboot orchid	*Lepanthes eltoroensis*	E	NE	N	n/a	n/a	n/a
plant	slick-spot peppergrass	*Lepidium papilliferum*	T	NE	N	n/a	n/a	n/a
plant	Missouri bladderpod	*Lesquerella (Physaria) filiformis*	T	NE	N	n/a	n/a	n/a
plant	San Bernardino Mountains bladderpod	*Lesquerella kingii* ssp. *bernardina (Physaria kingii* ssp. *bernardina)*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	lyrate bladderpod	*Lesquerella lyrata*	T	NE	N	n/a	n/a	n/a
plant	white bladderpod	*Physaria pallida*	E	NLAA	N	n/a	n/a	n/a
plant	Heller's blazing star	*Liatris helleri*	T	NLAA	Y	1500'	n/a	n/a
plant	Huachuca water umbel	*Lilaeopsis schaffneriana* spp. *recurva*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	western lily	*Lilium occidentale*	E	NE	N	n/a	n/a	n/a
plant	pondberry	*Lindera melissifolia*	E	NE	N	n/a	n/a	n/a
plant	Cook's lomatium	*Lomatium cookii*	E	NE	N	n/a	n/a	n/a
plant	Kincaid's lupine	*Lupinus oreganus var. kincaidii*	T, (CH)	NLAA, n/a	Y	300'	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	rough-leaf loosestrife	*Lysimachia asperulifolia*	E	NLAA	Y	1500'	n/a	n/a
plant	white birds-in-a-nest	*Macbridea alba*	T	NLAA	Y	All stands that include known occurrences or with boundaries that are within 100 feet of known occurrences are included in aerial retardant avoidance areas. All mapped "savannah" stands across the Apalachicola National Forest are also included in avoidance areas	n/a	n/a
plant	Mohr's Barbara's buttons	*Marshallia mohrii*	T	NE	N	n/a	n/a	n/a
plant	Cumberland sandwort	*Minuartia cumberlandensis*	E	NE	N	n/a	n/a	n/a
plant	Macfarlane's four-o'clock	*Mirabilis macfarlanei*	T	LAA	Y	300'	n/a	n/a
plant	Britton's beargrass	*Nolina brittoniana*	E	LAA	Y	300'	n/a	n/a
plant	Houghton's goldenrod	*Oligoneuron (Solidago) houghtonii*	T	NE	N	n/a	n/a	n/a
plant	Bakersfield cactus	*Opuntia (basilaris var.) treleasel*	E	LAA	N	n/a- Known occurrences are not mapped with avoidance areas.	n/a	n/a
plant	California orcutt grass	*Orcuttia californica*	E	NE	N	n/a	n/a	n/a
plant	slender orcutt grass	*Orcuttia tenuis*	T, CH	LAA, NLAA	Y	300'	N	n/a
plant	Canby's dropwort	*Oxypolis canbyi*	E	NE	N	n/a	n/a	n/a
plant	Cushenbury oxytheca	*Oxytheca parishii var goodmaniana (Acanthoscyphus parishii var. goodmaniana)*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	Fassett's locoweed	*Oxytropis campestris var. chartacea*	T	NE	N	n/a	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	beardless chinchweed	*Pectis imberbis*	E, CH	NLAA, NLAA	N	n/a	N	n/a
plant	San Rafeal cactus	*Pediocactus despainii*	E	NE	N	n/a	n/a	n/a
plant	Fickeisen plains cactus	*Pediocactus peeblesianus var. fickeiseniae*	E, CH	NLAA, NLAA	Y	300'	Y	300'
plant	winkler cactus	*Pediocactus winkleri*	T	NE	N	n/a	n/a	n/a
plant	blowout penstemon	*Penstemon haydenii*	E	NLAA	Y	0.25 Miles	n/a	n/a
plant	Penland beardtongue	*Penstemon penlandii*	E	NE	N	n/a	n/a	n/a
plant	clay phacelia	*Phacelia argillacea*	E	LAA	Y	300' - known occurrences and suitable habitat for reintroduction	n/a	n/a
plant	North Park phacelia	*Phacelia formosula*	E	NE	N	n/a	n/a	n/a
plant	DeBeque phacelia	*Phacelia submutica*	T, CH	NLAA, NLAA	Y	300'	Y	300'
plant	Yreka phlox	*Phlox hirsuta*	E	LAA	Y	300'	n/a	n/a
plant	Godfrey's butterwort	*Pinguicula ionantha*	T	NLAA	Y	All stands with known occurrences were included in aerial retardant avoidance areas. All mapped “savannah” stands across the Apalachicola National Forest were also included in these zones.	n/a	n/a
plant	whitebark pine	*Pinus albicaulis*	PT	NLAA	N	n/a	n/a	n/a
plant	Ruth's golden-aster	*Pityopsis ruthii*	E	NLAA	Y (waterway)	300'	n/a	n/a
plant	rough popcorn flower	*Plagiobothrys hirtus*	E	NE	N	n/a	n/a	n/a
plant	white fringless orchid	*Platanthera integrilabia*	T	NLAA	Y	300'	n/a	n/a
plant	eastern prairie white-fringed orchid	*Platanthera leucophaea*	T	NE	N	n/a	n/a	n/a
plant	western prairie fringed orchid	*Platanthera praeclara*	T	NLAA	N	n/a	n/a	n/a
plant	chupacallos	*Pleodendron macranthum*	E	NE	N	n/a	n/a	n/a

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plant	San Bernardino bluegrass	*Poa atropurpurea*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	Lewton's polygala	*Polygala lewtonii*	E	NLAA	Y	300'	n/a	n/a
plant	Maguire's primrose	*Primula cusickiana* var. *maguirei*	T	NLAA	Y	300' waterway with additional inclusions to encompass habitat where the primrose is known to exist outside of the 300-foot waterway buffer	n/a	n/a
plant	San Joaquin Adobe sunburst	*Pseudobahia peirsonii*	T	NE	N	n/a	n/a	n/a
plant	harperella	*Ptilimnium nodosum*	E	NE	N	n/a	n/a	n/a
plant	Arizona cliffrose	*Purshia subintegra*	E	NLAA	N	n/a	n/a	n/a
plant	Leedy's roseroot	*Rhodiola integrifolia* ssp. *leedyi*	T	NLAA	Y	300'	n/a	n/a
plant	Chapman's rhododendron	*Rhododendron minus var. chapmanii*	E	NLAA	N	n/a	n/a	n/a
plant	Florida gooseberry	*Ribes echinellum*	T	NE	N	n/a	n/a	n/a
plant	Gambel's watercress	*Rorippa gambellii*	E	NE	N	n/a	n/a	n/a
plant	bunched arrowhead	*Sagittaria fasciculata*	E	NE	N	n/a	n/a	n/a
plant	Kral's water-plantain	*Sagittaria secundifolia*	T	NE	N	n/a	n/a	n/a
plant	green pitcher plant	*Sarracenia oreophila*	E	NE	N	n/a	n/a	n/a
plant	mountain sweet pitcher plant	*Sarracenia rubra* ssp. *jonesii*	E	NE	N	n/a	n/a	n/a
plant	Alabama canebrake pitcher plant	*Sarracenia rubra* ssp. *alabamensis*	E	NE	N	n/a	n/a	n/a
plant	American chaffseed	*Schwalbea americana*	E	NE	N	n/a	n/a	n/a
plant	northeastern bulrush	*Scirpus ancistrochaetus*	E	NE	N	n/a	n/a	n/a
plant	Colorado hookless cactus	*Sclerocactus glaucus*	T	NLAA	Y	All known populations and modeled habitat	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
plant	Florida skullcap	*Scutellaria floridana*	T	NLAA	Y	All stands with known occurrences and all mapped savanna stands across the Apalachicola National Forest have been included in aerial retardant avoidance areas.	n/a	n/a
plant	large flowered skullcap	*Scutellaria montana*	T	NE	N	n/a	n/a	n/a
plant	San Francisco peaks ragwort	*Senecio franciscanus*	T, CH	NLAA, NE	N	n/a	N	n/a
plant	Layne's butterweed	*Senecio layneae*	T	LAA	Y	300'	n/a	n/a
plant	Keck's checker-mallow	*Sidalcea keckii*	E, (CH)	NE, na	N	n/a	n/a	n/a
plant	Nelson's checkermallow	*Sidalcea nelsoniana*	T	NE	N	n/a	n/a	n/a
plant	Wenatchee Mountains checker-mallow	*Sidalcea oregana var. calva*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	Pedate checker-mallow	*Sidalcea pedata*	E	LAA	Y	300'	n/a	n/a
plant	Spalding's catchfly	*Silence spaldingii*	T	LAA	Y	300'	n/a	n/a
plant	white irisette	*Sisyrinchium dichotomum*	E	NE	N	n/a	n/a	n/a
plant	Blue Ridge goldenrod	*Solidago spithamaea*	T	NLAA	Y	1500'	n/a	n/a
plant	Virginia spiraea	*Spiraea virginiana*	T	NLAA	Y (waterway)	300'	n/a	n/a
plant	Canelo Hills ladies-tresses	*Spiranthes delitescens*	E	LAA	Y	300'	n/a	n/a
plant	Ute ladies'-tresses orchid	*Spiranthes diluvialis*	T	NLAA	Y	all known colonies on the Uinta-Wasatch-Cache including the entire floodplain area; 300' waterway buffer onTonto and Ashley	n/a	n/a

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plant	Navasota ladies'-tresses	*Spiranthes parksii*	E	NLAA	Y	if found on forest lands occurrence would be mapped with 300' avoidance area	n/a	n/a
plant	Palo de Jazmín	*Styrax portoricensis*	E	NE	N	n/a	n/a	n/a
plant	California taraxacum	*Taraxacum californicum*	E, CH	LAA, NLAA	Y	300'	Y	300'
plant	Palo Colorado	*Ternstroemia luquillensis*	E	NE	N	n/a	n/a	n/a
plant	El Yunque Colorado	*Ternstroemia subsessilis*	E	NE	N	n/a	n/a	n/a
plant	lakeside daisy	*Hymenoxys (Tetraneuris) herbacea*	T	NE	N	n/a	n/a	n/a
plant	Slender-petaled mustard	*Thelypodium stenopetalum*	E	LAA	Y	300'	n/a	n/a
plant	Alabama streak-sorus fern	*Thelypteris pilosa var. alabamensis*	T	NE	N	n/a	n/a	n/a
plant	last chance townsendia	*Townsendia aprica*	T	LAA	Y	1 mile	n/a	n/a
plant	running buffalo clover	*Trifolium stoloniferum*	E	NLAA	Y	300'	n/a	n/a
plant	persistent trillium	*Trillium persistens*	E	NE	N	n/a	n/a	n/a
plant	relict trillium	*Trillium reliquum*	E	NLAA	Y	300'	n/a	n/a
plant	Greene's tuctoria (orcutt grass)	*Tuctoria greenei*	E, CH	LAA, NLAA	Y	300'	N	n/a
reptile	American alligator	*Alligator mississippiensis*	TSA	NE	N	n/a	n/a	n/a
reptile	loggerhead sea turtle	*Caretta caretta*		NLAA, na	Y - Los Padres	Mapped avoidance areas are required for all beach-shoreline areas on the Los Padres National Forest	n/a	n/a
reptile	green sea turtle - East Pacific DPS	*Chelonia mydas*	T, (CH)	NLAA, na	Y - Los Padres	Mapped avoidance areas are required for all beach-shoreline areas on the Los Padres National Forest	n/a	n/a
reptile	bog turtle	*Clemmys muhlenbergii*	TSA	NE	N	n/a	n/a	n/a

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
reptile	New Mexican ridge-nosed rattlesnake	*Crotalus willardi obscurus*	T	NLAA	N	n/a	n/a	n/a
reptile	leatherback sea turtle	*Dermochelys coriacea*	E, (CH)	NLAA, na	Y - Los Padres	Mapped avoidance areas are required for all beach-shoreline areas on the Los Padres National Forest	n/a	n/a
reptile	eastern indigo snake	*Drymarchon couperi*	T	NLAA	N	n/a	n/a	n/a
reptile	Puerto Rican boa	*Epicrates inornatus*	E	NE	N	n/a	n/a	n/a
reptile	Hawksbill sea turtle	*Eretmochelys imbricata*	E (CH)	NLAA, na	N	n/a	n/a	n/a
reptile	blunt-nosed leopard lizard	*Gambelia sila*	E	NLAA	Y	300' buffer on occupied sites	n/a	n/a
reptile	desert tortoise	*Gopherus agassizii*	T, (CH)	NLAA, na	N	n/a	n/a	n/a
reptile	gopher tortoise	*Gopherus polyphemus*	T	NE	N	n/a	n/a	n/a
reptile	yellow-blotched map turtle	*Graptemys flavimaculata*	T	NE	N	n/a	n/a	n/a
reptile	Kemp's ridley sea turtle	*Lepidochelys kempii*	E, (PCH)	NLAA, na	N	n/a	n/a	n/a
reptile	olive ridley sea turtle	*Lepidochelys olivacea*	T	NLAA	Y - Los Padres	Mapped avoidance areas are required for all beach-shoreline areas on the Los Padres National Forest	n/a	n/a
reptile	black pinesnake	*Pituophis melanoleucus lodingi*	T	NE	N	n/a	n/a	n/a
reptile	Louisiana pinesnake	*Pituophis ruthveni*	T	NE	N	n/a	n/a	n/a
reptile	sand skink	*Plestiodon (Neospes) reynoldsi*	T	NE	N	n/a	n/a	n/a
reptile	eastern massassauga	*Sistrurus catenatus*	T	NE	N	n/a	n/a	n/a
reptile	flattened musk turtle	*Sternotherus depressus*	T	NE	N	n/a	n/a	n/a
reptile	northern Mexican gartersnake	*Thamnophis eques megalops*	T, CH	NLAA, NLAA	Y	600' buffer of known populations	Y	600' buffer from waterway
reptile	narrow-headed gartersnake	*Thamnophis rufipunctatus*	T, CH	NLAA, NLAA	Y	600' buffer of known populations	Y	600' buffer from waterway

Category	Common Name	Scientific Name	Status	Determination	Species avoidance area?	species buffer distance	Critical habitat avoidance area?	Critical habitat buffer distance
						if found on forest lands occurrence would be mapped with avoidance area		

Summary of avoidance areas by species from the Biological Assessment and addendums

Airtanker Bases and Jettison Areas (additional species and species with changed determinations in blue)

Category	**Common Name**	**Scientific Name**	**Status**	**Determination**	
amphibian	California tiger salamander - central population	*Ambystoma californiense*	T, CH	LAA, LAA	
bird	eastern black rail	*Laterallus jamaicensis ssp. jamaicensis*	T	NLAA	
bird	California clapper rail	*Rallus longirostris obsoletus*	E	NLAA	
bird	California least tern	*Sterna antillarum browni*	E	NLAA	
crustacean	San Diego fairy shrimp	*Branchinecta sandiegonensis*	E, CH	NLAA, NLAA	
crustacean	California freshwater shrimp	*Syncaris pacifica*	E	NLAA	
fish	beautiful shiner	*Cyprinella formosa*	T, (CH)	NLAA, n/a	
fish	Pecos gambusia	*Gambusia nobilis*	E	NLAA	
fish	Virgin River chub	*Gila seminuda*	E, (CH)	NLAA, n/a	
fish	delta smelt	*Hypomesus transpacificus*	T, (CH)	NLAA, n/a	
fish	Big Spring spinedace	*Lepidomeda mollispinis pratensis*	T, (CH)	NLAA, n/a	
fish	peppered chub	*Macrhybopsis tetranema*	E, (CH)	NLAA, n/a	
fish	smalleye shiner	*Notropis buccula*	E, (CH)	NE, n/a	
fish	sharpnose shiner	*Notropis oxyrhynchus*	E, (CH)	NE, n/a	
fish	pecos bluntnose shiner	*Notropis simus pecoensis*	E, (CH)	NLAA, n/a	
fish	Topeka shiner	*Notropis topeka*	E, (CH)	NLAA, n/a	
fish	woundfin	*Plagopterus argentissimus*	E, (CH)	NLAA, n/a	
insect	Carson wandering skipper	*Pseudocopaedes eunus obscurus*	E	NLAA	
mammal	wood bison	*Bison bison atthabascae*	E	NLAA	
mammal	Columbia Basin pygmy rabbit	*Brachylagus idahoensis*	E	LAA	
mammal	giant kangaroo rat	*Dipodomys ingens*	E	NLAA	300' buffer at San Joaquin Experiment Station
mammal	Fresno kangaroo rat	*Dipodomys nitratoides exilis*	E, (CH)	NLAA, n/a	300' buffer at San Joaquin Experiment Station
mammal	Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*	E	NLAA	
plant	Sonoma alopecurus	*Alopecurus aequalis var. sonomensis*	E	NLAA	
plant	San Diego ambrosia	*Ambrosia pumila*	E, (CH)	NLAA, n/a	
plant	San Jacinto Valley crownscale	*Atriplex coronata var. notatior*	E	NLAA	
plant	Sonoma sunshine	*Blennosperma bakeri*	E	NLAA	
plant	white sedge	Carex albida	E	NLAA	

Category	Common Name	Scientific Name	Status	Determination
plant	hoover's spurge	Chamaesyce hooveri	T	NLAA
plant	Sonoma spineflower	Chorizanthe valida	E	NLAA
plant	Pennell's Bird's-beak	Cordylanthus tenuis ssp. capillaris	E	NLAA
plant	yellow larkspur	Delphinium luteum	E	NE
plant	Lompoc yerba santa	Eriodictyon capitatum	E	NLAA
plant	San Diego button-celery	Eryngium aristulatum var. parishii	E	NLAA
plant	Pine Hill flannelbush	Fremontodendron californicum ssp. decumbens	E	NLAA
plant	Pecos sunflower	Helianthus paradoxus	T	NLAA
plant	Burke's goldfileds	Lasthenia burkei	E	NLAA
plant	Contra Costa goldfields	Lasthenia conjugens	E	NLAA
plant	Pitkin Marsh lily	Lilium pardalinum ssp. pitkinense	E	NLAA
plant	Butte County meadowfoam	Limnanthes floccosa ssp. californica	E, CH	NLAA, NE
plant	large-flowered wooly meadowfoam	Limnanthes pumila	E	NLAA
plant	Sebastapol meadowfoam	Limnanthes vinculans	E	NLAA
plant	Cook's lomatium	Lomatium cookii	E, CH	NLAA, NLAA
plant	willowy monardella	Monardella viminea	E, (CH)	NLAA, n/a
plant	spreading navarretia	Navarretia fossalis	T, (CH)	NLAA, n/a
plant	many-flowered navarretia	Navarretia leucocephala ssp. plieantha	E	NLAA
plant	Knowlton's cactus	Pediocactus knowltonii	E	NLAA
plant	showy indian clover	Trifolium amoenum	E	NLAA
retile	giant garter snake	Thamnophis gigas	T	NLAA