

BIOLOGICAL OPINION
ON THE USDA FOREST SERVICE APPLICATION OF FIRE RETARDANTS
ON NATIONAL FOREST SYSTEM LANDS

This document is the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the continued aerial application of fire retardants on National Forest System (NFS) Lands and its effects on threatened and endangered species and designated critical habitat in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your request for formal consultation was received by us on June 29, 2007. We requested additional information which we received on August 29, 2007. With that information, consultation was initiated effective that date.

This consultation is programmatic in scope and does not evaluate site specific impacts that may occur as a result of the use of eight long-term fire retardant chemicals ("long-term" fire retardants are those that continue to retard burning even after the water content has evaporated), nor does it attempt to quantify or authorize any take of threatened or endangered species that may result from the proposed Federal action or adverse modification of critical habitat. These impacts will be analyzed and quantified through subsequent emergency consultations pursuant to 50 CFR 402.05. This consultation reviews fire retardant use at the national programmatic level with that specificity and analysis that can be predicted considering the nature of the Proposed Action. Fire retardants are typically used under emergency conditions (i.e., fire), a situation commonly addressed under emergency consultation procedures, which provide for a site-specific consultation on actual application. This consultation does not address the application of fire retardant foams or other methods of application of any fire retardant chemicals since these were not proposed as part of the Federal action.

The FWS recognizes the importance of the use of fire retardants in responding to wildland fires. This biological opinion in no way constrains the USFS' ability to defend human life or property during an emergency.

This biological opinion has been prepared in accordance with section 7(b)(4) of the Endangered Species Act, as amended (16 U.S.C. 1531 et seq.) is based on information provided in the final Aquatic Report/Biological Assessment, the final Environmental Assessment, the final Hydrology Report, numerous meetings and telephone conversations with personnel from the U.S.D.A. Forest Service (USFS) and National Marine Fisheries' Service (NMFS), and other sources of information. A complete administrative record of this consultation is on file at 4401 N. Fairfax Dr, room 420, Arlington, VA 22203 and available for viewing by appointment.

Consultation History

Background

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

In 2003, the USFS was sued by Forest Service Employees for Environmental Ethics for failure to comply with the National Environmental Policy Act (NEPA) and the Endangered Species Act. On September 30, 2005, Judge Molloy ruled that the USFS must complete an Environmental Assessment (EA) or Environmental Impact Statement (EIS) and begin formal consultation with FWS. Later, on February 9, 2006, the judge ruled that the USFS must comply with NEPA by no later than August 8, 2007, which was later extended to October 15, 2007. The FWS initially advised the Court that it would complete consultation by January 15, 2008, but later advised that it would require additional time.

History of this Consultation:

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

A conference call was held on November 16, 2006, and included personnel from USFS, FWS, and NMFS. The discussion included information that after the 2007 fire season, the USFS would no longer buy or use retardant formulations containing sodium ferro-cyanide and the USFS's intent to use the section 7 process to assist in making a NEPA decision on retardant use and the significance of environmental impacts; use section 7 to guide future use of retardant in ways that minimize risks to threatened and endangered species; and comply with a court order to comply with the Endangered Species Act. In this call, the USFS informed the Services that due to a court decision in 2005, consultation on this issue needed to be complete by August 8, 2007. The USFS informed the Services that a draft environmental assessment (EA) would be provided by December 1, 2006. At this time the USFS also provided a spreadsheet with information on fish kills caused by unintentionally introducing retardants to rivers between 2001 and 2005.

On December 8, 2006, the USFS provided a draft Aquatics Report to the Services and stated that a draft of the NEPA document would be provided on December 28, 2006. The draft Aquatics Report concluded that since the fire retardants "are typically never intentionally applied to waterways, the 300 foot buffer should suffice in keeping retardant chemicals out of the aquatic environment."

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

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

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

On April 20 the FWS provided informal comments addressing the draft EA. In our comments, we informed the USFS that a No Effect determination was inappropriate because the agency action must include the authorization and use of retardant, and also because we did not agree that the 2000 Guidelines would always avoid entry of retardant into waterways. We also requested an analysis of potential effects to upland vegetation.

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

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

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

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

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

On August 29, 2007, the USFS sent the Services a combined Aquatics Report and Biological Assessment. The report provided a “programmatic analysis of effects to aquatic species, habitat, and

upland vegetation.” Despite concerns that the effects of the proposed action required a more comprehensive evaluation, the Services agreed to initiate consultation without responses to the all requested information in an effort to meet the USFS’s deadline for completing its NEPA process of October 15, 2007.

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

On September 28, 2007, USFS detailed three biologists to the FWS Washington Office to assist in providing supplemental information as part of the Biological Assessment and other reports. With their assistance, the FWS continued to receive additional information from the USFS, including information regarding historical retardant use per Forest and estimates of amount of retardant carried per tanker.

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

On December 31, 2007, the FWS sent a letter to the USFS and advised the Court that FWS needed an extension until March 15, 2008 in order to complete the biological opinion. However, after the court set a hearing in the matter, USFS requested FWS to expedite completion. FWS delivered a draft Biological Opinion to USFS on February 12, 2008. This final biological opinion completes consultation.

BIOLOGICAL OPINION

Description of the Proposed Action

The USFS has requested programmatic consultation on their continued aerial application of eight long-term fire retardants specifically on National Forest System (NFS) lands. Long-term fire retardants are those that continue to retard burning even after the water content has evaporated. Foams, other chemical fire suppressants, other types of application of retardant, or the use of retardant by other agencies on lands beyond the NFS lands were not included in this request, and consequently are not analyzed in this biological opinion. The proposed action would adopt the current interim “Guidelines for Aerial Delivery of Retardant or Foam near Waterways” (App. A) as permanent. These guidelines, herein referred to as the 2000 Guidelines, define a waterway as any body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life. The 2000 Guidelines, established by the USFS, Bureau of Land Management, National Park Service and U.S. Fish and Wildlife Service were implemented to reduce the possibility of the application of fire retardant into waterways. This proposed action will not result in a requirement to apply retardant, nor does it compel the use of retardant at a later time or place. Rather, the proposed action will allow the Incident Commanders and fire managers to use retardant consistent with the 2000 Guidelines, as deemed necessary.

The USFS approves fire retardants for use after the products and their ingredients have been evaluated by the Wildland Fire Chemical Systems (WFCS) to determine whether they meet USFS needs, as described in the *US Dept of Agriculture, Forest Service Specifications 5100-304c, Long-term Retardant Wildland Firefighting, June 1, 2007*. According to the USFS website (<http://www.fs.fed.us/rm/fire/wfcs/index.htm>), WFCS is "...a part of Missoula Technology and Development Center and is located at the Missoula Technology & Development Center in Missoula, Montana. (WFCS) provides National Resource Agencies with detailed information promoting safe and effective Fire Suppression Chemicals and Aerial Delivery Systems." Once approved, the WFCS maintains the Qualified Products List (QPL), which presently includes eight long-term fire retardants, although after 2010 five of those formulations will no longer be used. The decision to approve particular chemicals as a Qualified Product is made at the Washington Office of the USFS.

A list of the approved fire retardants is provided in the Aquatics Report and Biological Assessment (BA) for this consultation. Each chemical is listed at a specific mix ratio and for use only in qualified applications. Additional information on these chemicals can be found at the website cited above. The trade names of the eight retardants are: Phos-Chek D75-R, Phos-Chek D75-F, Phos-Chek 259-R, Phos-Chek 259-F, Phos-Chek G75-F, Phos-Chek G75-W, Phos-Chek LV-R, and Phos-Chek LC-95A-R. In general, all eight fire retardants approved for use are ammonium phosphate compounds and a gum thickener and bactericide. The precise chemical composition was not provided for review in this consultation; therefore, we are unable to evaluate the specific chemical effects of each formulation on threatened and endangered species.

Method of Application

This consultation addresses only the aerial application of the eight fire retardant products described above. The USFS uses three primary kinds of firefighting aircraft to dispense these eight fire retardants: multi-engine airtankers, single engine airtankers, and helicopters.

- Multi-engine airtankers are comprised of ex-military and retired commercial transport aircraft. They carry 800 to 3,600 gallons of retardant. The speed, range, and retardant delivery capacity of the large (2,000 to 3,000 gallon) airtankers make them very effective in both initial attack and support to large fires. These airtankers typically make retardant drops from a height of 150 to 200 feet above vegetation and terrain. They move at airspeeds of 125 to 150 knots. Large fixed-wing airtankers have complex, computer controlled retardant dispersal systems capable of both precise incremental drops and long-trailing drops one-fourth of a mile or more in length. Retardant flow rates are controlled to vary the retardant coverage level. Retardant is dispersed as needed after consideration of a fire's intensity/behavior and the vegetative fuel type(s) involved. Large airtankers can load or reload retardant at established or temporary bases, which are located strategically across the country. Normally, large airtankers can be loaded within a 10-minute period.
- Single engine airtankers (SEATS) are small, fixed-wing aircraft that carry from 400 to 800 gallons of foam or retardant. SEATS can operate from remote airstrips and open fields or closed roads, reloading at portable retardant bases. SEATS are predominately modified agricultural aircraft although some have been designed specifically for wildland firefighting. SEATS are most effective in initial attack of small wildfires within 50 miles of a reload base where turn-around times are short and repetitive drops can be made.

- Small, medium and large helicopters carry from 100 to 3,000 gallons of water, foam, or retardant. This can be carried either in buckets slung beneath the aircraft or in mounted (fixed) tanks. Large heli-tankers can be very cost effective, making rapid, multiple drops of 2,000 gallons or more on escaping wildfires by refilling at nearby water sources or at portable retardant bases. They also provide a unique capability to those urban/wildland interface situations near water sources where they can bring to bear a combination of rapid revisit times and precision drops. Small and medium helicopters are most effective in the direct support of firefighters on the ground where they are directed to specific targets.

Decision Making and Use of Retardants

During a wildfire, events may unfold quickly and require rapid response and wide discretionary decision-making. Therefore, the decision where and when to use an aerial application of fire retardant is left to the discretion of the Incident Commander and other USFS personnel (FS 5100 Manual), and is informed by policy and guidance set by the Washington Office and appropriate Regional Office of the USFS, as well as procedures required by the FS 5100 Manual.

The USFS provides guidance for fire suppression activities through its Land Management Planning process. Land management plans have been completed for each National Forest and include guidance on fire management planning, but do not mandate specific decisions. Rather, this guidance consists of a compilation of existing direction readily accessible to practitioners and managers in the event of an unplanned ignition.

In the event that fire suppression decisions are deemed necessary, a WFSA (Wildland Fire Situation Analysis) is prepared. This is required when one of the following conditions has occurred:

- Wildland fire escapes initial actions or is expected to exceed initial actions
- A wildland fire being managed for resource benefits exceeds prescription parameters in the fire management plan
- A prescribed fire exceeds its prescription and is declared a wildland fire.

WFSA is a decision support process that provides an analytical method for evaluating alternative suppression strategies that are defined by different goals and objectives, suppression costs, and impacts on the land management base. A WFSA alternative describes a suppression strategy consistent with the “delegation of authority,” (a set of instructions) communicated from a land unit administrator to an incoming incident commander. The “delegation” identifies what is important to protect, and may also establish cost targets. The FS 5100 Manual requires that the Agency Administrator ensures that a WFSA is prepared when the conditions exist and that all decisions are documented.

The generalized WFSA process is as follows:

1. Upon determination that one of the above-mentioned conditions has occurred, the Agency Administrator or designated staff prepare a preliminary WFSA document (App.B). This document is constantly reviewed and refined as necessary throughout the fire and includes concerns and constraints, such as the presence and locations of threatened or endangered species, designated critical habitat or other important resources. It may also specify particular fire suppression tactics that can or cannot be used.
2. A Resource Advisor (RA) is assigned to the fire and assists in the development of the WFSA document. The RA also works with the Incident Commander (IC) and the Incident

Management Team daily to provide information on all important resources that may be affected by the fire.

3. In addition to the WFSA document, the USFS Administrator provides the IC with a Delegation of Authority letter, which allows the IC to act on their behalf and meet the expectations of the Administrator in implementing the selected alternative(s) from the WFSA. This letter will also include locations and concerns associated with any designated critical habitat, threatened and endangered species, cultural artifact concerns, or any other special direction that needs to be communicated to the IC and the Incident Management Team.

On October 9, 2007, NMFS issued its biological opinion on the USFS's proposal to aerially apply eight fire retardants to USFS lands. They concluded that the USFS's proposed action was likely to jeopardize the continued existence of 26 threatened and endangered species and to adversely modify the designated critical habitat of these species. Their Reasonable and Prudent Alternatives were accepted by the USFS and are now a part of the USFS's proposed action.

Reasonable and Prudent Alternatives (quoted from NMFS' Biological Opinion)

“The USFS must:

1. Provide evaluations on the two fire retardant formulations, LC 95-A and 259R, for which acute toxicity tests have not been conducted, using standard testing protocols. Although direct fish toxicity tests have not been conducted on three additional formulations, G75-W, G75-F, LV-R, studies are not warranted in light of the fact the USFS intends to phase out their use of these formulations by 2010. All formulations expected to be in use beyond 2010 shall be evaluated using, at a minimum, the established protocols to assess acute mortality to fish. Evaluations must be completed and presented to NMFS no later than two years from the date of this Opinion. Depending on the outcome of these evaluations and after conferring with NMFS, the USFS must make appropriate modifications to the program that would minimize the effects on NMFS' listed resources (e.g., whether a retardant(s) should be withdrawn from use and replaced with an alternative retardant(s)).
2. Engage in toxicological studies on long-term fire retardants approved for current use in fighting fires, to evaluate acute and sublethal effects of the formulations on NMFS' listed resources. The toxicological studies will be developed and approved by both the USFS and NMFS. The studies should be designed to explore the effects of fire retardant use on: unique life stages of anadromous fish such as smolts and buried embryo/alevin life stages ranging in development from spawning to yolk sac absorption and the onset of exogenous feeding (approximately 30 days post-hatch); and anadromous fish exposed to fire retardants under multiple stressor conditions expected during wildfires, such as elevated temperature and low DO. Within 12 months of accepting the terms of this Opinion, USFS provide NMFS with a draft research plan to conduct additional toxicological studies on the acute and sublethal effects of the fire retardant formulations. Depending on the outcome of these studies described per the research plan and after conferring with NMFS, the USFS must make appropriate modifications to the program that would minimize the effects on NMFS' listed resources (e.g., whether a retardant(s) should be withdrawn from use and replaced with an alternative retardant(s)).
3. Develop guidance that directs the US Forest Service to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and changes in the structure of the biological community. The field guidance shall

require monitoring of such parameters as macroinvertebrate communities, soil and water chemistry, or other possible surrogates for examining the direct and indirect effects of fire retardants on the biological community within and downstream of the retardant drop area as supplemental to observations for signs of dead or dying fish. The guidance may establish variable protocols based upon the volume of retardants expected to have entered the waterway, but must require site evaluations commensurate with the volume of fire retardants that entered the waterway.

4. Provide policy and guidance to ensure that USFS local unit resource specialist staff provide the local NMFS Regional Office responsible for section 7 consultations with a summary report of the site assessment that identifies: (a) the retardant that entered the waterway, (b) an estimate of the area affected by the retardant, (c) a description of whether the retardant was accidentally dropped into the waterway or whether an exception to the 2000 Guidelines was invoked and the reasons for the accident or exception, (d) an assessment of the direct and indirect impacts of the fire retardant drop, (e) the nature and results of the field evaluation that was conducted following control and abatement of the fire, and any on site actions that may have been taken to minimize the effects of the retardant on aquatic communities.

5. Provide NMFS Headquarter's Office of Protected Resources with a biannual summary (every two years) that evaluates the cumulative impacts (as the Council on Environmental Quality has defined that term pursuant to the National Environmental Policy Act of 1969) of their continued use of long-term fire retardants including: (a) the number of observed retardant drops entering a waterway, in any sub-watershed and watershed, (b) whether the observed drops occurred in a watershed inhabited by NMFS' listed resources, (c) an assessment as to whether listed resources were affected by the misapplication of fire retardants within the waterway, and (d) the USFS' assessment of cumulative impacts of the fire retardant drops within the subwatershed and watershed and the consequences of those effects on NMFS' listed resources. The evidence the USFS shall use for this evaluation would include, but is not limited to: (i) the results of consultation with NMFS' Regional Offices and the outcome of the site assessment described in detail in the previous element of this RPA (Element 4) and (ii) the results of new fish toxicity studies identified within Element 2; and (d) any actions the USFS took or intends to take to supplement the 2000 Guidelines to minimize the exposure of listed fish species to fire retardants, and reduce the severity of their exposure."

Action Area

The section 7 implementing regulations define the "Action Area" of a federal action as all areas to be affected, directly or indirectly, and not merely the immediate area involved in the action (50 CFR 402.02). This biological opinion assesses the consequences of the USFS's continued use of eight fire retardants for potential use on any USFS lands across the United States and its territories. According to the USFS, the National Forest System consists of 192 million acres of National Forests and National Grasslands across 42 states and 1 territory. In all, this amounts to 155 National Forests, 22 National Grasslands, 6 National Monuments, 20 National Recreational Areas, 9 National Scenic Areas, and 1 National Preserve, of which 403 are designated wilderness units and river reaches that are designated as Wild and Scenic Rivers.

Based on our assessment we have determined that the direct and indirect effects of the USFS' use of the fire retardants may extend beyond NSF lands due to interrelated and interdependent actions, or due to indirect effects of fire retardant application. Though we expect that the USFS would typically conduct fire suppression activities primarily on NSF lands, we understand that it is likely that the USFS may fight fires along the interface between federal lands and other landholders where the

effects of fire retardants extend beyond USFS jurisdiction. Consequently, we are broadly characterizing the Action Area as all NSF lands (excluding the Caribbean National Forest, where fire retardant is not used), plus a reasonable “buffer” area immediately adjacent to NSF lands. The size of this buffer is dependant upon the species in question and the likelihood of said species being exposed to fire retardant when applied on NSF lands.

Consultation Methods

This consultation is programmatic in scope and addresses impacts to 387 species found on or immediately adjacent to USFS lands (see Table 1). The consultation addresses the Forest Service’s authorization and use of the aerial application of fire retardants which contain ammonium salts on National Forest lands throughout the United States, with the exception of the Caribbean National Forest, where fire retardants are not used. Because of the programmatic nature of this consultation, our purpose is not to attempt to quantify take, but rather to determine whether the proposed action is likely to jeopardize the continued existence of any listed species or result in adverse modification of critical habitat. We expect that take may occur as a result of the use of fire retardant. Quantification and authorization of take resulting from a specific use of fire retardant, cumulative effects, as well as any compensatory measures required to offset any such take, will be conducted at the local level via the emergency consultation process as outlined in 50 CFR 402.05.

Our analysis took place in two parts.

Part one: the FWS Washington Office (WO) conducted an analysis based upon the literature and the information on the species that was available to us. That species information consisted of listing packages, critical habitat designation packages, recovery plans, five-year reviews, petition findings and information from NatureServe. Using this information, the FWS made a preliminary “not likely to be jeopardized” determination for 181 of the species subject to this consultation.

Part two: the remaining 206 species belonged to taxonomic groups that the WO identified as being potentially vulnerable to jeopardy resulting from the effects of exposure to long-term fire retardants and which required closer analysis using specialized and current information that is housed in our Regions and Field Offices (RO/FO), including current status of these species, recent studies, species survey reports, and protective measures included in local agreements with other agencies or jurisdictions. Therefore, the FWS’ RO/FOs conducted a second focused analysis of these species, utilizing current information regarding the status of the species, current studies, and where applicable, any protective measures or agreements that have been developed at the local level.

Table 1. List of all species included in this consultation. The Scientific Name column provides a hyperlink to each species’ profile in the Service’s Threatened and Endangered Species System online database that can also be accessed by searching for the Scientific Name or the Common Name in the Threatened and Endangered Species System database that is available online at <http://ecos.fws.gov>.

	Common Name	Federal Status	Scientific Name
	Plants		
1.	San Diego Thorn-mint	T	Acanthomintha ilicifolia
2.	Northern Wild Monkshood	T	Aconitum noveboracense
3.	Sensitive Joint-vetch	T	Aeschynomene virginica

4.	Munz' Onion	E	<u>Allium munzii</u>
5.	Little Amphianthus	T	<u>Amphianthus pusillus</u>
6.	Price's Potato-bean	T	<u>Apios priceana</u>
7.	McDonald's Rock-cress	E	<u>Arabis mcdonaldiana</u>
8.	Shale Barren Rock-cress	E	<u>Arabis serotina</u>
9.	Cumberland Sandwort	E	<u>Arenaria cumberlandensis</u>
10.	Marsh Sandwort	E	<u>Arenaria paludicola</u>
11.	Bear Valley Sandwort	T	<u>Arenaria ursina</u>
12.	Sacramento Prickly-poppy	E	<u>Argemone pleiacantha ssp. pinnatisecta</u>
13.	Mead's Milkweed	T	<u>Asclepias meadii</u>
14.	Hart's Tongue Fern	T	<u>Asplenium scolopendrium var. americanum</u>
15.	Cushenbury Milk-vetch	E	<u>Astragalus albens</u>
16.	Applegate's Milk-vetch	E	<u>Astragalus applegatei</u>
17.	Braunton's Milk-vetch	E	<u>Astragalus brauntonii</u>
18.	Desert Milkvetch	T	<u>Astragalus desereticus</u>
19.	Coachella Milk-vetch	E	<u>Astragalus lentiginosus var. coachellae</u>
20.	Heliotrope Milk-vetch	T	<u>Astragalus montii</u>
21.	Osterhout's Mik-vetch	E	<u>Astragalus osterhoutii</u>
22.	Tripleribed Milk-vetch	E	<u>Astragalus tricarinatus</u>
23.	Encinitas Baccharis	T	<u>Baccharis vanessae</u>
24.	Nevin's Barberry	E	<u>Berberis nevinii</u>
25.	Virginia Round-leaf Birch	T	<u>Betula uber</u>
26.	Florida Bonamia	T	<u>Bonamia grandiflora</u>
27.	Thread-leaved Brodiaea	T	<u>Brodiaea filifolia</u>
28.	Capa Rosa	E	<u>Callicarpa ampla</u>
29.	Mariposa Pussypaws	T	<u>Calyptidium pulchellum</u>
30.	Ashgray Paintbrush	T	<u>Castilleja cinerea</u>
31.	California Jewelflower	E	<u>Caulanthus californicus</u>
32.	Vail Lake Ceanothus	T	<u>Ceanothus ophiochilus</u>
33.	Purple (=Camatta Canyon) Amole	T	<u>Chlorogalum purpureum</u>
34.	La Graciaosa Thistle	E	<u>Cirsium loncholepis</u>
35.	Pitcher's Thistle	T	<u>Cirsium pitcheri</u>
36.	Sacramento Mountain Thistle	T	<u>Cirsium vinaceum</u>
37.	Springville Fairyfan	T	<u>Clarkia springvillensis</u>
38.	Alabama Leather Flower	E	<u>Clematis socialis</u>
39.	Pigeon Wings	T	<u>Clitoria fragrans</u>
40.	Apalachicola Rosemary	E	<u>Conradina glabra</u>
41.	Cumberland Rosemary	T	<u>Conradina verticillata</u>
42.	Pima Pineapple Cactus	E	<u>Coryphantha scheeri var. robustispina</u>
43.	Leafy Prairie Clover	E	<u>Dalea foliosa</u>
44.	Slender-horned Spineflower	E	<u>Dodecahema leptoceras</u>
45.	Santa Monica Mountains Dudleya	T	<u>Dudleya cymosa ssp. ovatifolia</u>
46.	Smooth Purple Coneflower	E	<u>Echinacea laevigata</u>
47.	Kuenzler Hedgehog Cactus	E	<u>Echinocereus fendleri var. kuenzleri</u>
48.	Arizona Hedgehog Cactus	E	<u>Echinocereus triglochidiatus var. arizonicus</u>

49.	Kern Mallow	E	<i>Eremalche kernensis</i>
50.	Giant Woollystar	E	<i>Eriastrum densifolium ssp. sanctorum</i>
51.	Maguire Daisy	T	<i>Erigeron maguirei</i>
52.	Parish's Fleabane Daisy	T	<i>Erigeron parishii</i>
53.	Zuni Fleabane	T	<i>Erigeron rhizomatus</i>
54.			<i>Eriogonum kennedyi var.</i>
	Southern Mountain Buckwheat	T	<i>austromontanum</i>
55.			<i>Eriogonum longifolium var.</i>
	Scrub Buckwheat	T	<i>gnaphalifolium</i>
56.	Cushenbury Buckwheat	E	<i>Eriogonum ovalifolium var. vineum</i>
57.	Uvillo	E	<i>Eugenia haematocarpa</i>
58.	Penland Alpine Fen Mustard	T	<i>Eutrema penlandii</i>
59.	Mexican Flannelbush	E	<i>Fremontodendron mexicanum</i>
60.	Gentner's fritillary	E	<i>Fritillaria gentneri</i>
61.	Colorado Butterfly Plant	T	<i>Gaura neomexicana var. coloradensis</i>
62.	Geocarpon	T	<i>Geocarpon minimum</i>
63.	Spreading Avens	E	<i>Geum radiatum</i>
64.	Gymnoderma lineare	E	<i>Gymnoderma lineare</i>
65.	Showy Stickweed	E	<i>Hackelia venusta</i>
66.	Harper's Beauty	E	<i>Harperocallis flava</i>
67.	Todsens Pennyroyal	E	<i>Hedeoma todsenii</i>
68.	Roan Mountain Bluet	E	<i>Hedyotis purpurea var. montana</i>
69.	Virginia Sneezeweed	T	<i>Helenium virginicum</i>
70.	Eggert's Sunflower	T	<i>Helianthus eggertii</i>
71.	Schweinitz's Sunflower	E	<i>Helianthus schweinitzii</i>
72.	Swamp Pink	T	<i>Helonias bullata</i>
73.	Dwarf-flowered Heartleaf	T	<i>Hexastylis naniflora</i>
74.	Water Howellia	T	<i>Howellia aquatilis</i>
75.	Mountain Golden Heather	T	<i>Hudsonia montana</i>
76.	Lakeside Daisy	T	<i>Hymenoxys herbacea</i>
77.	Cuero de Sapo	E	<i>Ilex sintenisii</i>
78.	Peter's Mountain-mallow	E	<i>Iliamna corei</i>
79.	Holy Ghost Ipomopsis	E	<i>Ipomopsis sancti-spiritus</i>
80.	Dwarf Lake Iris	T	<i>Iris lacustris</i>
81.	Louisiana Quillwort	E	<i>Isoetes louisianensis</i>
82.	Small Whorled Pogonia	T	<i>Isotria medeoloides</i>
83.	San Joaquin Woolly-Threads	E	<i>Lembertia congdonii</i>
84.	Babyfoot Orchid	E	<i>Lepanthes eltoroensis</i>
85.	Missouri Bladder-pod	E	<i>Lesquerella filiformis</i>
86.	San Bernardino Mountains Bladderpod	E	<i>Lesquerella kingii ssp. bernardina</i>
87.	Lyrate Bladderpod	T	<i>Lesquerella lyrata</i>
88.	White Bladderpod	E	<i>Lesquerella pallida</i>
89.	Heller's Blazing Star	T	<i>Liatris helleri</i>
90.	Huachuca water-umbel	E	<i>Lilaeopsis schaffneriana var. recurva</i>
91.	Western Lily	E	<i>Lilium occidentale</i>
92.	Butte County Meadowfoam	E	<i>Limnanthes floccosa ssp. californica</i>
93.	Pondberry	E	<i>Lindera melissifolia</i>
94.	Cook's Lomatium	E	<i>Lomatium cookii</i>

95.	Kincaid's Lupine	T	<u><i>Lupinus oreganus</i> var. <i>kincaidii</i></u>
96.	Rough-leaf Loosestrife	E	<u><i>Lysimachia asperulaefolia</i></u>
97.	White Bird-in-a-nest	T	<u><i>Macbridea alba</i></u>
98.	Mohr's Barbara's Buttons	T	<u><i>Marshallia mohrii</i></u>
99.	Macfarlane's Four-O'Clock	T	<u><i>Mirabilis macfarlanei</i></u>
100.	Britton's Beargrass	E	<u><i>Nolina brittonia</i></u>
101.	Bakersfield Cactus	E	<u><i>Opuntia treleasei</i></u>
102.	Slender Orcutt Grass	T	<u><i>Orcuttia tenuis</i></u>
103.	Canby's Dropwort	E	<u><i>Oxypolis canbyi</i></u>
104.	Cushenbury Oxytheca	E	<u><i>Oxytheca parishii</i> var. <i>goodmaniana</i></u>
105.	Fassett's Locoweed	T	<u><i>Oxytropis campestris</i> var. <i>chartacea</i></u>
106.	San Rafael Cactus	E	<u><i>Pediocactus despainii</i></u>
107.	Winkler Cactus	T	<u><i>Pediocactus winkleri</i></u>
108.	Blowout Penstemon	E	<u><i>Penstemon haydenii</i></u>
109.	Clay Phacelia	E	<u><i>Phacelia argillacea</i></u>
110.	Yreka phlox	E	<u><i>Phlox hirsuta</i></u>
111.	Texas Trailing Phlox	E	<u><i>Phlox nivalis</i> ssp. <i>texensis</i></u>
112.	Godfrey's Butterwort	T	<u><i>Pinguicula ionantha</i></u>
113.	Ruth's Golden-aster	E	<u><i>Pityopsis ruthii</i></u>
114.	Rough Popcorn Flower	E	<u><i>Plagiobothrys hirtus</i></u>
115.	Eastern Prairie White-fringed Orchid	T	<u><i>Platanthera leucophaea</i></u>
116.	Western Prairie Fringed Orchid	T	<u><i>Platanthera praeclara</i></u>
117.	Chupacallos	E	<u><i>Pleodendron macranthum</i></u>
118.	San Bernardino Bluegrass	E	<u><i>Poa atropurpurea</i></u>
119.	Lewton's Polygala	E	<u><i>Polygala lewtonii</i></u>
120.	Maguire Primrose	T	<u><i>Primula maguirei</i></u>
121.	San Joaquin Adobe Sunburst	T	<u><i>Pseudobahia peirsonii</i></u>
122.	Harperella	E	<u><i>Ptilimnium nodosum</i></u>
123.	Arizona Cliffrose	E	<u><i>Purshia subintegra</i></u>
124.	Miccosukee Gooseberry	T	<u><i>Ribes echinellum</i></u>
125.	Gambel's Watercress	E	<u><i>Rorippa gambellii</i></u>
126.	Bunched Arrowhead	E	<u><i>Sagittaria fasciculata</i></u>
127.	Kral's Water Plantain	T	<u><i>Sagittaria secundifolia</i></u>
128.	Green Pitcher Plant	E	<u><i>Sarracenia oreophila</i></u>
129.	Alabama Canebrake Pitcher Plant	E	<u><i>Sarracenia rubra alabamensis</i></u>
130.	Mountain Sweet Pitcher Plant	E	<u><i>Sarracenia rubra</i> ssp. <i>jonesii</i></u>
131.	American Chaffseed	E	<u><i>Schwalbea americana</i></u>
132.	Northeastern Bulrush	E	<u><i>Scirpus ancistrochaetus</i></u>
133.	Unita Basin Hookless Cactus	T	<u><i>Sclerocactus glaucus</i></u>
134.	Florida Skullcap	T	<u><i>Scutellaria floridana</i></u>
135.	Large Flowered Skullcap	T	<u><i>Scutellaria montana</i></u>
136.	Leedy's Roseroot	T	<u><i>Sedum integrifolium leedyi</i></u>
137.	San Francisco Peaks groundsel	T	<u><i>Senecio franciscanus</i></u>
138.	Layne's Butterweed	T	<u><i>Senecio layneae</i></u>
139.	Keck's Checker Mallow	E	<u><i>Sidalcea keckii</i></u>
140.	Nelson's Checker Mallow	T	<u><i>Sidalcea nelsoniana</i></u>

141.	Wenatchee Mountains Checker Mallow	E	<i>Sidalcea oregana</i> var. <i>calva</i>
142.	Bird-footed Checkerbloom	E	<i>Sidalcea pedata</i>
143.	Spalding's Catchfly	T	<i>Silene spaldingii</i>
144.	White Irisette	E	<i>Sisyrinchium dichotomum</i>
145.	White-Haired Goldenrod	T	<i>Solidago albopilosa</i>
146.	Houghton's Goldenrod	T	<i>Solidago houghtonii</i>
147.	Blue Ridge Goldenrod	T	<i>Solidago spithamaea</i>
148.	Virginia Spiraea	T	<i>Spiraea virginiana</i>
149.	Canelo Hills Ladies Tresses	E	<i>Spiranthes delitescens</i>
150.	Ute Ladies'-tresses	T	<i>Spiranthes diluvialis</i>
151.	Navasota Ladies'-tresses	E	<i>Spiranthes parksii</i>
152.	Palo de Jazmin	E	<i>Styrax portoricensis</i>
153.	California Dandelion	E	<i>Taraxacum californicum</i>
154.	Palo Colorado	E	<i>Ternstroemia luquillensis</i>
155.	Unknown Common Name	E	<i>Ternstroemia subsessilis</i>
156.	Howell's Spectacular Thelypody	T	<i>Thelypodium howellii spectabilis</i>
157.	Slender-petaled mustard	E	<i>Thelypodium stenopetalum</i>
158.	Alabama Streak-Sorus Fern	T	<i>Thelypteris pilosa</i> var. <i>alabamensis</i>
159.	Kneeland Prairie Pennycress	E	<i>Thlaspi californicum</i>
160.	Last Chance Townsendia	T	<i>Townsendia aprica</i>
161.	Running Buffalo Clover	E	<i>Trifolium stoloniferum</i>
162.	Persistent Trillium	E	<i>Trillium persistens</i>
163.	Relict Trillium	E	<i>Trillium reliquum</i>
164.	Greene's Tuctoria	E	<i>Tuctoria greenei</i>
165.	Tennessee Yellow-eyed Grass	E	<i>Xyris tennesseensis</i>
Invertebrates			
166.	Cumberland Elktoe	E	<i>Alasmidonta atropurpurea</i>
167.	Dwarf Wedgemussel	E	<i>Alasmidonta heterodon</i>
168.	Appalachian Elktoe	E	<i>Alasmidonta raveneliana</i>
169.	Fat Three-Ridge Mussel	E	<i>Amblema neislerii</i>
170.	Tumbling Creek Cave Snail	E	<i>Antrobia culveri</i>
171.	Ouachita Rock Pocketbook	E	<i>Arkansia wheeleri</i>
172.	Uncompahgre Fritillary Butterfly	E	<i>Boloria acrocynema</i>
173.	Conservancy Fairy Shrimp	E	<i>Branchinecta conservatio</i>
174.	Longhorn Fairy Shrimp	E	<i>Branchinecta longiantenna</i>
175.	Vernal Pool Fairy Shrimp	T	<i>Branchinecta lynchi</i>
176.	A Crayfish	E	<i>Cambarus aculabrum</i>
177.	Hell Creek Cave Crayfish	E	<i>Cambarus zophonastes</i>
178.	Fanshell	E	<i>Cyprogenia stegaria</i>
179.	Valley Elderberry Longhorn Beetle	T	<i>Desmocerus californicus dimorphus</i>
180.	Dromedary Pearlymussel	E	<i>Dromus dromas</i>
181.	Lacy Elimia	T	<i>Elimia crenatella</i>
182.	Purple Bankclimber Mussel	T	<i>Elliptoideus sloatianus</i>
183.	Cumberlandian Combshell	E	<i>Epioblasma brevidens</i>

184.	Oyster Mussel	E	<u><i>Epioblasma capsaeformis</i></u>
185.	Curtis Pearlymussel	E	<u><i>Epioblasma florentina curtisi</i></u>
186.	Yellow Blossom (Pearlymussel)	E	<u><i>Epioblasma florentina florentina</i></u>
187.	Tan Riffleshell	E	<u><i>Epioblasma florentina walkeri</i></u>
188.	Upland Combshell	E	<u><i>Epioblasma metastriata</i></u>
189.	Purple Cat's Paw Pearlymussel	E	<u><i>Epioblasma obliquata obliquata</i></u>
190.	Southern Acornshell	E	<u><i>Epioblasma othcaloogensis</i></u>
191.	Green Blossom (Pearlymussel)	E	<u><i>Epioblasma torulosa gubernaculum</i></u>
192.	Northern Riffleshell	E	<u><i>Epioblasma torulosa rangiana</i></u>
193.	Tubercled-blossom Pearlymussel	E	<u><i>Epioblasma torulosa torulosa</i></u>
194.	Turgid Blossom	E	<u><i>Epioblasma turgidula</i></u>
195.	Smith's Blue Butterfly	E	<u><i>Euphilotes enoptes smithi</i></u>
196.	Quino Checkerspot Butterfly	E	<u><i>Euphydryas editha quino</i></u>
197.	Kern Primrose Sphinx Moth	T	<u><i>Euproserpinus euterpe</i></u>
198.	Shiny Pigtoe	E	<u><i>Fusconaia cor</i></u>
199.	Finerayed Pigtoe	E	<u><i>Fusconaia cuneolus</i></u>
200.	Cracking Pearlymussel	E	<u><i>Hemistena lata</i></u>
201.	Pawnee Montane Skipper	T	<u><i>Hesperia leonardus montana</i></u>
202.	Koster's tryonia snail	PE	<u><i>Juturnia kosteri</i></u>
203.	Pink Mucket	E	<u><i>Lampsilis abrupta</i></u>
204.	Finelined Pocketbook	T	<u><i>Lampsilis altilis</i></u>
205.	Orangenacre Mucket	T	<u><i>Lampsilis perovalis</i></u>
206.	Arkansas Fatmucket	T	<u><i>Lampsilis powelli</i></u>
207.	Shinyrayed pocketbook	E	<u><i>Lampsilis subangulata</i></u>
208.	Carolina Heelsplitter	E	<u><i>Lasmigona decorata</i></u>
209.	Birdwing Pearlymussel*	E	<u><i>Lemiox rimosus</i></u>
210.	Scaleshell Mussel	E	<u><i>Leptodea leptodon</i></u>
211.	Round rocksnail	T	<u><i>Leptoxis ampla</i></u>
212.	Painted rocksnail	T	<u><i>Leptoxis taeniata</i></u>
213.	Flat pebblesnail	E	<u><i>Lepyrium showalteri</i></u>
214.	Cylindrical lioplax	E	<u><i>Lioplax cyclostomaformis</i></u>
215.	Karner Blue Butterfly	E	<u><i>Lycaeides melissa samuelis</i></u>
216.	Louisiana Pearlshell	T	<u><i>Margaritifera hembeli</i></u>
217.	Alabama Moccasinshell	T	<u><i>Medionidus acutissimus</i></u>
218.	Coosa Moccasinshell	E	<u><i>Medionidus parvulus</i></u>
219.	Ochlockonee Moccasinshell	E	<u><i>Medionidus simpsonianus</i></u>
220.	Noonday Globe	T	<u><i>Mesodon clarki nantahala</i></u>
221.	Magazine Mountain Shagreen	T	<u><i>Mesodon magazinensis</i></u>
222.	Spruce-fir Moss Spider	E	<u><i>Microhexura montivaga</i></u>
223.	Mitchell's Satyr	E	<u><i>Neonympha mitchelli mitchelli</i></u>
224.	American Burying Beetle	E	<u><i>Nicrophorus americanus</i></u>
225.	Ring Pink (Mussel)	E	<u><i>Obovaria retusa</i></u>
226.	Shasta Crayfish	E	<u><i>Pacifastacus fortis</i></u>
227.	Littlewing Pearlymussel	E	<u><i>Pegias fabula</i></u>
228.	Clubshell	E	<u><i>Pleurobema clava</i></u>
229.	James Spinymussel	E	<u><i>Pleurobema collina</i></u>
230.	Southern Clubshell	E	<u><i>Pleurobema decisum</i></u>

231.	Dark Pigtoe	E	<u><i>Pleurobema furvum</i></u>
232.	Southern Pigtoe	E	<u><i>Pleurobema georgianum</i></u>
233.	Ovate clubshell	E	<u><i>Pleurobema perovatum</i></u>
234.	Rough Pigtoe	E	<u><i>Pleurobema plenum</i></u>
235.	Oval Pigtoe	E	<u><i>Pleurobema pyriforme</i></u>
236.	Heavy Pigtoe	E	<u><i>Pleurobema taitianum</i></u>
237.	Fat Pocketbook	E	<u><i>Potamilus capax</i></u>
238.	Heavy Pigtoe	E	<u><i>Potamilus inflatus</i></u>
239.	Triangular Kidneyshell	E	<u><i>Ptychobranhus greenii</i></u>
240.	Laguna Mountains Skipper	E	<u><i>Pyrgus ruralis lagunae</i></u>
241.	Rough Rabbitsfoot	E	<u><i>Quadrula cylindrica strigillata</i></u>
242.	Cumberland Monkeyface (pearlymussel)	E	<u><i>Quadrula intermedia</i></u>
243.	Appalachian Monkeyface	E	<u><i>Quadrula sparsa</i></u>
244.	Hine's Emerald Dragonfly	E	<u><i>Somatochlora hineana</i></u>
245.	Oregon Silverspot Butterfly	T	<u><i>Speyeria zerene hippolyta</i></u>
246.	Alamosa Springsnail	E	<u><i>Tryonia alamosae</i></u>
247.	Tulotoma Snail	E	<u><i>Tulotoma magnifica</i></u>
248.	Purple Bean Mussel	E	<u><i>Villosa perpurpurea</i></u>
249.	Cumberland Bean Pearlymussel	E	<u><i>Villosa trabalis</i></u>
Fish			
250.	Gulf Sturgeon	T	<u><i>Acipenser oxyrinchus desotoi</i></u>
251.	White Sturgeon (Kootenai R. Pop.)	E	<u><i>Acipenser transmontanus</i></u>
252.	Modoc sucker	E	<u><i>Catostomus microps</i></u>
253.	Santa Ana Sucker	T	<u><i>Catostomus santaanae</i></u>
254.	Warner Sucker	T	<u><i>Catostomus warnerensis</i></u>
255.	Shortnose Sucker	E	<u><i>Chasmistes brevirostris</i></u>
256.	June Sucker	E	<u><i>Chasmistes liorus</i></u>
257.	Pygmy Sculpin	T	<u><i>Cottus paulus</i></u>
258.	Railroad Valley Springfish	T	<u><i>Crenichthys nevadae</i></u>
259.	Blue Shiner	T	<u><i>Cyprinella caerulea</i></u>
260.	Beautiful Shiner	T	<u><i>Cyprinella formosa</i></u>
261.	Desert Pupfish	E	<u><i>Cyprinodon macularius</i></u>
262.	Lost River Sucker	E	<u><i>Deltistes luxatus</i></u>
263.	Spotfin Chub	T	<u><i>Erimonax monachus (Cyprinella monacha)</i></u>
264.	Slender Chub	T	<u><i>Erimystax cahni</i></u>
265.	Etowah Darter	E	<u><i>Etheostoma etowahae</i></u>
266.	Duskytail Darter	E	<u><i>Etheostoma percnum</i></u>
267.	Tidewater Goby	E	<u><i>Eucyclogobius newberryi</i></u>
268.	Unarmored Threespine Stickleback	E	<u><i>Gasterosteus aculeatus williamsoni</i></u>
269.	Owens Tui Chub	E	<u><i>Gila bicolor snyderi</i></u>
270.	Humpback chub	E	<u><i>Gila cypha</i></u>
271.	Sonora Chub	T	<u><i>Gila ditaenia</i></u>
272.	Bonytail Chub	E	<u><i>Gila elegans</i></u>

273.	Gila Chub	E	<i>Gila intermedia</i>
274.	Chihuahua Chub	T	<i>Gila nigrescens</i>
275.	Yaqui Chub	E	<i>Gila purpurea</i>
276.	Rio Grande Silveryminnow	E	<i>Hybognathus amarus</i>
277.	Delta Smelt	T	<i>Hypomesus transpacificus</i>
278.	Yaqui Catfish	T	<i>Ictalurus pricei</i>
279.	Little Colorado Spinedace	T	<i>Lepidomeda vittata</i>
280.	Spikedace	T	<i>Meda fulgida</i>
281.	Palezone Shiner	E	<i>Notropis albizonatus</i>
282.	Cahaba Shiner	E	<i>Notropis cahabae</i>
283.	Arkansas River Shiner	T	<i>Notropis girardi</i>
284.	Cape Fear Shiner	E	<i>Notropis mekistocholas</i>
285.	Topeka Shiner	E	<i>Notropis topeka</i>
286.	Smoky Madtom	E	<i>Noturus baileyi</i>
287.	Yellowfin Madtom	T	<i>Noturus flavipinnis</i>
288.	Little Kern Golden Trout	T	<i>Oncorhynchus aguabonita whitei</i>
289.	Apache (Arizona) Trout	T	<i>Oncorhynchus apache</i>
290.	Lahontan Cutthroat Trout	T	<i>Oncorhynchus clarki henshawi</i>
291.	Paiute Cutthroat Trout	T	<i>Oncorhynchus clarki seleniris</i>
292.	Greenback Cutthroat Trout	T	<i>Oncorhynchus clarki stomias</i>
293.	Gila Trout	E	<i>Oncorhynchus gilae</i>
294.	Oregon Chub	E	<i>Oregonichthys crameri</i>
295.	Amber Darter	E	<i>Percina antesella</i>
296.	Goldline Darter	T	<i>Percina aurolineata</i>
297.	Conasauga Logperch	E	<i>Percina jenkinsi</i>
298.	Leopard Darter	T	<i>Percina pantherina</i>
299.	Roanoke Logperch	E	<i>Percina rex</i>
300.	Snail Darter	T	<i>Percina tanasi</i>
301.	Blackside Dace	T	<i>Phoxinus Cumberlandensis</i>
302.	Gila Topminnow	E	<i>Poeciliopsis occidentalis</i>
303.	Sacramento Splittail	T	<i>Pogonichthys macrolepidotus</i>
304.	Colorado (=squawfish) Pikeminnow	E	<i>Ptychocheilus lucius</i>
305.	Kendall Warm Springs Dace	E	<i>Rhinichthys osculus thermalis</i>
306.	Bull Trout	T	<i>Salvelinus confluentus</i>
307.	Pallid Sturgeon	E	<i>Scaphirhynchus albus</i>
308.	Alabama Sturgeon	E	<i>Scaphirhynchus suttkusi</i>
309.	Loach Minnow	T	<i>Tiaroga cobitis</i>
310.	Razorback Sucker	E	<i>Xyrauchen texanus</i>
Amphibians			
311.	Flatwoods Salamander	T	<i>Ambystoma cingulatum</i>
312.	Sonoran Tiger Salamander	E	<i>Ambystoma tigrinum stebbinsi</i>
313.	Wyoming Toad	E	<i>Bufo baxteri</i>
314.	Arroyo Southwestern Toad	E	<i>Bufo californicus</i>
315.	Houston Toad	E	<i>Bufo houstonensis</i>
316.	Red hills salamander	T	<i>Phaeognathus hubrichti</i>
317.	Cheat Mountain Salamander	T	<i>Plethodon nettingi</i>
318.	Shenandoah Salamander	E	<i>Plethodon shenandoah</i>

319.	California Red-legged Frog	T	<u><i>Rana aurora draytonii</i></u>
320.	Mississippi Gopher Frog	E	<u><i>Rana capito servosa</i></u>
321.	Chiricahua leopard frog	T	<u><i>Rana chiricahuensis</i></u>
322.	Mt. Yellow-legged frog (So. CA DPS)	E	<u><i>Rana muscosa</i></u>
Reptiles			
323.	New Mexico Ridgenose Rattlesnake	T	<u><i>Crotalus willardi obscurus</i></u>
324.	Eastern Indigo Snake	T	<u><i>Drymarchon corais couperi</i></u>
325.	Puerto Rican Boa	E	<u><i>Epicrates inornatus</i></u>
326.	Blunt-nosed Leopard Lizard	E	<u><i>Gambelia silus</i></u>
327.	Desert Tortoise (Sonoran pop.)	T	<u><i>Gopherus agassizii</i></u>
328.	Gopher Tortoise	T	<u><i>Gopherus polyphemus</i></u>
329.	Sand Skink	T	<u><i>Neoseps reynoldsi</i></u>
330.	Flattened Musk Turtle	T	<u><i>Sternotherus depressus</i></u>
331.	Giant Garter Snake	T	<u><i>Thamnophis gigas</i></u>
Birds			
332.	Florida Scrub Jay	T	<u><i>Aphelocoma coerulescens</i></u>
333.	Marbled murrelet	T	<u><i>Brachyramphus marmoratus</i></u>
334.	Western Snowy Plover	T	<u><i>Charadrius alexandrinus nivosus</i></u>
335.	Piping Plover	T/E	<u><i>Charadrius melodus</i></u>
336.	Kirtland's Warbler	E	<u><i>Dendroica kirtlandii</i></u>
337.	Southwestern Willow Flycatcher	E	<u><i>Empidonax traillii extimus</i></u>
338.	Northern Aplomado Falcon	E	<u><i>Falco femoralis septentrionalis</i></u>
339.	Whooping Crane	E	<u><i>Grus americana</i></u>
340.	Mississippi Sandhill Crane	E	<u><i>Grus canadensis pulla</i></u>
341.	California Condor	E	<u><i>Gymnogyps californianus</i></u>
342.	Wood Stork	E	<u><i>Mycteria americana</i></u>
343.	Brown Pelican	E	<u><i>Pelecanus occidentalis</i></u>
344.	Brown Pelican	E	<u><i>Pelecanus occidentalis californicus</i></u>
345.	Red-cockaded Woodpecker	E	<u><i>Picoides borealis</i></u>
346.	Coastal California Gnatcatcher	T	<u><i>Polioptila californica californica</i></u>
347.	Yuma Clapper Rail	E	<u><i>Rallus longirostris yumanensis</i></u>
348.	Least Tern	E	<u><i>Sterna antillarum</i></u>
349.	California Least Tern	E	<u><i>Sterna antillarum browni</i></u>
350.	Northern Spotted Owl	T	<u><i>Strix occidentalis caurina</i></u>
351.	Mexican Spotted Owl	T	<u><i>Strix occidentalis lucida</i></u>
352.	Bachman's Warbler	E	<u><i>Vermivora bachmanii</i></u>
353.	Black-capped Vireo	E	<u><i>Vireo atricapilla</i></u>
354.	Least Bell's Vireo	E	<u><i>Vireo bellii pusillus</i></u>
Mammals			
355.	Sonoran Pronghorn	E	<u><i>Antilocapra americana sonoriensis</i></u>
356.	Gray Wolf, Western pop.	T	<u><i>Canis lupus</i></u>
357.	Gray Wolf, Southwestern pop. Mex.	E	<u><i>Canis lupus baileyi</i></u>

358.	Ozark Big-eared Bat	E	<i>Corynorhinus townsendii ingens</i>
359.	Virginia Big-eared Bat	E	<i>Corynorhinus townsendii virginianus</i>
360.	Utah Prairie Dog	T	<i>Cynomys parvidens</i>
361.	Giant Kangaroo Rat	E	<i>Dipodomys ingens</i>
362.	San Bernardino Kangaroo Rat	E	<i>Dipodomys merriami parvus</i>
363.	Fresno Kangaroo Rat	E	<i>Dipodomys nitratoides exilis</i>
364.	Tipton Kangaroo Rat	E	<i>Dipodomys nitratoides nitratoides</i>
365.	Stephen's Kangaroo Rat	E	<i>Dipodomys stephensi</i>
366.	Southern Sea Otter	T	<i>Enhydra lutris nereis</i>
367.	Carolina Northern Flying Squirrel	E	<i>Glaucomys sabrinus coloratus</i>
368.	Virginia Northern Flying Squirrel	E	<i>Glaucomys sabrinus fuscus</i>
369.	Lesser Long-nosed Bat	E	<i>Leptonycteris curasoae yerbabuenae</i>
370.	Mexican Long-nosed Bat	E	<i>Leptonycteris nivalis</i>
371.	Canada Lynx	T	<i>Lynx canadensis</i>
372.	Black-footed Ferret	E	<i>Mustela nigripes</i>
373.	Gray Bat	E	<i>Myotis grisescens</i>
374.	Indiana Bat	E	<i>Myotis sodalis</i>
375.	Bighorn Sheep (Peninsular)	E	<i>Ovis canadensis pop 2</i>
376.	Bighorn Sheep (Sierra Nevada)	E	<i>Ovis canadensis pop 3</i>
377.	Jaguar	E	<i>Panthera onca</i>
378.	Florida Panther	E	<i>Puma concolor coryi</i>
379.	Eastern Cougar	E	<i>Puma concolor cougar</i>
380.	Woodland Caribou	E	<i>Rangifer tarandus caribou</i>
381.	Northern Idaho Ground Squirrel	T	<i>Spermophilus brunneus brunneus</i>
382.	Mount Graham Red Squirrel	E	<i>Tamiasciurus hudsonicus grahamensis</i>
383.	Florida (West Indian) Manatee	E	<i>Trichechus manatus</i>
384.	Louisiana Black Bear	T	<i>Ursus americanus luteolus</i>
385.	Grizzly Bear (Lower 48)	T	<i>Ursus arctos horribilis</i>
386.	San Joaquin Kit Fox	E	<i>Vulpes macrotis mutica</i>
387.	Preble's Meadow Jumping Mouse	T	<i>Zapus hudsonius preblei</i>

WO analysis:

Our initial concern was how to manage such a large number of species in order to make a consultation of this size and scope manageable, and to be able to complete this consultation in a timely manner. We determined that the initial steps should be a review of the available literature on the effects of ammonium-based long-term fire retardants on plants, animals and ecological systems and a review of the available biological information of each species, including range distribution, habitat and threats. To obtain the species' information, we examined the listing packages, recovery plans, critical habitat designations, five-year reviews, NatureServe and any petitions, as available for each species.

Taxonomic groupings:

Based on the literature and the biological review, we determined that we could cluster most of the species into taxonomic groupings which could be analyzed as a group. The species were first grouped, as follows: plants, invertebrates, fishes, amphibians, reptiles, birds and mammals. These taxa were further divided as indicated by the literature, which suggested that some groups may be more vulnerable to exposure to long-term fire retardants and therefore, needed a closer analysis. These subgroups were legumes, aquatic invertebrates, freshwater mussels, terrestrial invertebrates, and ruminants.

For example, the best available scientific literature identified no direct effects to mammals after direct exposure to Phos-Chek (Poulton, B., 1997). However, the use of ammonium compounds in long-term fire retardants have been implicated in livestock mortality (Dodge, M., 1970). In particular, ruminants may have an increased vulnerability to nitrate poisoning as an indirect effect of exposure to the ammonium salts which have entered into the soil, been nitrified into nitrates and subsequently being taken up by plants, which were then consumed by the ruminant (Dodge, M., 1970). As a result, we identified ruminants as a subgroup of mammals that would require closer analysis by our Regions.

“Coarse filter”

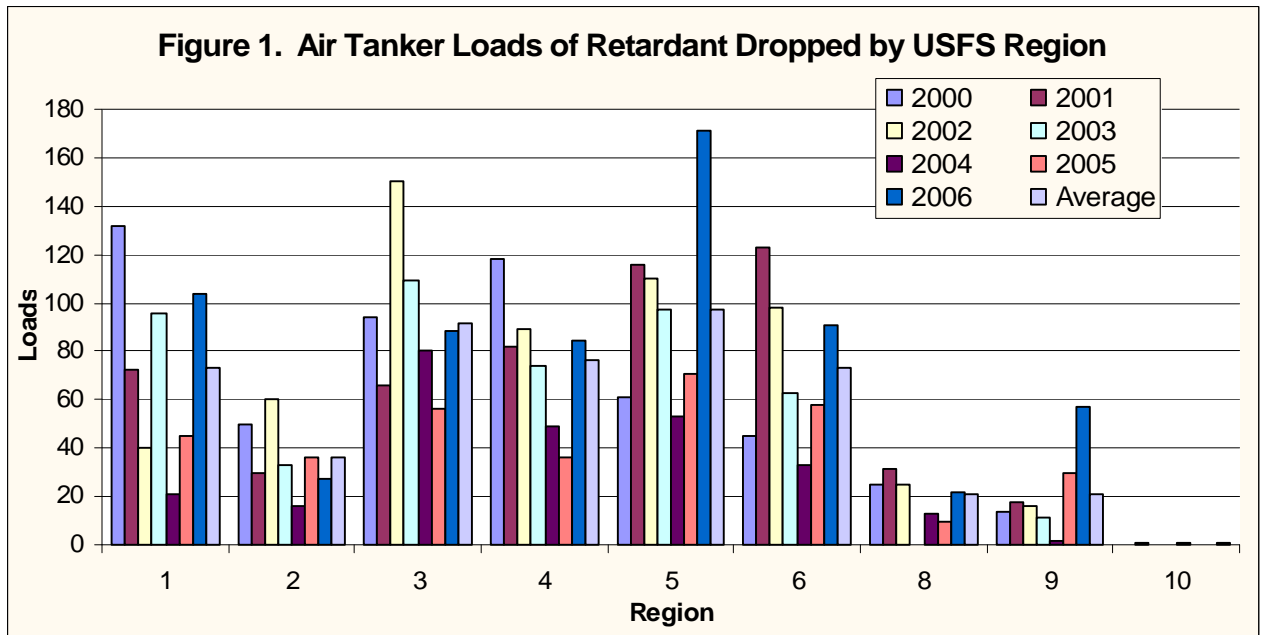
We then established what we informally referred to as a “coarse filter” to see if we could make any preliminary determinations regarding jeopardy or no jeopardy. Our coarse filter consisted of four questions which served to establish a logical thought process for our analysis:

- (1) What is the range and distribution of the species?

We determined that while a species that is widely distributed (e.g., its range is spread over a large geographic area) may experience loss of some individuals due to retardant use on a specific fire event, it would be unlikely to be jeopardized unless some aspect of the species' biology or the critical nature of a specific population was compromised by that exposure.

- (2) What is the likelihood of exposure of the species to fire retardant during a fire?

The locations and amount of use of fire retardant by the USFS is not uniform across the U.S. The use of retardant over the past seven years (the years for which they have data) was reported to us at the Forest scale by the USFS. A graph was then created to combine and summarize this data. The summary of the amount of retardant use by USFS Region* was plotted (Figure 1). We then estimated the likely concentration of retardant on the ground, based upon the pattern of typical applications (Norris and Webb 1989), the quantity used per retardant tanker and how many tankers might be ordered in a day.



* The USFS Regions are defined at: <http://www.fs.fed.us/contactus/regions.shtml>

(3) If the species were exposed, would the exposure be likely to result in “take?”

The literature suggests that most taxonomic groups suffer limited direct effects from exposure to long-term fire retardant (Poulton, B. et al., 1977; Labat Environmental 2007; Munk, 1996) with the possible exceptions of certain plants (Larson and Duncan, 1982; Larson and Newton, 1996; Bradstock et al., 1987), ruminants (Dodge, M., 1970) and aquatic species (Augsperger et al., 2003; Poulton et al., 1997; Labat Environmental 2007). We used this information to make general conclusions about which taxonomic groups would be likely to experience take as a direct effect of being exposed to long-term fire retardant.

(4) If take would occur as determined by (3) above, would the “take” rise to such a level that it would be likely to jeopardize the continued existence of the species?

Based upon the best available scientific literature and the other information referenced above, we identified which taxonomic groups, or subgroups would be considered particularly vulnerable to jeopardy due to exposure to long-term fire retardant. Aquatic species appeared at this level of analysis to be the most vulnerable with concerns also being indicated for ruminants and some plants (e.g., legumes, that is, plants belonging to the pea family; and narrow endemics). Jeopardy appeared to be most likely to occur if a species is: a “narrow endemic,” that is, a species that solely occupies a small geographic area and no where else; a legume; an aquatic species, particularly invertebrates and certain fishes. We used all of the information in the previous three criteria to make our preliminary determinations of “not likely to jeopardize” the survival and recovery of the species.

By applying the “coarse filter” to each of the taxonomic groups or subgroups that we identified based upon the literature, we made a preliminary determination of “no jeopardy” for 181 species. The remaining 206 species comprised those species for which we could not make a determination. We then distributed these species to the RO/FOs for their analysis. We also included our preliminary

determinations so that the RO/FOs could “ground truth” our coarse filter and could re-analyze any of those species, if warranted. Consequently, 11 species for which we had made a preliminary determination of not likely to jeopardize were given additional review by the RO/FOs. After conducting our analysis, the Service determined that 342 species were not likely to be jeopardized by the proposed action (Table 2).

Table 2. List of all species included in this consultation for which the Service reached a determination that the proposed action is neither likely to jeopardize the continued existence of the species nor likely to result in the destruction or adverse modification of critical habitat.

	Common Name	Federal Status	Scientific Name
Plants			
1.	San Diego Thorn-mint	T	<i>Acanthomintha ilicifolia</i>
2.	Northern Wild Monkshood	T	<i>Aconitum noveboracense</i>
3.	Sensitive Joint-vetch	T	<i>Aeschynomene virginica</i>
4.	Little Amphianthus	T	<i>Amphianthus pusillus</i>
5.	Price's Potato-bean	T	<i>Apios priceana</i>
6.	McDonald's Rock-cress	E	<i>Arabis mcdonaldiana</i>
7.	Shale Barren Rock-cress	E	<i>Arabis serotina</i>
8.	Cumberland Sandwort	E	<i>Arenaria cumberlandensis</i>
9.	Marsh Sandwort	E	<i>Arenaria paludicola</i>
10.			<i>Argemone pleiacantha ssp.</i>
	Sacramento Prickly-poppy	E	<i>pinnatisecta</i>
11.	Mead's Milkweed	T	<i>Asclepias meadii</i>
12.			<i>Asplenium scolopendrium var.</i>
	Hart's Tongue Fern	T	<i>americanum</i>
13.	Applegate's Milk-vetch	E	<i>Astragalus applegatei</i>
14.	Braunton's Milk-vetch	E	<i>Astragalus brauntonii</i>
15.	Desert Milkvetch	T	<i>Astragalus desereticus</i>
16.			<i>Astragalus lentiginosus var.</i>
	Coachella Milk-vetch	E	<i>coachellae</i>
17.	Heliotrope Milk-vetch	T	<i>Astragalus montii</i>
18.	Osterhout's Mik-vetch	E	<i>Astragalus osterhoutii</i>
19.	Encinitas Baccharis	T	<i>Baccharis vanessae</i>
20.	Virginia Round-leaf Birch	T	<i>Betula uber</i>
21.	Florida Bonamia	T	<i>Bonamia grandiflora</i>
22.	Thread-leaved Brodiaea	T	<i>Brodiaea filifolia</i>
23.	Capa Rosa	E	<i>Callicarpa ampla</i>
24.	California Jewelflower	E	<i>Caulanthus californicus</i>
25.	La Graciaosa Thistle	E	<i>Cirsium loncholepis</i>
26.	Pitcher's Thistle	T	<i>Cirsium pitcheri</i>
27.	Sacramento Mountain Thistle	T	<i>Cirsium vinaceum</i>
28.	Springville Fairyfan	T	<i>Clarkia springvillensis</i>
29.	Alabama Leather Flower	E	<i>Clematis socialis</i>
30.	Pigeon Wings	T	<i>Clitoria fragrans</i>
31.	Apalachicola Rosemary	E	<i>Conradina glabra</i>
32.	Cumberland Rosemary	T	<i>Conradina verticillata</i>

33.	Pima Pineapple Cactus	E	<u><i>Coryphantha scheeri</i> var. <i>robustispina</i></u>
34.	Leafy Prairie Clover	E	<u><i>Dalea foliosa</i></u>
35.	Santa Monica Mountains Dudleya	T	<u><i>Dudleya cymosa</i> ssp. <i>ovatifolia</i></u>
36.	Smooth Purple Coneflower	E	<u><i>Echinacea laevigata</i></u>
37.	Kuenzler Hedgehog Cactus	E	<u><i>Echinocereus fendleri</i> var. <i>kuenzleri</i></u>
38.	Arizona Hedgehog Cactus	E	<u><i>Echinocereus triglochidiatus</i> var. <i>arizonicus</i></u>
39.	Kern Mallow	E	<u><i>Eremalche kernensis</i></u>
40.	Giant Woollystar	E	<u><i>Eriastrum densifolium</i> ssp. <i>sanctorum</i></u>
41.	Maguire Daisy	T	<u><i>Erigeron maguirei</i></u>
42.	Zuni Fleabane	T	<u><i>Erigeron rhizomatus</i></u>
43.	Scrub Buckwheat	T	<u><i>Eriogonum longifolium</i> var. <i>gnaphalifolium</i></u>
44.	Uvillo	E	<u><i>Eugenia haematocarpa</i></u>
45.	Penland Alpine Fen Mustard	T	<u><i>Eutrema penlandii</i></u>
46.	Mexican Flannelbush	E	<u><i>Fremontodendron mexicanum</i></u>
47.	Gentner's fritillary	E	<u><i>Fritillaria gentneri</i></u>
48.	Colorado Butterfly Plant	T	<u><i>Gaura neomexicana</i> var. <i>coloradensis</i></u>
49.	Geocarpon	T	<u><i>Geocarpon minimum</i></u>
50.	Spreading Avens	E	<u><i>Geum radiatum</i></u>
51.	Gymnoderma lineare	E	<u><i>Gymnoderma lineare</i></u>
52.	Showy Stickweed	E	<u><i>Hackelia venusta</i></u>
53.	Harper's Beauty	E	<u><i>Harperocallis flava</i></u>
54.	Todsens Pennyroyal	E	<u><i>Hedeoma todsenii</i></u>
55.	Roan Mountain Bluet	E	<u><i>Hedyotis purpurea</i> var. <i>montana</i></u>
56.	Virginia Sneezeweed	T	<u><i>Helenium virginicum</i></u>
57.	Eggert's Sunflower	T	<u><i>Helianthus eggertii</i></u>
58.	Schweinitz's Sunflower	E	<u><i>Helianthus schweinitzii</i></u>
59.	Swamp Pink	T	<u><i>Helonias bullata</i></u>
60.	Dwarf-flowered Heartleaf	T	<u><i>Hexastylis naniflora</i></u>
61.	Water Howellia	T	<u><i>Howellia aquatilis</i></u>
62.	Mountain Golden Heather	T	<u><i>Hudsonia montana</i></u>
63.	Lakeside Daisy	T	<u><i>Hymenoxys herbacea</i></u>
64.	Cuero de Sapo	E	<u><i>Ilex sintenisii</i></u>
65.	Peter's Mountain-mallow	E	<u><i>Iliamna corei</i></u>
66.	Dwarf Lake Iris	T	<u><i>Iris lacustris</i></u>
67.	Louisiana Quillwort	E	<u><i>Isoetes louisianensis</i></u>
68.	Small Whorled Pogonia	T	<u><i>Isotria medeoloides</i></u>
69.	San Joaquin Woolly- Threads	E	<u><i>Lembertia congdonii</i></u>
70.	Babyfoot Orchid	E	<u><i>Lepanthes eltoroensis</i></u>
71.	Missouri Bladder-pod	E	<u><i>Lesquerella filiformis</i></u>
72.	Lyrate Bladderpod	T	<u><i>Lesquerella lyrata</i></u>
73.	White Bladderpod	E	<u><i>Lesquerella pallida</i></u>

74.	Heller's Blazing Star	T	<u><i>Liatrix helleri</i></u>
75.	Huachuca water-umbel	E	<u><i>Lilaeopsis schaffneriana</i> var. <i>recurva</i></u>
76.	Western Lily	E	<u><i>Lilium occidentale</i></u>
77.	Butte County Meadowfoam	E	<u><i>Limnanthes floccosa</i> ssp. <i>californica</i></u>
78.	Pondberry	E	<u><i>Lindera melissifolia</i></u>
79.	Cook's Lomatium	E	<u><i>Lomatium cookii</i></u>
80.	Kincaid's Lupine	T	<u><i>Lupinus oreganus</i> var. <i>kincaidii</i></u>
81.	Rough-leaf Loosestrife	E	<u><i>Lysimachia asperulaefolia</i></u>
82.	White Bird-in-a-nest	T	<u><i>Macbridea alba</i></u>
83.	Mohr's Barbara's Buttons	T	<u><i>Marshallia mohrii</i></u>
84.	Macfarlane's Four-O'Clock	T	<u><i>Mirabilis macfarlanei</i></u>
85.	Britton's Beargrass	E	<u><i>Nolina brittonia</i></u>
86.	Bakersfield Cactus	E	<u><i>Opuntia treleasei</i></u>
87.	Slender Orcutt Grass	T	<u><i>Orcuttia tenuis</i></u>
88.	Canby's Dropwort	E	<u><i>Oxyopolis canbyi</i></u>
89.	Fassett's Locoweed	T	<u><i>Oxytropis campestris</i> var. <i>chartacea</i></u>
90.	San Rafael Cactus	E	<u><i>Pediocactus despainii</i></u>
91.	Winkler Cactus	T	<u><i>Pediocactus winkleri</i></u>
92.	Blowout Penstemon	E	<u><i>Penstemon haydenii</i></u>
93.	Clay Phacelia	E	<u><i>Phacelia argillacea</i></u>
94.	Yreka phlox	E	<u><i>Phlox hirsuta</i></u>
95.	Texas Trailing Phlox	E	<u><i>Phlox nivalis</i> ssp. <i>texensis</i></u>
96.	Godfrey's Butterwort	T	<u><i>Pinguicula ionantha</i></u>
97.	Ruth's Golden-aster	E	<u><i>Pityopsis ruthii</i></u>
98.	Rough Popcorn Flower	E	<u><i>Plagiobothrys hirtus</i></u>
99.	Eastern Prairie White-fringed Orchid	T	<u><i>Platanthera leucophaea</i></u>
100.	Western Prairie Fringed Orchid	T	<u><i>Platanthera praeclara</i></u>
101.	Chupacallos	E	<u><i>Pleodendron macranthum</i></u>
102.	Lewton's Polygala	E	<u><i>Polygala lewtonii</i></u>
103.	Maguire Primrose	T	<u><i>Primula maguirei</i></u>
104.	San Joaquin Adobe Sunburst	T	<u><i>Pseudobahia peirsonii</i></u>
105.	Harperella	E	<u><i>Ptilimnium nodosum</i></u>
106.	Arizona Cliffrose	E	<u><i>Purshia subintegra</i></u>
107.	Miccosukee Gooseberry	T	<u><i>Ribes echinellum</i></u>
108.	Gambel's Watercress	E	<u><i>Rorippa gambellii</i></u>
109.	Bunched Arrowhead	E	<u><i>Sagittaria fasciculata</i></u>
110.	Kral's Water Plantain	T	<u><i>Sagittaria secundifolia</i></u>
111.	Green Pitcher Plant	E	<u><i>Sarracenia oreophila</i></u>
112.	Alabama Canebrake Pitcher Plant	E	<u><i>Sarracenia rubra alabamensis</i></u>
113.	Mountain Sweet Pitcher Plant	E	<u><i>Sarracenia rubra</i> ssp. <i>jonesii</i></u>
114.	American Chaffseed	E	<u><i>Schwalbea americana</i></u>
115.	Northeastern Bulrush	E	<u><i>Scirpus ancistrochaetus</i></u>
116.	Unita Basin Hookless Cactus	T	<u><i>Sclerocactus glaucus</i></u>

117. Florida Skullcap	T	<i>Scutellaria floridana</i>
118. Large Flowered Skullcap	T	<i>Scutellaria montana</i>
119. Leedy's Roseroot	T	<i>Sedum integrifolium leedyi</i>
120. San Francisco Peaks groundsel	T	<i>Senecio franciscanus</i>
121. Layne's Butterweed	T	<i>Senecio layneae</i>
122. Keck's Checker Mallow	E	<i>Sidalcea keckii</i>
123. Nelson's Checker Mallow	T	<i>Sidalcea nelsoniana</i>
124. Wenatchee Mountains Checker Mallow	E	<i>Sidalcea oregana var. calva</i>
125. Spalding's Catchfly	T	<i>Silene spaldingii</i>
126. White Irisette	E	<i>Sisyrinchium dichotomum</i>
127. White-Haired Goldenrod	T	<i>Solidago albopilosa</i>
128. Houghton's Goldenrod	T	<i>Solidago houghtonii</i>
129. Blue Ridge Goldenrod	T	<i>Solidago spithamaea</i>
130. Virginia Spiraea	T	<i>Spiraea virginiana</i>
131. Canelo Hills Ladies Tresses	E	<i>Spiranthes delitescens</i>
132. Ute Ladies'-tresses	T	<i>Spiranthes diluvialis</i>
133. Navasota Ladies'-tresses	E	<i>Spiranthes parksii</i>
134. Palo de Jazmin	E	<i>Styrax portoricensis</i>
135. Palo Colorado	E	<i>Ternstroemia luquillensis</i>
136. Unknown Common Name	E	<i>Ternstroemia subsessilis</i>
137. Howell's Spectacular Thelypody	T	<i>Thelypodium howellii spectabilis</i>
138. Alabama Streak-Sorus Fern	T	<i>Thelypteris pilosa var. alabamensis</i>
139. Kneeland Prairie Pennycress	E	<i>Thlaspi californicum</i>
140. Last Chance Townsendia	T	<i>Townsendia aprica</i>
141. Running Buffalo Clover	E	<i>Trifolium stoloniferum</i>
142. Persistent Trillium	E	<i>Trillium persistens</i>
143. Relict Trillium	E	<i>Trillium reliquum</i>
144. Greene's Tuctoria	E	<i>Tuctoria greenei</i>
145. Tennessee Yellow-eyed Grass	E	<i>Xyris tennesseensis</i>
Invertebrates		
146. Cumberland Elktoe	E	<i>Alasmidonta atropurpurea</i>
147. Dwarf Wedgemussel	E	<i>Alasmidonta heterodon</i>
148. Appalachian Elktoe	E	<i>Alasmidonta raveneliana</i>
149. Fat Three-Ridge Mussel	E	<i>Amblema neislerii</i>
150. Tumbling Creek Cave Snail	E	<i>Antrobia culveri</i>
151. Ouachita Rock Pocketbook	E	<i>Arkansia wheeleri</i>
152. Uncompahgre Fritillary Butterfly	E	<i>Boloria acrocneuma</i>
153. Conservancy Fairy Shrimp	E	<i>Branchinecta conservatio</i>
154. Longhorn Fairy Shrimp	E	<i>Branchinecta longiantenna</i>
155. Vernal Pool Fairy Shrimp	T	<i>Branchinecta lynchi</i>

156.	A Crayfish	E	<u>Cambarus aculabrum</u>
157.	Hell Creek Cave Crayfish	E	<u>Cambarus zophonastes</u>
158.	Fanshell	E	<u>Cyprogenia stegaria</u>
159.	Valley Elderberry Longhorn Beetle	T	<u>Desmocerus californicus dimorphus</u>
160.	Dromedary Pearlymussel	E	<u>Dromus dromas</u>
161.	Lacy Elimia	T	<u>Elimia crenatella</u>
162.	Purple Bankclimber Mussel	T	<u>Elliptoideus sloatianus</u>
163.	Cumberlandian Combshell	E	<u>Epioblasma brevidens</u>
164.	Oyster Mussel	E	<u>Epioblasma capsaeformis</u>
165.	Curtis Pearlymussel	E	<u>Epioblasma florentina curtisi</u>
166.	Yellow Blossom (Pearlymussel)	E	<u>Epioblasma florentina florentina</u>
167.	Tan Riffleshell	E	<u>Epioblasma florentina walkeri</u>
168.	Upland Combshell	E	<u>Epioblasma metastriata</u>
169.	Purple Cat's Paw Pearlymussel	E	<u>Epioblasma obliquata obliquata</u>
170.	Southern Acornshell	E	<u>Epioblasma othcaloogensis</u>
171.	Green Blossom (Pearlymussel)	E	<u>Epioblasma torulosa gubernaculum</u>
172.	Northern Riffleshell	E	<u>Epioblasma torulosa rangiana</u>
173.	Tubercled-blossom Pearlymussel	E	<u>Epioblasma torulosa torulosa</u>
174.	Turgid Blossom	E	<u>Epioblasma turgidula</u>
175.	Smith's Blue Butterfly	E	<u>Euphilotes enoptes smithi</u>
176.	Kern Primrose Sphinx Moth	T	<u>Euproserpinus euterpe</u>
177.	Shiny Pigtoe	E	<u>Fusconaia cor</u>
178.	Finerayed Pigtoe	E	<u>Fusconaia cuneolus</u>
179.	Cracking Pearlymussel	E	<u>Hemistena lata</u>
180.	Pawnee Montane Skipper	T	<u>Hesperia leonardus montana</u>
181.	Koster's tryonia snail	PE	<u>Juturnia kosteri</u>
182.	Pink Mucket	E	<u>Lampsilis abrupta</u>
183.	Orangenacre Mucket	T	<u>Lampsilis perovalis</u>
184.	Arkansas Fatmucket	T	<u>Lampsilis powelli</u>
185.	Shinyrayed pocketbook	E	<u>Lampsilis subangulata</u>
186.	Carolina Heelsplitter	E	<u>Lasmigona decorata</u>
187.	Birdwing Pearlymussel*	E	<u>Lemiox rimosus</u>
188.	Scaleshell Mussel	E	<u>Leptodea leptodon</u>
189.	Round rocksnail	T	<u>Leptoxis ampla</u>
190.	Painted rocksnail	T	<u>Leptoxis taeniata</u>
191.	Flat pebblesnail	E	<u>Lepyrium showalteri</u>
192.	Cylindrical lioplax	E	<u>Lioplax cyclostomaformis</u>
193.	Karner Blue Butterfly	E	<u>Lycaeides melissa samuelis</u>
194.	Louisiana Pearlshell	T	<u>Margaritifera hembeli</u>
195.	Ochlockonee Moccasinsshell	E	<u>Medionidus simpsonianus</u>
196.	Noonday Globe	T	<u>Mesodon clarki nantahala</u>
197.	Magazine Mountain	T	<u>Mesodon magazinensis</u>

	Shagreen		
198.	Spruce-fir Moss Spider	E	<i>Microhexura montivaga</i>
199.	Mitchell's Satyr	E	<i>Neonympha mitchelli mitchelli</i>
200.	American Burying Beetle	E	<i>Nicrophorus americanus</i>
201.	Ring Pink (Mussel)	E	<i>Obovaria retusa</i>
202.	Shasta Crayfish	E	<i>Pacifastacus fortis</i>
203.	Littlewing Pearlymussel	E	<i>Pegias fabula</i>
204.	Clubshell	E	<i>Pleurobema clava</i>
205.	Dark Pigtoe	E	<i>Pleurobema furvum</i>
206.	Ovate clubshell	E	<i>Pleurobema perovatum</i>
207.	Rough Pigtoe	E	<i>Pleurobema plenum</i>
208.	Oval Pigtoe	E	<i>Pleurobema pyriforme</i>
209.	Heavy Pigtoe	E	<i>Pleurobema taitianum</i>
210.	Fat Pocketbook	E	<i>Potamilus capax</i>
211.	Heavy Pigtoe	E	<i>Potamilus inflatus</i>
212.	Rough Rabbitsfoot	E	<i>Quadrula cylindrica strigillata</i>
213.	Cumberland Monkeyface (pearlymussel)	E	<i>Quadrula intermedia</i>
214.	Appalachian Monkeyface	E	<i>Quadrula sparsa</i>
215.	Hine's Emerald Dragonfly	E	<i>Somatochlora hineana</i>
216.	Oregon Silverspot Butterfly	T	<i>Speyeria zerene hippolyta</i>
217.	Alamosa Springsnail	E	<i>Tryonia alamosae</i>
218.	Tulotoma Snail	E	<i>Tulotoma magnifica</i>
219.	Purple Bean Mussel	E	<i>Villosa perpurpurea</i>
220.	Cumberland Bean Pearlymussel	E	<i>Villosa trabalis</i>
	Fish		
221.	Gulf Sturgeon	T	<i>Acipenser oxyrinchus desotoi</i>
222.	White Sturgeon (Kootenai R. Pop.)	E	<i>Acipenser transmontanus</i>
223.	Modoc sucker	E	<i>Catostomus microps</i>
224.	Warner Sucker	T	<i>Catostomus warnerensis</i>
225.	Shortnose Sucker	E	<i>Chasmistes brevirostris</i>
226.	June Sucker	E	<i>Chasmistes liorus</i>
227.	Pygmy Sculpin	T	<i>Cottus paulus</i>
228.	Railroad Valley Springfish	T	<i>Crenichthys nevadae</i>
229.	Beautiful Shiner	T	<i>Cyprinella formosa</i>
230.	Desert Pupfish	E	<i>Cyprinodon macularius</i>
231.	Lost River Sucker	E	<i>Deltistes luxatus</i>
232.	Spotfin Chub	T	<i>Erimonax monachus (Cyprinella monacha)</i>
233.	Slender Chub	T	<i>Erimystax cahni</i>
234.	Duskytail Darter	E	<i>Etheostoma percnurum</i>
235.	Tidewater Goby	E	<i>Eucyclogobius newberryi</i>
236.	Humpback chub	E	<i>Gila cypha</i>
237.	Bonytail Chub	E	<i>Gila elegans</i>
238.	Gila Chub	E	<i>Gila intermedia</i>
239.	Chihuahua Chub	T	<i>Gila nigrescens</i>

240. Yaqui Chub	E	<i>Gila purpurea</i>
241. Rio Grande Silveryminnow	E	<i>Hybognathus amarus</i>
242. Delta Smelt	T	<i>Hypomesus transpacificus</i>
243. Yaqui Catfish	T	<i>Ictalurus pricei</i>
244. Palezone Shiner	E	<i>Notropis albizonatus</i>
245. Cahaba Shiner	E	<i>Notropis cahabae</i>
246. Arkansas River Shiner	T	<i>Notropis girardi</i>
247. Cape Fear Shiner	E	<i>Notropis mekistocholas</i>
248. Topeka Shiner	E	<i>Notropis topeka</i>
249. Smoky Madtom	E	<i>Noturus baileyi</i>
250. Yellowfin Madtom	T	<i>Noturus flavipinnis</i>
251. Apache (Arizona) Trout	T	<i>Oncorhynchus apache</i>
252. Lahontan Cutthroat Trout	T	<i>Oncorhynchus clarki henshawi</i>
253. Gila Trout	E	<i>Oncorhynchus gilae</i>
254. Oregon Chub	E	<i>Oregonichthys crameri</i>
255. Goldline Darter	T	<i>Percina aurolineata</i>
256. Leopard Darter	T	<i>Percina pantherina</i>
257. Roanoke Logperch	E	<i>Percina rex</i>
258. Snail Darter	T	<i>Percina tanasi</i>
259. Blackside Dace	T	<i>Phoxinus cumberlandensis</i>
260. Gila Topminnow	E	<i>Poeciliopsis occidentalis</i>
261. Sacramento Splittail	T	<i>Pogonichthys macrolepidotus</i>
262. Colorado (=squawfish) Pikeminnow	E	<i>Ptychocheilus lucius</i>
263. Bull Trout	T	<i>Salvelinus confluentus</i>
264. Pallid Sturgeon	E	<i>Scaphirhynchus albus</i>
265. Alabama Sturgeon	E	<i>Scaphirhynchus suttkusi</i>
266. Razorback Sucker	E	<i>Xyrauchen texanus</i>

Amphibians

267. Flatwoods Salamander	T	<i>Ambystoma cingulatum</i>
268. Sonoran Tiger Salamander	E	<i>Ambystoma tigrinum stebbinsi</i>
269. Wyoming Toad	E	<i>Bufo baxteri</i>
270. Arroyo Southwestern Toad	E	<i>Bufo californicus</i>
271. Houston Toad	E	<i>Bufo houstonensis</i>
272. Red hills salamander	T	<i>Phaeognathus hubrichti</i>
273. Cheat Mountain Salamander	T	<i>Plethodon nettingi</i>
274. Shenandoah Salamander	E	<i>Plethodon shenandoah</i>
275. California Red-legged Frog	T	<i>Rana aurora draytonii</i>
276. Mississippi Gopher Frog	E	<i>Rana capito servosa</i>
277. Chiricahua leopard frog	T	<i>Rana chiricahuensis</i>

Reptiles

278. New Mexico Ridgenose Rattlesnake	T	<i>Crotalus willardi obscurus</i>
279. Eastern Indigo Snake	T	<i>Drymarchon corais couperi</i>
280. Puerto Rican Boa	E	<i>Epicrates inornatus</i>
281. Blunt-nosed Leopard	E	<i>Gambelia silus</i>

Lizard		
282. Desert Tortoise (Sonoran pop.)	T	<i>Gopherus agassizii</i>
283. Gopher Tortoise	T	<i>Gopherus polyphemus</i>
284. Sand Skink	T	<i>Neoseps reynoldsi</i>
285. Flattened Musk Turtle	T	<i>Sternotherus depressus</i>
286. Giant Garter Snake	T	<i>Thamnophis gigas</i>
Birds		
287. Florida Scrub Jay	T	<i>Aphelocoma coerulescens</i>
288. Marbled murrelet	T	<i>Brachyramphus marmoratus</i>
289. Western Snowy Plover	T	<i>Charadrius alexandrinus nivosus</i>
290. Piping Plover	T/E	<i>Charadrius melodus</i>
291. Kirtland's Warbler	E	<i>Dendroica kirtlandii</i>
292. Southwestern Willow Flycatcher	E	<i>Empidonax traillii extimus</i>
293. Northern Aplomado Falcon	E	<i>Falco femoralis septentrionalis</i>
294. Whooping Crane	E	<i>Grus americana</i>
295. Mississippi Sandhill Crane	E	<i>Grus canadensis pulla</i>
296. California Condor	E	<i>Gymnogyps californianus</i>
297. Wood Stork	E	<i>Mycteria americana</i>
298. Brown Pelican	E	<i>Pelecanus occidentalis</i>
299. Brown Pelican	E	<i>Pelecanus occidentalis californicus</i>
300. Red-cockaded Woodpecker	E	<i>Picoides borealis</i>
301. Coastal California Gnatcatcher	T	<i>Polioptila californica californica</i>
302. Yuma Clapper Rail	E	<i>Rallus longirostris yumanensis</i>
303. Least Tern	E	<i>Sterna antillarum</i>
304. California Least Tern	E	<i>Sterna antillarum browni</i>
305. Northern Spotted Owl	T	<i>Strix occidentalis caurina</i>
306. Mexican Spotted Owl	T	<i>Strix occidentalis lucida</i>
307. Bachman's Warbler	E	<i>Vermivora bachmanii</i>
308. Black-capped Vireo	E	<i>Vireo atricapilla</i>
309. Least Bell's Vireo	E	<i>Vireo bellii pusillus</i>
Mammals		
310. Sonoran Pronghorn	E	<i>Antilocapra americana sonoriensis</i>
311. Gray Wolf, Western pop.	T	<i>Canis lupus</i>
312. Gray Wolf, Southwestern pop. Mex.	E	<i>Canis lupus baileyi</i>
313. Ozark Big-eared Bat	E	<i>Corynorhinus townsendii ingens</i>
314. Virginia Big-eared Bat	E	<i>Corynorhinus townsendii virginianus</i>
315. Utah Prairie Dog	T	<i>Cynomys parvidens</i>
316. Giant Kangaroo Rat	E	<i>Dipodomys ingens</i>
317. San Bernardino Kangaroo Rat	E	<i>Dipodomys merriami parvus</i>
318. Fresno Kangaroo Rat	E	<i>Dipodomys nitratoides exilis</i>
319. Tipton Kangaroo Rat	E	<i>Dipodomys nitratoides nitratoides</i>
320. Stephen's Kangaroo Rat	E	<i>Dipodomys stephensi</i>

321. Southern Sea Otter	T	<u><i>Enhydra lutris nereis</i></u>
322. Carolina Northern Flying Squirrel	E	<u><i>Glaucomys sabrinus coloratus</i></u>
323. Virginia Northern Flying Squirrel	E	<u><i>Glaucomys sabrinus fuscus</i></u>
324. Lesser Long-nosed Bat	E	<u><i>Leptonycteris curasoae yerbabuena</i></u>
325. Mexican Long-nosed Bat	E	<u><i>Leptonycteris nivalis</i></u>
326. Canada Lynx	T	<u><i>Lynx canadensis</i></u>
327. Black-footed Ferret	E	<u><i>Mustela nigripes</i></u>
328. Gray Bat	E	<u><i>Myotis grisescens</i></u>
329. Indiana Bat	E	<u><i>Myotis sodalis</i></u>
330. Bighorn Sheep (Peninsular)	E	<u><i>Ovis canadensis pop 2</i></u>
331. Bighorn Sheep (Sierra Nevada)	E	<u><i>Ovis canadensis pop 3</i></u>
332. Jaguar	E	<u><i>Panthera onca</i></u>
333. Florida Panther	E	<u><i>Puma concolor coryi</i></u>
334. Eastern Cougar	E	<u><i>Puma concolor cougar</i></u>
335. Woodland Caribou	E	<u><i>Rangifer tarandus caribou</i></u>
336. Northern Idaho Ground Squirrel	T	<u><i>Spermophilus brunneus brunneus</i></u>
337. Mount Graham Red Squirrel	E	<u><i>Tamiasciurus hudsonicus grahamensis</i></u>
338. Florida (West Indian) Manatee	E	<u><i>Trichechus manatus</i></u>
339. Louisiana Black Bear	T	<u><i>Ursus americanus luteolus</i></u>
340. Grizzly Bear (Lower 48)	T	<u><i>Ursus arctos horribilis</i></u>
341. San Joaquin Kit Fox	E	<u><i>Vulpes macrotis mutica</i></u>
342. Preble's Meadow Jumping Mouse	T	<u><i>Zapus hudsonius preblei</i></u>

Effects of the Action

We believe that the likelihood of adverse impacts to threatened and endangered species resulting from the use of retardants is greater than as set forth in USFS's analysis and so have proceeded to analyze those greater impacts. Our reasons are cited in the discussion below.

Aquatic

Overview. The proposed action includes the USFS application and use of eight approved long-term retardants (that do not contain sodium ferrocyanide or YPS) on USFS land. The trade names of the eight retardants are: Phos-Chek D75-R, D75-F, 259-R, 259-F, G75-F, G75-W, LV-R, and LC-95A-R. Since Phos-Chek does not contain YPS, the constituents of the different formulations that could cause toxicity are different ammonia formulations (diammonium sulfate, etc.), nitrates/nitrites, guar gum (<10 percent of the total composition), performance additives (proprietary information, but could include surfactants), clay, and iron oxide or other coloring agents. Most scientific studies of Phos-Chek have focused on the function of ammonia as the potentially toxic agent. The Phos-Chek retardants in this consultation do not list nitrates or nitrites in their ingredient list, but MacDonald et

al. (1995) found nitrate-nitrogen concentrations from 0.41-0.88 mg/L (ppm; the range is from soft to hard water) and nitrite-nitrogen concentrations from 0.2-0.22 mg/L. Performance additives constitute up to 10 percent of the total composition when it is used. Clay is used as a thickening agent in these long-term retardants and constitutes less than 5 percent of the total composition when it is used. Coloring agents typically comprise less than 5 percent of the total composition when it is used. No toxicity information is available for guar gum, performance additives, clay, or coloring agents. These ingredients may have toxic potential.

When these retardants are released into the environment by helicopters or airplanes, the potential exists for these chemicals to enter into aquatic systems such as lakes, ponds, or streams and affect aquatic organisms. As described in the proposed action, retardants could enter a waterway through accidental delivery, drift, and surface run-off.

Accidental delivery is an application of retardant into a waterway that does not follow the exceptions outlined in the “Guidelines for Aerial Delivery of Retardant or Foam near Waterways”. Of the three examples listed above, accidental delivery into a waterway has the highest potential for adverse effects to aquatic organisms. Several laboratory studies concluded that the exposure of fish and other aquatic organisms to ammonia can result in mortality (Little and Calfee 2000, 2004, and 2005, Buhl and Hamilton 2000). Gaikowski et al. (1996) studied Phos-Chek D75-F and concluded that if we consider the concentration of the retardants used in field mixtures, which is much higher than the lab studies, an accidental spill in a waterway would lead to substantial mortality. We recognize that other factors should be considered when analyzing the possible adverse effects of an accidental delivery, as discussed below.

Drift occurs after the retardant has been released from the aircraft and wind directs particles of the retardant into a waterway. Environmental conditions, such as wind direction and speed are evaluated as part of the “Guidelines for Aerial Delivery of Retardant or Foam near Waterways” when retardant drops occur beyond the 300-foot buffer. However, drift from an accidental retardant drop within the 300-foot buffer (but outside of a waterway) should be considered. The effect of drift is not as significant to aquatic organisms as accidental delivery but adverse effects such as mortality are likely to occur. Several environmental factors such as wind speed and direction, amount of retardant dropped from the aircraft, topography, the type of waterway (pond vs. stream), and dilution should be considered when analyzing the level of toxicity in a waterway.

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

Effects to Fish

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

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

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

Effects to Algae and Benthic Macroinvertebrates

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

One study was conducted using the indigenous aquatic invertebrates which would only be found in Arizona in perennial waters. Mayflies (*Epeorus (Iron) albertae*) were consistently more sensitive to Phos-Chek D75-F than stoneflies (*Hesperoperla pacifica*) (Poulton et al. 1997). The LC₅₀¹ for mayflies exposed to Phos-Chek D75-F for 3 hours was 1,033 mg/L (Poulton et al. 1997). This concentration is similar to the field concentration that would result from drift or run-off but is almost 10 times lower than the concentration expected if an accidental drop occurred. Mayflies were less sensitive to Phos-Chek D75-F when compared to trout or fathead minnows (Poulton et al. 1997). It is possible that in Arizona's streams, Phos-Chek D75-F would be more directly toxic to fishes than to the fish food items, such as mayflies.

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

Water hardness can alter the toxicity of the Phos-Chek formulations. The toxicity of Phos-Chek D75-F was increased in soft water compared to hard water (MacDonald et al. 1995, Poulton et al. 1997). Water hardness (CaCO₃) on Forest Service lands in Arizona range from 96-150 mg/L near the Coronado National Forest (USGS gauge on the Santa Cruz near Nogales) to 580-1,200 mg/L near the Kaibab National Forest (USGS gauge at Kanab Creek near Fredonia) (USGS 2008).

The most toxic portion of the long-term retardants like Phos-Chek is ammonia (MacDonald et al. 1995). Un-ionized ammonia is more toxic to aquatic organisms than total ammonia (MacDonald et al. 1995, Poulton et al. 1997). Nitrates and nitrites could contribute to the toxicity of long-term retardants, but did not appear to influence the toxicity of Phos-Chek D75-F to daphnids. MacDonald et al. (1995) found that nitrate-nitrogen concentrations in the Phos-Chek toxicity tests were 75-160 times less than those reported to be toxic to freshwater invertebrates. Nitrite-nitrogen concentrations in a Phos-Chek D75-F toxicity study on crayfish were also 30 times less than the crayfish 96-hour LC50 (Gutzmer and Tomasso 1985).

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

Ammonia toxicity to plants is influenced by pH. At neutral pH, Phos-Chek D75-F formed little un-ionized ammonia. Therefore, MacDonald et al. (1995) concluded that some factor other than

¹ LC₅₀ –is the concentration lethal to 50% of the test organisms.

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

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

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

Trophic Interaction

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

Other Considerations

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

Discussion. As described above, aquatic systems and species have been subjected to a number of studies and have identified acute toxic effects to a number of fish species and to aquatic invertebrates as a result of exposure to ammonium compounds. Ultimately, toxicity to aquatic organisms in the

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

Little attention has been paid to the indirect effects of these chemicals. For example, the EA cites studies that found that juvenile rainbow trout were able to avoid areas of high concentration of fire retardant by swimming away (Little and Calfee, 2002), but does not consider the possible indirect effects to this species due to the interruption of sheltering, feeding or breeding activities. For example, Wells et al. (2004) comments that while the avoidance behavior demonstrated by fish may be advantageous in the short term, it may also result in displacement of fish into less advantageous areas and may also disrupt essential migratory behaviors and could affect the stability of viable populations of these species. The EA also does not take into consideration situations where there is little or no area for the fish to swim away. For example, the Kendall Warm Springs dace (*Rhinichthys osculus thermalis*) is limited to one small stream approximately 328 yards (300 meters) in length that originates at a series of thermal springs near the base of a bluff in Sublette County, Wyoming and exists nowhere else. In the case of a misapplication of retardant into these areas, it is unlikely that the dace would be able to swim away from the exposure.

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

The EA and Aquatics Report and Biological Evaluation cite one study (Norris et al., 1991) that states that the retardant breaks down within 24 hours, leaving only chemicals of “low toxicity.” However, another study cited elsewhere in the EA (Little and Calfee, 2002) demonstrated that retardant, including Phos-Chek D75-R, can remain toxic enough to kill fish for up to 21 days.

Another study provided to the FWS by the USFS, though not cited in the EA, stated that “rainwater runoff from watersheds treated with recommended mixed retardant concentrations may pose environmental hazard for weeks after application (Little and Calfee, 2002b).” A rain event during this time could expose aquatic organisms to potentially lethal levels of ammonia. They also found that the level of toxicity was highly dependant upon the presence of organic content. Substrates with high organic content virtually eliminated toxicity, whereas retardant dropped on those with little or no

organic content such as sand or gravel maintained their toxicity for an extended period. This same study also found that the responses of subject fish exposed to “ammonia concentrations in aqueous D75-R solutions were within the lethal range after 7 days of weathering but declined to sublethal concentrations thereafter. These results suggest that the decomposition of D75-R occurs after 7 days of weathering.” This suggests that at least under some conditions, the ammonia concentration from fire retardant in water can remain toxic to fish even after seven days.

The EA also cites Labat Environmental (2007) and states that “any risks that exist are minor, small in scale, and unlikely to affect more than a few individuals at a time.” However, the cited paper also states in the “Ecological Risk Summary and Discussion (page 45)” that in the case of accidental application across streams, “all retardant ... present risk to survival of populations or individuals of one or more aquatic species if applied across a small stream.”

The EA states that by following the 2000 Guidelines, “aerial delivery of retardant to a waterway would normally not occur (page 15).” However, in addition to the eleven incidents of accidental application of retardant identified by the USFS in their EA, NMFS identified several more instances, including some with mortality to listed fish that were unreported by the USFS (NMFS, 2007) and were not addressed by emergency consultation.

The FWS has also identified additional misapplications of retardant into waterways:

In 2003 retardant was misapplied into Copper Creek during the Snowbank/Talon fire. In the case of Copper Creek, USFS personnel were unable to get to the site until three days after the drop due to safety concerns and were unable to conduct an in depth analysis until eight days after the misapplication, which suggests that in such cases it is likely that an assessment may not be possible while the effects are detectable. We are also aware of additional misapplications on the Nine Mile Complex on the Lolo NF in 2000 and the Brown Canyon fire on the Sawtooth NF in 2006.

We also note that there have been instances where USFS personnel has not recognized an accidental drop (the Cannon fire, included on the USFS’ Misapplication List), or has determined an incident not to be a misapplication where they did not actually document adverse effects to fish though the drop was within the buffer zone (the 2006 Rush and Titus fires on the Klamath NF). It therefore appears that USFS does not have a systematic procedure for identifying and monitoring impacts resulting from accidental exposure to fire retardant; it is likely that other incidents have occurred but gone unreported, and we have adjusted our analysis accordingly.

While we agree that the 2000 Guidelines are a useful tool in minimizing impacts to aquatic species due to the application of fire retardant, it is not a guarantee that no impacts will occur. For example, the 2000 Guidelines direct pilots to avoid visible water. However, small streams, streams underneath tree canopies or seasonal bodies of water such as vernal pools could be have retardant dropped into them simply because the pilot was unable to see them, especially under smoky conditions. As NMFS points out in their biological opinion, such an accidental application would be unexpected and therefore, unlikely to be reported or monitored. We believe that it is unrealistic to expect a pilot to always precisely adhere to the 2000 Guidelines when his/her primary concern is emergency response. Additionally, the 2000 Guidelines do allow the intentional application in waterways in situations as explained in the exceptions (see App. A). While we acknowledge that the USFS will not intentionally drop retardant into recognizable waterways except as stated in the 2000 Guidelines, we do not concur that retardant is unlikely to enter waterways; rather, we believe that it will sometimes be unavoidable due to circumstances mentioned above.

Terrestrial.

The available literature contains little information as to the toxicity of long-term fire retardants on terrestrial species. Only a few studies have investigated the direct impacts on terrestrial systems (Poulton, B. et al., 1997; Bell, 2003; Hopmans and Bickford 2003; Dodge, M., 1970) and almost none have evaluated any indirect effects.

Terrestrial species.

Among taxonomic groups, little seems to be known about the direct and indirect effects of the use of aerial fire retardant on most terrestrial species. A few studies have shown indirect effects (e.g., nitrate poisoning or behavioral disruption) to some aquatic organisms (see discussion and citations above) and domestic livestock (Dodge, M., 1970). Parallels to the findings of any of these studies are difficult given the differing biological and ecological processes and requirements of widely divergent species. Based upon what information does exist, it would be reasonable to assume that the use of fire retardant would not have large scale direct effects to most terrestrial species and therefore would not contribute to jeopardy of these species. However, as discussed below, our analysis demonstrated specific taxonomic groups that appeared to be at some risk from the use of retardants.

Mammals

Herbivores and particularly ruminants may be indirectly exposed to nitrate poisoning, due to feeding on plants with elevated levels of nitrate within plant tissues (Dodge, M., 1970). However, the literature suggests that multiple factors must converge for this to happen. The likelihood of these factors occurring with respect to threatened and endangered species was determined by the RO/FO local analysis.

Plants.

We do not concur with the EA's assessment of potential impacts to upland vegetation. For example, in the EA, page 18, the USFS states that "the application of retardant may have a beneficial effect on vegetation because the main ingredient of retardant is agricultural fertilizer," and cites Labat Environmental (2007). In fact, in the cited study the authors noted that previous studies in both North America and Australia had found a change in species richness after exposure to long-term fire retardant. Particularly, Labat noted that: "in the North Dakota prairie ecosystem, species richness was reduced in plots exposed to both retardant and foam regardless of whether the plot was burned or unburned. All plots were dominated by *Poa pratensis*, which clearly gained a competitive advantage from retardant application and crowded out other species. Investigations in the Great Basin shrub steppe ecosystem also showed that plots treated with fire chemicals experienced initial declines in species richness; however, differences among plots were undetectable after a year. Depression of species richness was most pronounced in the riparian corridor." Additionally, two studies (Larson and Duncan, 1982; Bradstock et al., 1987) have shown short-term leaf death and mortality in leguminous shrubs and forbs after retardant application.

The EA also did not address indirect effects to terrestrial plant species. Indirectly, retardant can affect plant communities and rare plants by facilitating the invasion of non-native species (Bell 2003, Larson and Newton 1996). Retardant application can also affect plant communities and rare plants indirectly by attracting more herbivore and browsers to an application site (Larson and Duncan

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

This is of concern because invasion of non-native weeds is the most likely effect of the use of fire retardant on threatened or endangered plants. While those plant species that are widely distributed are not likely to be jeopardized by the application of retardant on a single fire, of greatest concern are those plants which are considered “narrow endemics,” that is, species that occupy a small geographic area and no where else. Consequently, terrestrial plants with a narrow distribution were among those that were sent to the Regions for localized analysis.

Jeopardy and/or Adverse Modification Determinations

After reviewing the current status of the above referenced species and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is likely to jeopardize the continued existence or adversely modify the designated critical habitat of 45 threatened or endangered species (Table 3). The following section documents our analysis of these species and their critical habitat.

Table 3. List of species that are likely to be jeopardized by the proposed action or whose critical habitat is likely to be destroyed or adversely modified by the proposed action.

	Common name	Federal status	Scientific name	Destruction or Adverse Modification ²	Jeopardy ³
<i>Plants</i>					
1.	Munz's Onion	E	<i>Allium munzii</i>	N	Y
2.	Bear Valley Sandwort	T	<i>Arenaria ursine</i>	N	Y
3.	Cushenbury Milk-vetch	E	<i>Astragalus albens</i>	N	Y
4.	Tripleribbed Milk-vetch	E	<i>Astragalus tricarinatus</i>	None	Y
5.	Mariposa pussypaws	T	<i>Calyptridium pulchellum</i>	None	Y
6.	Ashgray Paintbrush (aka Ash-Grey Indian Paintbrush)	T	<i>Castilleja cinerea</i>	N	Y
7.	Vail Lake Ceanothus	T	<i>Ceanothus ophiochilus</i>	Y	Y
8.	Purple Amole (aka Camatta Canyon amole)	T	<i>Chlorogalum purpureum</i>	N	Y
9.	Slender-horned Spineflower	E	<i>Dodecahema leptoceras</i>	None	Y
10.	Parish's daisy	E	<i>Erigeron parishii</i>	N	Y

² Y=yes; N=no; None= no critical habitat designated for the species.

³ Y=yes; N= no.

11.	Southern Mountain Buckwheat	T	<i>Eriogonum kennedyi</i> <i>var. austromontanum</i>	N	Y
12.	Cushenbury Buckwheat	E	<i>Eriogonum ovalifolium</i> <i>var. vineum</i>	N	Y
13.	Holy Ghost Ipomopsis	E	<i>Ipomopsis sancti-spiritus</i>	None	Y
14.	San Bernardino Mountains Bladderpod	E	<i>Lesquerella kingii</i> ssp. <i>Bernardina</i>	N	Y
15.	Nevin's Barberry (=Truckee)	E	<i>Mahonia (=Barberia)</i> <i>nevinii</i>	Y ⁴	Y
16.	Cushenbury Oxytheca	E	<i>Oxytheca parishii</i> var. <i>goodmaniana</i>	N	Y
17.	San Bernardino Bluegrass	E	<i>Poa atropurpurea</i>	N ³	Y
18.	Bird-footed Checkerbloom (aka Pedate Checkermallow)	E	<i>Sidalcea pedata</i>	None	Y
19.	California Dandelion	E	<i>Taraxacum californicum</i>	N ³	Y
20.	Slender-petaled mustard	E	<i>Thelypodium stenopetalum</i>	None	Y
<i>Insects</i>					
21.	Quino Checkerspot Butterfly	E	<i>Euphydryas editha</i> <i>quino</i>	Y ³	Y
22.	Laguna Mountains Skipper	E	<i>Pyrgus ruralis lagunae</i>	Y	Y
<i>Freshwater mussels</i>					
23.	Finelined Pocketbook	T	<i>Lampsilis altilis</i>	Y	N
24.	Alabama Moccasinshell	T	<i>Medionidus acutissimus</i>	Y	N
25.	Coosa Moccasinshell	E	<i>Medionidus parvulus</i>	Y	Y
26.	James spiny mussel	E	<i>Pleurobema collina</i>	None	Y
27.	Southern Clubshell	E	<i>Pleurobema decisum</i>	Y	N
28.	Southern Pigtoe	E	<i>Pleurobema georgianum</i>	Y	Y
29.	Triangular Kidneyshell	E	<i>Ptychobranchus greenii</i>	Y	N
<i>Fish</i>					
30.	Santa Ana Sucker	T	<i>Catostomus santaanae</i>	N	Y
31.	Blue shiner	T	<i>Cyprinella caerulea</i>	None	Y
32.	Etowah darter	E	<i>Etheostoma etowahae</i>	None	Y
33.	Unarmored Threespine Stickleback	E	<i>Gasterosteus aculeatus</i> <i>williamsoni</i>	None	Y
34.	Owens Tui Chub	E	<i>Gila bicolor snyderi</i>	N	Y
35.	Sonora Chub	T	<i>Gila ditaenia</i>	N	Y
36.	Little Colorado Spinedace	T	<i>Lepidomeda vittata</i>	N	Y
37.	Spikedace	T	<i>Meda fulgida</i>	N	Y
38.	Paiute cutthroat trout	T	<i>Oncorhynchus clarki</i> <i>seleniris</i>	None	Y
39.	Greenback cutthroat trout	T	<i>Oncorhynchus clarki</i> <i>stomias</i>	None	Y

⁴ Critical habitat has been proposed, but not finalized, for this species.

40.			<i>Oncorhynchus mykiss</i>	N	Y
	Little Kern Golden Trout	T	<i>whitei</i>		
41.	Amber Darter	E	<i>Percina antesella</i>	Y	Y
42.	Conasauga logperch	E	<i>Percina jenkinsi</i>	Y	Y
43.			<i>Rhinichthys osculus</i>	None	Y
	Kendall Warm Springs dace	E	<i>thermalis</i>		
44.	Loachminnow	T	<i>Tiaroga cobitis</i>	N	Y
	<i>Amphibians</i>				
45.	Mountain yellow-legged frog (Southern California DPS)	E	<i>Rana muscosa</i>	Y	Y

Plants

Holy Ghost ipomopsis (*Ipomopsis sancti-spiritus*)

Effects Analysis

Holy Ghost ipomopsis grows in openings in Rocky Mountain montane conifer forest at elevations of 2,350-2,500 m (7,730-8,220 ft). It is known from a single natural population. Plants are relatively continuous in scattered patches for about 3.5 km (2.2 mi) of Holy Ghost Canyon. There are about 80 ha (200 ac) of occupied habitat. Counts of flowering plants in Holy Ghost Canyon have ranged from 150 to 650 during various years. A demographic study estimated young plants outnumber flowering plants three to one, which gives a minimum population estimate of about 600 plants and a maximum of about 2,600 plants.

The surrounding area is heavily developed for recreational use including a paved forest road, summer homes, and developed campgrounds. As a result, the area is not grazed by domestic livestock and has had full fire suppression for many decades.

Threats to Holy Ghost ipomopsis include competition from non-native plants such as orchard grass (*Dactylis glomerata*) and smooth brome (*Bromus enermis*) introduced for soil stabilization and forage. Scotch thistle (*Onopordum acanthium*) is established in the area and may pose a future threat.

Efforts began in 2006 to establish three new populations of Holy Ghost ipomopsis in nearby canyons. A population in Indian Creek Canyon is about 4 km (2.5 mi) south of Holy Ghost Canyon. Populations near Panchuela Campground and in Winsor Creek Canyon are about 8 km (5 mi) north of Holy Ghost Canyon. The total size of the three introduced populations is about 6 ha (15 ac). It is still uncertain if the introduced populations will become self-sustaining.

Conclusion

After reviewing the current status of the Holy Ghost ipomopsis and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is likely to jeopardize the continued existence of the Holy Ghost ipomopsis. No critical habitat has been designated for this species; therefore, none will be affected.

Holy Ghost ipomopsis grows in a single canyon where the fuel loads are high because of decades of fire suppression and grazing exclusion. In 2006, a project to establish populations in three nearby canyons began, though it is too early to know if these new populations will sustain themselves. Under current conditions, fire suppression by any means is the preferred action to protect Holy Ghost ipomopsis.

Encroachment of non-native plants into the habitat of Holy Ghost ipomopsis has been identified as a threat to the species. These invasive plants are mostly long-established non-natives such as smooth brome and orchard grass introduced for erosion control and forage, but these plants have the potential to displace much native vegetation, including Holy Ghost ipomopsis. Invasive exotic plants are also moving into the area. Scotch thistle has moved rapidly up the Pecos river valley in recent years and now grows within a few kilometers of Holy Ghost Canyon. The introduction of fertilizers in the form of fire retardant would be likely to increase these invasive exotic plant species by providing them with additional nutrients, thus allowing them to out-compete the Holy Ghost ipomopsis.

Our conclusion that the use of fire retardant on National Forest lands is likely to jeopardize the continued existence of the Holy Ghost ipomopsis is based on the following: 1) Holy Ghost ipomopsis grows naturally in only a single canyon; 2) the likelihood of fire retardant application in this canyon is high because of the need to protect summer homes and other developments; 3) fire retardant chemicals have the potential to promote greater growth of competing vegetation that has been identified as a threat to Holy Ghost ipomopsis, and; 4) these chemicals have the potential to promote the encroachment of non-native invasive plants into the habitat of Holy ghost ipomopsis. Due to the fact that fire retardant chemicals are likely to be used in the only canyon where Holy Ghost ipomopsis grows naturally and these chemicals could encourage the growth of competing vegetation and non-native invasive plants, we determine that the use of fire retardant is likely to jeopardize the continued existence of Holy Ghost ipomopsis.

Mariposa Pussy-Paws

(*Calyptridium pulchellum*)

Environmental Baseline

As of 2007, the California Natural Diversity Data Base shows eight occurrences of *Calyptridium pulchellum* and indicates that all known occurrences are extant because there is no documentation of extirpation. However, only five of the eight occurrences have been confirmed to be present within the past decade (CNDDDB 2007). The five remaining occurrences are spread over a range of approximately 40 miles but are not evenly spaced within that range, with two occurrences being located in Mariposa County, two in Madera County, and one in Fresno County. The Fresno County occurrence is on public land managed by the Sierra National Forest; while the other occurrences are located on private land (USFWS 2004).

Of the original five *C. pulchellum* occurrences in Madera County, one has not contained any plants since 1983; a second has declined from fewer than 100 plants in 1988 and 1989 to one plant in 1990, with none found since; and a third population dropped from 576 plants in 1993 to 89 in 1995 and contained only 3 plants in 1998 (California Natural Diversity Data Base 2007). As a result of the declines and lack of detections in these three Madera County populations, they are considered to have been extirpated (USFWS 2004), therefore they are not being considered as extant in this jeopardy analysis.

The Service's 2004 *Draft Recovery Plan for Fifteen Plants of the Southern Sierra Nevada Foothills, California*, states, in regard to the Fresno County occurrence, that in order to consider *C. pulchellum* for delisting, this occurrence is protected, and the population is self-sustaining. The Fresno County occurrence is located approximately 20 miles from the next nearest known occurrence, found in Madera County. Additionally, the Fresno County population occurs in a unique ecological setting that is substantially different from all other occurrences (USFWS 2004). Species that occupy a restricted ecological niche and geographic range are likely to be extirpated by any single random event (Primack 2006). In order to assist in the recovery of this species, it is necessary to have *C. pulchellum* distributed over as wide of a geographic area as possible and occupying a wide variety of ecological niches. As such, it is necessary to maintain the Fresno population in order to preserve species distribution, both geographically and ecologically, in order to allow for the recovery of *C. pulchellum*.

Direct, Indirect and Cumulative Effects

The only population of *C. pulchellum* on Forest Service lands is located within an open area adjacent to shrub-type vegetation. In the event of a wildfire, the densely vegetated shrub areas could burn intensely and rapidly. However, in the sparsely vegetated habitat of *C. pulchellum*, the fire intensity would be greatly reduced, making it an ideal location for the application of fire retardant. By applying fire retardant in the more open areas, where the fire will burn with less intensity, the retardant's effectiveness in either halting the fire spread, or extinguishing the advancing fire front, will be greatly enhanced. As a result, the application of fire retardant to the habitat occupied by *C. pulchellum* would be effective in controlling the spread of the wildfire; therefore it is highly likely that fire retardant would be used in the area occupied by this listed plant in the event of a wildfire. Additionally, due to the small area that this population covers, less than 1 acre, it is likely that fire retardant will affect the entire population on the Sierra National Forest. *C. pulchellum* is an annual plant that typically senesces by late August (USFWS 1998). Since most fire suppression activities occur during late summer and fall in California, it is unlikely that a retardant drop would result in the direct exposure, and subsequent mortality, of *C. pulchellum*.

If a retardant drop occurs on or near *C. pulchellum*, this will result in an increased soil nutrient level that may persist for up to six years (Hopmans and Bickford 2003). Increased nutrients in the soil may allow for greater vegetative growth of *C. pulchellum* plants that will grow from seed in subsequent years; however, this plant is known to grow only in sparsely-vegetated areas with low-nutrient soils presumably because it competes poorly with other species on more fertile soils (USFWS 2004). Since plants that are poor competitors are typically out-competed by other plants in nutrient rich environments (Ricklefs 2006), the addition of nutrients is expected to adversely affect *C. pulchellum* as described below.

The increased level of nutrients, due to the application of fire retardant, will allow for the increased growth of both native and non-native plant species (Larson and Duncan 1982) in the current *C. pulchellum* habitat. Hopmans and Bickford (2003) suggest that the increased growth rates in plants can continue for six years, and altered species composition may persist for up to 20 years. Since competition with other plants is considered to be the greatest threat to the Sierra National Forest population and the encroachment of competitive plants is evident (USFWS 2004), the Service anticipates that the existing *C. pulchellum* population would be eliminated due to the increase in abundance of competing plant species. This would then effectively remove this site as suitable habitat from the range of the species.

Conclusion

After reviewing the current status of the *C. pulchellum*, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the Aerial Application of Fire Retardant following the Forest Service's *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is likely to jeopardize the continued existence of *C. pulchellum*. The proposed action would lead to a substantial reduction in number of *C. pulchellum*, a substantial reduction in range by removing this site as suitable habitat for *C. pulchellum*, and it would preclude the recovery of *C. pulchellum*. This conclusion is based on the following reasons: (1) the application of fire retardant is expected to eliminate approximately 25 percent of the known individual plants; (2) the spatial extent of the species outside the proposed action area is limited, and this action will reduce the range by 50 percent; and (3) the existing population that would be extirpated by the action is essential to the recovery of the species, in that it represents a unique ecological section, and provides for species distribution which reduces the likelihood of a single event being responsible for the extinction of the species.

Camatta Canyon Amole (*Chlorogalum purpureum* var. *reductum*)

Environmental Baseline

The Camatta Canyon amole (aka purple amole) is endemic to the La Panza Range in central San Luis Obispo County. Most of the population occurs on the Los Padres National Forest; however, it also extends onto the adjacent right-of-way of State Highway 58 managed by the California Department of Transportation and nearby privately-owned lands. Because surveys have not been conducted, the precise extent of the population across the several properties is not known. The California Department of Fish and Game (2007) reports the total area inhabited by the Camatta Canyon amole to comprise 127 acres. Of these 127 acres, approximately 90 percent are on NFS lands. The Camatta Canyon amole in the Los Padres National Forest grows in blue oak savannah and annual grassland (California Department of Fish and Game 2007) where invasive plant species are also present. This particular area could be targeted for fire retardant drops.

Effects

Invasive, non-native plant species continue to be a primary threat to the Camatta Canyon amole. These plant species may have the ability to displace the Camatta Canyon amole by out-competing and monopolizing the limited resources (soil nutrients, water, sunlight, pollinators), with the potential effects of preventing growth and recruitment. The nutrients in the fire retardants could stimulate the growth and increase in abundance of the invasive, non-native plant species. Also, if the increase in invasive plant species attracts grazing animals, this could have a negative impact on the Camatta Canyon amole. Because the Camatta Canyon amole is not confined to a small, discrete location, the USFS proposal to fence off areas to exclude grazing animals is not feasible for this species.

An increase in abundance of the invasive, non-native plant species may also alter characteristics of the fire regime, such as frequency, intensity, and seasonality of fires (Brooks et al. 2004). Fires at certain times of the year have the ability to prevent annual reproductive success of the purple amole (Niceswanger 2002), and likely also of the Camatta Canyon amole. The Camatta Canyon amole is susceptible to damage by fire when the living structures, including the seeds, are above ground or near the soil surface.

Conclusion

Due to the potential for all of these effects to arise from a fire retardant drop in the habitat of the Camatta Canyon amole, we conclude that this activity would reduce appreciably the likelihood of the species' survival and recovery in the wild and is likely to jeopardize its continued existence.

The primary constituent elements of critical habitat for Camatta Canyon amole consist of, but are not limited to: (i) Well-drained, red clay soils with a large component of gravel and pebbles on the upper soil surface; and, (ii) Plant communities in functioning ecosystems that support associated plant and animal species (*e.g.*, pollinators, predator-prey species, etc.), including grassland, blue oak woodland (*Quercus douglasii*) or oak savannahs, and open areas within shrubland communities. Within these vegetation communities Camatta Canyon amole appears where there is little cover of other species which compete for resources available for growth and reproduction. Therefore, and increase in of the invasive, non-native plant species is likely to adversely modify or destroy critical habitat critical habitat for the Camatta Canyon amole.

Slender-horned Spineflower (*Dodecahema leptoceras*)

Effects

A fire retardant drop in slender-horned spineflower habitat could significantly affect this species. Slender-horned spineflower occurs in isolated populations (52 FR 36265). There are only eight populations of this species rangewide, and 6 of these occur on or near Forest Service lands. One population occurs on the San Bernardino National Forest, one occurs partially on the Cleveland National Forest, and three other populations occur in Lytle Creek and Cajon Creek adjacent to the San Bernardino National Forest and in Big Tujunga Canyon adjacent to the Angeles National Forest. This species is a prostrate annual, and the more robust populations of this species occur with other native annual forb species on floodplain terraces in areas without perennial vegetation. Occurrences of slender-horned spineflower are typically found in areas with no ground disturbance or exotic species invasions (Stephenson and Calcarone 1999) and occur in nutrient-poor alluvial soils (Allen 1996).

An increase in exotic annual grasses has been shown to eventually preclude spineflower from previously occupied habitat (CNDDDB 2007, Consortium of California Herbaria, 2007). Thus, slender-horned spineflower is especially susceptible to invasions by annual species that (52 FR 36265). Based on the general effects of the action described above for plant species, a fire retardant drop could result in the enhancement of non-native weeds. Many occurrences are in proximity to weedy exotics (52 FR 36265) such that they are vulnerable to their invasion should they become enhanced by fire retardant drops. The loss or significant degradation of even one occurrence due to a non-native species invasion would represent an appreciable reduction in the distribution of this species.

Conclusion

Due to the potential for the above described effects to arise from a fire retardant drop in the habitat of the slender-horned spineflower, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

Slender-Petaled Mustard (*Thelypodium stenopetalum*)
California Dandelion (*Taraxacum californicum*)
Pedate Checkermallow (aka Bird-footed checkerbloom) (*Sidalcea pedata*)

Environmental Baseline

Mountain Meadow Species - Occurrences of these species are small and isolated. The occurrences of pedate checkermallow range in size from 0.1-3.3 acres (USFWS 1998); California taraxacum occurrences contain from 2 to 300 individuals (63 FR 49006); and slender-petaled mustard exists at only at 6-8 locations (USFWS 1998). For California taraxacum, there are about 20 occurrences (63 FR 49006) with 11 on the San Bernardino National Forest (USFWS 2001). The Forest Service has identified 73 site-specific localities of California taraxacum with 53 of these on the San Bernardino National Forest (USFWS 2005). For slender-petaled mustard, there are 6 (possibly 8) occurrences with 2 on the San Bernardino National Forest (USFWS 2005).

Effects

Many occurrences are in open areas near the urbanized areas of Big Bear City and Big Bear Lake Village where fire retardant has a high likelihood of placement. The open nature of the habitat for these mountain meadow species are sought-after anchor points for retardant lines, as well as hand lines and dozer lines (S. Eliason, USFS, pers. comm. 2008). The direct effects of a retardant drop on these species are unclear. Based on the general effects of the action described above for plant species, a fire retardant drop could result in the enhancement of non-native weeds. Exotic species are threats to these species; thus, a fire retardant drop that promotes non-native species could result in significant effects. California taraxacum is specifically threatened by the non-native European dandelion (*Taraxacum officinale*), which can out compete and hybridize with California taraxacum (63 FR 49006).

Conclusion

There are few populations of these species rangewide; thus, the loss or significant degradation of even one occurrence due to a non-native species invasion would represent an appreciable reduction in the distribution of these species. Therefore, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

The primary constituent elements of critical habitat for *Taraxacum californicum* are:

(i) Wet meadows subject to flooding during wet years and forest openings with seeps, springs, or creeks in the San Bernardino Mountains in San Bernardino County located at elevations of 6,700 to 9,000 feet (2,000 to 2,800 meters), that provide space for individual and population growth, reproduction, and dispersal; and, (ii) Well-drained, loamy alluvial to sandy loam soils occurring in the wet meadow system or forest openings with seeps, springs, or creeks, with a 0 to 46 percent slope, to provide water, air, minerals, and other nutritional or physiological requirements to the species.

Based on the general effects of the action described above for plant species, a fire retardant drop could result in the enhancement of non-native weeds that reduce space for individual and population growth, reproduction, and dispersal of *Taraxacum californicum*. Therefore, an increase in invasive, non-native plant species is likely to adversely modify or destroy critical habitat for the *Taraxacum californicum*.

Munz's Onion (*Allium munzii*)

Effects

Munz's onion occurs in small and isolated populations only within Western Riverside County, California. A population of over 5,000 plants occurs on the Cleveland National Forest and is designated critical habitat. This population occurs on Elsinore Peak and is considered to be the most undisturbed and pristine of any of the known occurrences of this species (Boyd and Mistretta 1991). This site represents the southwestern-most extent of the range for Munz's onion. Based on the general effects of the action described above for plant species, a fire retardant drop could result in the enhancement of non-native weeds. Type conversion and exotic species are threats to this species (63 FR 54975); thus, a fire retardant drop that promotes non-native species could result in significant effects.

Conclusion

There are few populations of these species rangewide; thus, the loss or significant degradation of even one occurrence due to a non-native species invasion would represent an appreciable reduction in the distribution of these species. Therefore, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

The primary constituent elements of critical habitat for *Allium munzii* are:

(1) Clay soil series of sedimentary origin (e.g., Altamont, Auld, Bosanko, Claypit, Porterville), or clay lenses (pockets of clay soils) of such that may be found as unmapped inclusions in other soil series, or soil series of sedimentary or igneous origin with a clay subsoil (e.g., Cajalco, Las Posas, Vallecitos), found on level or slightly sloping landscapes, generally between the elevations of 985 ft and 3,500 ft (300 m and 1,068 m) above mean sea level (AMSL), and as part of open native or non-native grassland plant communities and "clay soil flora" that can occur in a mosaic with Riversidean sage scrub, chamise chaparral, scrub oak chaparral, coast live oak woodland, and peninsular juniper woodland and scrub; or

(2) Alluvial soil series of sedimentary or igneous origin (e.g., Greenfield, Ramona, Placentia, Temescal) and terrace escarpment soils found as part of alluvial fans underlying open native or non-native grassland plant communities that can occur in a mosaic with Riversidean sage scrub generally between the elevations of 985 ft and 3,500 ft (300 m and 1,068 m) AMSL, or Pyroxenite deposits of igneous origin found on Bachelor Mountain as part of non-native grassland and Riversidean sage scrub generally between the elevations of 985 ft and 3,500 ft (300 m and 1,068 m) AMSL; and

(3) Clay soils or other soil substrate as described above with intact, natural surface and subsurface structure that have been minimally altered or unaltered by ground-disturbing activities (e.g., disked, graded, excavated, re-contoured); and,

(4) Within areas of suitable clay soils, microhabitats that are moister than surrounding areas because of (A) north or northeast exposure or (B) seasonally available moisture from surface or subsurface runoff.

Most of the grasslands remaining in California are non-native grasslands. Native listed plants persist in these degraded habitats where the soils and microclimate continue to provide for individual and population growth, reproduction, and dispersal. Based on the general effects of the action described above for plant species, a fire retardant drop could effect soils and soil chemistry and result in the enhancement of non-native weeds that reduce space for individual and population growth, reproduction, and dispersal of *Allium munzii*. Therefore, and increase in invasive, non-native plant species is likely to adversely modify or destroy critical habitat critical habitat for the *Allium munzii*.

Southern Mountain Buckwheat (*Eriogonum kennedyivar. austromontanum*)

Ash-Grey Indian Paintbrush (*Castilleja cinerea*)
Bear Valley Sandwort (*Arenaria ursina*)

Pebble Plains Plants-These species are all narrowly-distributed endemics in the San Bernardino Mountains and occur primarily on the San Bernardino National Forest. Forest Service management actions are vital to the conservation and recovery of these species. While no fire retardant has been applied to these species in recent years (S. Eliason, pers. comm., 2008), many of the occurrences exist in open areas proximal to wildland urban interface where fire retardant has a high likelihood of placement. In addition, the open nature of the habitat for these pebble plains species are sought-after anchor points for retardant lines, as well as hand lines and dozer lines (S. Eliason, USFS, pers. comm. 2008). The direct effects of a retardant drop on these species are unclear. Based on the general effects of the action described above for plant species, a fire retardant drop could result in the enhancement of non-native weeds. Type conversion and exotic species are threats to these species; thus, a fire retardant drop that promotes non-native species could result in significant effects.

Conclusion

There are few populations of these species rangewide; thus, the loss or significant degradation of even one population due to a non-native species invasion would represent an appreciable reduction in the distribution of these species. Therefore, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

The primary constituent elements of critical habitat for *Eriogonum kennedyi* var. *austromontanum* are the habitat components that provide:

- (i) Pebble plains in dry meadow-like openings within upper montane coniferous forest, pinyon-juniper woodlands, or Great Basin sagebrush in the San Bernardino Mountains of San Bernardino County, California; at elevations between 5,900 to 9,800 ft (1,830 to 2,990 m) that provide space for individual and population growth, reproduction and dispersal; and
- (ii) Seasonally wet clay, or sandy clay soils, generally containing quartzite pebbles, subject to natural hydrological processes that include water hydrating the soil and freezing in winter and drying in summer causing lifting and churning of included pebbles, that provide space for individual and population growth, reproduction and dispersal, adequate water, air, minerals, and other nutritional or physiological requirements to the species.

The primary constituent elements of critical habitat for *Castilleja cinerea* are the habitat components that provide:

- (i) Pebble plains in dry meadow-like openings, or non-pebble plain dry meadow margin areas, within upper montane coniferous forest, pinyon-juniper woodlands, or Great Basin sagebrush in the San Bernardino Mountains of San Bernardino County, California; at elevations between 5,900 to 9,800 ft (1,830 to 2,990 m) that provide space for individual and population growth, reproduction and dispersal;
- (ii) Seasonally wet clay, or sandy clay soils, generally containing quartzite pebbles, subject to natural hydrological processes that include water hydrating the soil and freezing in winter and drying in summer causing lifting and churning of included pebbles, or seasonally wet silt or saline clay soils in non-pebble plain dry meadow margin areas that provide space for individual and population growth, reproduction and dispersal, adequate water, air, minerals, and other nutritional or physiological requirements to the species; and
- (iii) The presence of one or more of its known host species such as *Eriogonum kennedyi* var. *austromontanum*, *E. kennedyi* var. *kennedyi*, and *E. wrightii* var. *subscaposum* in pebble plain

habitat and species such as *Artemisia tridentata*, *A. nova*, and *E. wrightii* var. *subscaposum* in pebble plain and non-pebble plain meadow margin habitat that provide some of the physiological requirements for this species.

The primary constituent elements of critical habitat for *Arenaria ursina* are the habitat components that provide:

(i) Pebble plains in dry meadow-like openings within upper montane coniferous forest, pinyon-juniper woodlands, or Great Basin sagebrush in the San Bernardino Mountains of San Bernardino County, California; at elevations between 5,900 to 9,800 ft (1,830 to 2,990 m) that provide space for individual and population growth, reproduction and dispersal; and

(ii) Seasonally wet clay, or sandy clay soils, generally containing quartzite pebbles, subject to natural hydrological processes that include water hydrating the soil and freezing in winter and drying in summer causing lifting and churning of included pebbles, that provide space for individual and population growth, reproduction and dispersal, adequate water, air, minerals, and other nutritional or physiological requirements to the species.

Based on the general effects of the action described above for plant species, a fire retardant drop could effect soils and result in the enhancement of non-native weeds that reduce space for individual and population growth, reproduction, and dispersal of *Eriogonum kennedyi* var. *austromontanum*, *Castilleja cinerea*, and *Arenaria ursina*. Therefore, an increase in invasive, non-native plant species is likely to adversely modify or destroy critical habitat critical habitat for the *Eriogonum kennedyi* var. *austromontanum*, *Castilleja cinerea*, and *Arenaria ursina*.

Cushenbury Oxytheca	<i>(Oxytheca parishii</i> var. <i>goodmaniana)</i>
Cushenbury Milk-Vetch	<i>(Astragalus albens)</i>
Cushenbury Buckwheat	<i>(Eriogonum ovalifolium</i> var. <i>vineum)</i>
San Bernardino Mountains Bladderpod	<i>(Lesquerella kingii</i> ssp. <i>bernardina)</i>

Carbonate plants - These species are all narrowly-distributed endemics in the San Bernardino Mountains with many of the remaining occurrences on the San Bernardino National Forest. Forest Service management actions are vital to the conservation and recovery of these species. The open nature of the habitat for these carbonate plants are sought-after anchor points for retardant lines, as well as hand lines and dozer lines (S. Eliason, USFS, pers. comm. 2008). The direct effects of a retardant drop on these species are unclear. Based on the general effects of the action described above for plant species, a fire retardant drop could result in the enhancement of non-native weeds. Exotic species are threats to these species; thus, a fire retardant drop that promotes non-native species could result in significant effects.

Conclusion

There are few populations of these species rangewide; thus, the loss or significant degradation of even one population due to a non-native species invasion would represent an appreciable reduction in the distribution of these species. Therefore, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

Based on our current knowledge of these species, the primary constituent elements of critical habitat for each species is listed below and consist of, but are not limited to:

Astragalus Albens

- (1) Soils derived primarily from the upper and middle members of the Bird Spring Formation and Undivided Cambrian parent materials that occur on dry flats and slopes or along rocky washes with limestone outwash/deposits at elevations between 1,171 and 2,013 m (3,864 and 6,604 ft);
- (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and
- (3) Associated plant communities that have areas with an open canopy cover and little accumulation of organic material (e.g., leaf litter) on the surface of the soil.

Erigeron Parishii

- (1) Soils derived primarily from upstream or upslope limestone, dolomite, or quartz monzonite parent materials that occur on dry, rocky hillsides, shallow drainages, or outwash plains at elevations between 1,171 and 1,950 m (3,842 and 6,400 ft);
- (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and
- (3) Associated plant communities that have areas with an open canopy cover.

Eriogonum Ovalifolium var. *Vineum*

- (1) Soils derived primarily from the upper and middle members of the Bird Spring Formation and Bonanza King Formation parent materials that occur on hillsides at elevations between 1,400 and 2,400 m (4,600 and 7,900 ft);
- (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and
- (3) Associated plant communities that have areas with an open canopy cover (generally less than 15 percent cover) and little accumulation of organic material (e.g., leaf litter) on the surface of the soil.

Lesquerella Kingii ssp. *Bernardina*

- (1) Soils derived primarily from Bonanza King Formation and Undivided Cambrian parent materials that occur on hillsides or on large rock outcrops at elevations between 2,098 and 2,700 m (6,883 and 8,800 ft);
- (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and
- (3) Associated plant communities that have areas with an open canopy cover and little accumulation of organic material (e.g., leaf litter) on the surface of the soil.

Oxytheca Parishii var. *Goodmaniana*

- (1) Soils derived primarily from upslope limestone, a mixture of limestone and dolomite, or limestone talus substrates with parent materials that include Bird Spring Formation, Bonanza King Formation, middle and lower members of the Monte Cristo Limestone, and the Crystal Pass member of the Sultan Limestone Formation at elevations between 1,440 and 2,372 m (4,724 and 7,782 ft);
- (2) Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment); and
- (3) Associated plant communities that have areas with a moderately open canopy cover (generally between 25 and 53 percent (Neel 2000)).

Based on the general effects of the action described above for plant species, a fire retardant drop could effect soils and soil chemistry and result in the enhancement of non-native weeds that reduce the openness of canopy cover and reduce space for individual and population growth, reproduction,

and dispersal of *Astragalus Albens*, *Erigeron Parishii*, *Eriogonum Ovalifolium* var. *Vineum*, *Lesquerella Kingii* ssp. *Bernardina*, and *Oxytheca Parishii* var. *Goodmaniana*. Therefore, the proposed action is likely to adversely modify or destroy critical habitat for *Astragalus Albens*, *Erigeron Parishii*, *Eriogonum Ovalifolium* var. *Vineum*, *Lesquerella Kingii* ssp. *Bernardina*, and *Oxytheca Parishii* var. *Goodmaniana*.

San Bernardino Bluegrass (*Poa atropurpurea*)

This endemic bluegrass species is found in montane meadow habitat in Big Bear Valley in the San Bernardino Mountain range on the and at six meadow locations in the Laguna and Palomar Mountains in San Diego County. It is an upper elevation plant [1,800 to 2,300 m (6000 to 7500 ft)] commonly found in the drier margins of vernal moist meadows. Most of these occurrences lie on National Forest System lands on the Cleveland and San Bernardino National Forests. Due to limited survey effort, data are not available to know the relative abundance of the bluegrass or importance of these occurrences; therefore, this analysis assumes they are of approximately equal value. At many of the known sites, the bluegrass has become so sparse that the species has been detected for many years. As a result, the USFS has been using the phenology of Kentucky bluegrass as a management indicator for releasing cattle onto USFS grazing allotments that support San Bernardino bluegrass.

Many of these populations appear vulnerable to extirpation and stimulation of non-native plants (see below) would be expected to compound current threat levels to the species.

Based on the general effects of the action described above for plant species, a fire retardant drop would be expected to promote the spread or increase the density of non-native invasive plants. Since non-native plants are widely and densely distributed in the bluegrass habitat, and are thought to limit the distribution and abundance of the species, an increase in weed competition is likely to adversely affect the bluegrass.

Conclusion

With only a few known occurrences remaining, and most on National Forest System lands, the loss or degradation of any of these occurrences would represent an appreciable reduction in the reproduction, numbers, and distribution of the San Bernardino bluegrass. Therefore, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

The primary constituent elements of critical habitat for *Poa atropurpurea* are:

- (1) Wet meadows subject to flooding during wet years in the San Bernardino Mountains in San Bernardino County at elevations of 6,700 to 8,100 feet (2,000 to 2,469 meters), and in the Laguna and Palomar Mountains of San Diego County at elevations of 6,000 to 7,500 feet (1,800 to 2,300 meters), that provide space for individual and population growth, reproduction, and dispersal; and
- (2) Well-drained, loamy alluvial to sandy loam soils occurring in the wet meadow system, with a 0 to 16 percent slope, to provide water, air, minerals, and other nutritional or physiological requirements to the species.

Based on the general effects of the action described above for plant species, a fire retardant drop could effect soils and soil chemistry and result in the enhancement of non-native weeds that reduce the space for individual and population growth, reproduction, and dispersal of *Poa atropurpurea*.

Therefore, the proposed action is likely to adversely modify or destroy critical habitat for *Poa atropurpurea*.

Tripled-ribbed Milk-vetch (*Astragalus tricarinatus*)

Only one source population of this highly restricted endemic plant is known. Located in on private and or BLM lands adjacent to near the San Bernardino National Forest boundary in the upper Mission Creek watershed, this population near Wathier Landing was subjected to a an apparently heavy application (“tons”; S. Eliason, USFS, in litt.) of fire retardant during the Heart/Millard Fire in 2006, under the unified incident command of the USFS, BLM, and County. This event documents the vulnerability of the milk-vetch to future retardant applications as well, regardless of landownership, especially since patches of open habitat, which characterizes this last major population, represent preferred retardant drop sites (S. Eliason, USFS, in litt.).

Based on the general effects of the action described above for plant species, fire retardant drops would be expected to (1) promote the spread or increase the density of non-native invasive plants, and (2) result in negative physiological effects to this legume, which as a family is especially vulnerable to retardants. We, therefore, believe that this population was adversely affected during the 2006 fire, although post-fire monitoring has not been conducted (S. Eliason, USFS, in litt.) to our knowledge, and emergency consultation was not initiated.

Conclusion

With this occurrence representing the last known large population of the milk-vetch, and the documented source of smaller subpopulations downstream within the same watershed, the species being susceptible to adverse physiological effects of fire retardants, the degradation or loss of this occurrence would constitute an appreciable reduction in the reproduction, numbers, and distribution of the milk-vetch. Therefore, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species’ survival and recovery in the wild. No Critical habitat has been designated, therefore, none will be affected.

Vail Lake Ceanothus (*Ceanothus ophiophilus*)

Vail lake ceanothus is considered a narrow endemic and is currently restricted to three locations in chamise chaparral communities on north-facing slopes and on soils derived from an unusual pyroxenite-rich rock outcrop that may be gabbroic in origin. Soil on the outcrop is nutrient poor and constitutes harsh growing conditions for most plants (CDFG 2000). Two of the three populations, which constitute 50 percent of the species known occupied habitat, occur on the Cleveland National Forest (CNF) and are subject to applications of fire retardant. Data on the toxicity of retardants to sensitive plant species are lacking; however, based on the general effects of the action for plant species described above, fire retardant enhances the spread of non-native weeds, which increases combustible fuel loads that can alter fire regimes and potentially lead to type conversion. These habitat alterations could result in significant effects to the species. Further, nutrient poor soils may be critical for the species to maintain reproductive isolation and it is uncertain if the retardant concentrates or persists in the soil where this plant occurs. More information on the concentrations and persistence of retardant compounds in this particular soil is necessary to determine if the retardant may alter soil nutrient levels, thus limiting the reproduction and growth of the plant.

Conclusion

Given the level of uncertainty of the action on Vail lake ceanothus and the potential of the action to eliminate 50 percent of population of this plant, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

Critical Habitat - (*Ceanothus ophiochilus*)

Vail lake ceanothus is considered a narrow endemic and is currently restricted to three locations in chamise chaparral communities on north-facing slopes and on soils derived from an unusual pyroxenite-rich rock outcrop that may be gabbroic in origin. Soil on the outcrop is nutrient poor and constitutes harsh growing conditions for most plants (CDFG 2000). Two of the three populations, which constitute 50 percent of the species known occupied habitat, occur on the Cleveland National Forest (CNF) and are subject to applications of fire retardant. Data on the toxicity of retardants to sensitive plant species are lacking; however, based on the general effects of the action for plant species described above, fire retardant enhances the spread of non-native weeds, which increases combustible fuel loads that can alter fire regimes and potentially lead to type conversion. These habitat alterations could result in significant effects to the species. Further, nutrient poor soils may be critical for the species to maintain reproductive isolation and it is uncertain if the retardant concentrates or persists in the soil where this plant occurs. More information on the concentrations and persistence of retardant compounds in this particular soil is necessary to determine if the retardant may alter soil nutrient levels, thus limiting the reproduction and growth of the plant.

The only designated critical habitat unit for this species occurs on the CNF.

Conclusion

Given the level of uncertainty of the action on the primary constituent elements of critical habitat for the Vail lake ceanothus and the potential of the action to eliminate adversely effect 50 percent of its habitat, we conclude this action would likely result in destruction or adverse modification of designated critical habitat.

Nevin's Barberry (=Truckee)

(*Mahonia nevinii*)

The total number of individuals for Nevin's barberry is reportedly fewer than 1,000 plants (63 FR 54956) but may be fewer than 500. One large population, which collectively contains about 200 individuals, occurs in Vail Lake/Oak Mountain area on private lands in the Vail Lake region adjacent to the Cleveland National Forest. The other large population of Nevin's barberry, thought to contain between 130-250 individuals, is in San Francisquito Canyon on the Angeles National Forest in Los Angeles County (63 FR 54956). Both these populations (comprising approximately 78 percent of the overall population) will likely be affected by a fire retardant drop, either by direct hit or drift. Data on the toxicity of retardants to sensitive plant species are lacking; however, based on the general effects of the action for plant species described above, fire retardant enhances the spread of non-native weeds, which increases combustible fuel loads that can alter fire regimes and potentially lead to type conversion. Type conversion, invasion of exotic species, and altered fire regimes are threats to this species; thus, fire retardant applications could result in significant effects.

Conclusion

With only a few, isolated populations of this species rangewide, the loss or significant degradation of even one occurrence due to a non-native species invasion would represent an appreciable reduction in its distribution. Therefore, we conclude that this action is likely to jeopardize its continued existence by appreciably reducing the likelihood of the species' survival and recovery in the wild.

Nevin's Barberry Proposed Critical Habitat (*Mahonia nevinii*)

Of the two designated critical habitat units proposed for this species, one occurs on Cleveland National Forest (72 FR 58793). One large population, which collectively contains about 200 individuals, occurs in Vail Lake/Oak Mountain area on private lands in the Vail Lake region adjacent to the Cleveland National Forest. Data on the toxicity of retardants to sensitive plant species are lacking; however, based on the general effects of the action for plant species described above, fire retardant enhances the spread of non-native weeds, which increases combustible fuel loads that can alter fire regimes and potentially lead to type conversion. Type conversion, invasion of exotic species, and altered fire regimes are threats to this species; thus, fire retardant applications could result in significant effects.

Conclusion

Due to the uncertain effects of fire retardant on this plant and its primary constituent elements, this action would likely result in destruction or adverse modification of the proposed critical habitat.

Invertebrates

James spinymussel (*Pleurobema collina*)

Effects Analysis

The effects of fire retardant use on the George Washington and Jefferson National Forests (GWJ) were evaluated for nineteen federally listed endangered aquatic species. These species include 18 freshwater mussel species and 1 fish species. Most of these species do not actually occur on the National Forests, however, instream habitat, particularly water quality, is influenced by Forest Service (FS) activities within the watersheds. The James spinymussel (*Pleurobema collina*) occurs in the James river drainage.

Use of fire retardants on the GWJ

Waterways containing listed species could be exposed to fire retardants either through an intentional planned release or accidental drop across or adjacent to a water body during aerial application or on-the-ground activities where the retardant is stored or mixed at a reload base or portable base. Although the 2000 guidelines establish standards to avoid direct application to water bodies, the incident commander has the flexibility to make exceptions to those standards. Furthermore, the *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (U.S. Forest Service et al. 2000) only address visible water bodies. Direct application within the 300 foot buffer of non-visible water bodies is likely to occur. We expect that first to third order streams could be accidentally contaminated with fire retardant. As a result of these uncertainties and estimating that the average footprint of a typical drop is 40 feet wide and spans 1000 or more feet (S. Croy, USFS, pers. comm.),

it is likely that application of fire retardant across water bodies, particularly intermittent and ephemeral streams, will likely occur during drops.

Compared to other National Forest fire suppression activities, use of fire retardant on the GWJ has been minimal. Historically, the Wyers Cave air tanker base, located at Shenandoah Valley Airport, supplied fire retardant for the majority of drops on the GWJ. Between 1986 and 2000, aircraft from the Wyers Cave air tanker base dropped 306,000 gallons of unspecified fire retardant on National Forest land as well as National Park Service and private lands, mainly in the Shenandoah Valley area. Since 2001, only 21,000 gallons of fire retardant (Phos-Chek D75-R) have been applied specifically to fires on the GWJ. By comparison, 48,940,258 gallons of fire retardant were used over all National Forest lands from 2001 through 2006. Fire retardant use on the GWJ during that time frame accounts for about 0.04 % of total national usage. Given that the GWJ comprises less than 1% of the National Forest land base, the GWJ, by far, uses proportionally less fire retardant chemicals. On a per acre basis, the total National Forest usage is 26 times greater than what has been applied on the GWJ. According to the Fire and Aviation Management Web Application database, 333 wildland fires have been reported on the GWJ since 2001. Of those fires, only 5 (1.5%) were treated with fire retardant (Table 2). All five retardant applications occurred on either mid to upper slopes or ridge tops; none of the drops occurred over perennial streams. Also, all historic applications of retardant on the GWJ have been with heavy fixed-wing air tankers (2 to 4 engines) and no drops have been made using helicopters or SEATS (Single Engine Air Tankers). Therefore all retardant storage, mixing, and loading operations have been at large airports and not in the field at temporary portable bases.

Compared to pre-2000 use, application of retardants to suppress fires on the GWJ has been of a declining trend. Predicted future use of fire retardants on the GWJ is expected to decline even further. Several factors have contributed to this trend.

The great majority of forest fires on the GWJ are ground fires. Crown fires are extremely rare and only occur as single tree or group torching in isolated pine stands. Forests of the GWJ are dominated by a deciduous forest canopy that tends to intercept fire retardants during dispersal, especially during leaf-on conditions, inhibiting the retardant from reaching the ground and rendering the practice of aerial application as sub-effective.

Aerial application of fire retardant typically occurs during initial attack (i.e. during the first few hours after a fire's discovery). Many fires on the GWJ are not immediately adjacent to the wildland-urban interface and thus the need to rapidly protect human-made structures from wildland fires has been minimal.

Using fire retardants is expensive and is not commonly available.

The GWJ is migrating away from an emphasis on immediate fire control and moving toward a wildland fire doctrine of appropriate management response, focusing more on point protection.

As a result of decreasing demand for fire retardants in the GWJ area, several air tanker bases have been discontinued. Historically the GWJ was served by four possible air tanker bases located in Asheville, North Carolina, Knoxville, Tennessee, Wyers Cave, Virginia, and sometimes a portable base in Dublin, Virginia. Both the Asheville and Wyers Cave bases have been closed, and the Knoxville base is scheduled to be closed in 2008 or 2009. The Dublin base is portable and will only operate depending on conditions and fire occurrences. To replace those bases, three Southeastern permanent fixed bases are planned for Fort Smith, Arkansas, Lake City, Florida, and Chattanooga, Tennessee. Because delivery of fire retardants to the GWJ will be logistically difficult based on distance limitations and higher costs, the option to use aerial applied fire retardants will be less likely than historic use.

Table 4. Fires that were treated with fire retardant (Phos-Chek D75-R) on the GWJ since 2001. NA = not applicable

Name of fire	Year	Ranger District	Watershed	Amount of retardant (gal)	Number of drops	Distance to listed species (miles)
Huckleberry	2001	Eastern Divide	James	5,000	3	8
Marbleyard	2002	Glennwood-Pedler	James	8,000	4	3
Strike 3	2002	Lee	Shenandoah	2,000	1	NA
Cardinal	2006	Lee	Shenandoah	4,000	2	NA
Hoot-Owl	2007	Clinch	Clinch	2,000	1	35

Occurrence of fire retardant applied over streams

Although streams and rivers serve as natural breaks for fire control, fire retardant application on the GWJ has never been anchored to waterways. Fire retardant application on the GWJ has been typically anchored to rocky outcroppings, the “black” (where the fire has already burned), roads, trails, bulldozer lines, or hand lines. Most fires on the GWJ occur on higher elevation terrain with the head of the fire progressing uphill, commonly in combination with an upslope wind influence. Application of fire retardant has been used to block or deflect the movement of the fire or dampen the intensity of the fire on the mid to upper slopes. Since fire retardant use on the GWJ has been and is expected to remain isolated to ridge tops and mid to upper slopes, the potential for application of fire retardant over higher order perennial streams is very low. However, it likely that fire retardant application will occur across ephemeral, intermittent, or low order perennial streams (1 – 3 order). Monitoring of streams after a fire has not occurred, so direct effects to streams from historic application are unknown.

James spiny mussel is influenced by the Eastern Divide, James River, Glenwood, Pedlar, Warm Springs, and North River Ranger Districts. The James spiny mussel occurs in the James River basin, Roanoke River basin, and Dan River sub-basin. Approximately 60% of the entire James spiny mussel population occurs within the upper James River and Maury River watersheds (B. Watson, Virginia Department of Game and Inland Fisheries, pers. comm. 2008). The James spiny mussel population occurs in a patchy distribution throughout the Upper James and Maury Rivers; however, major population centers occur in South Fork Potts Creek, Monroe County, West Virginia; Johns Creek, Craig County, Virginia; and Mill Creek, Bath County, Virginia. The Johns Creek and South Fork Potts Creek populations account for approximately 45-50% of the entire James spiny mussel population. The most recent survey (2006) of the South Fork Potts Creek documented 339 James spiny mussels in approximately 5.28 km stretch of the creek. The 2004 survey of Johns Creek documented 95 mussels in 450 meters of the stream in a total of 15 person hours.

Both the Johns Creek and South Fork Potts Creek populations occur in the upper reaches of those watersheds and are surrounded by National Forest lands that border or are within close proximity (<1

mile) of the streams. Approximately 42% and 28% of the upper James and Maury Rivers watersheds are under FS ownership, respectively, representing a significant portion of the land base. Although the James spiny mussel occurs within the FS property, most of the population in the Upper James and Maury River either borders or lies in close proximity to National Forest lands. As a result of these factors, fire retardant has a high probability of being used in close proximity to James spiny mussel habitat. For example: four fire retardant drops were made during the 2002 Marbleyard fire within 2.1 miles of James spiny mussel habitat and 3 miles of a known occurrence.

Toxicity of fire retardant

Chemical components of the retardant Phos-Check D75-R, and presumably all members in the Phos-Check family, include un-ionized ammonia and total ammonia. Un-ionized ammonia is neutrally charged (Emerson et al. 1975) and easily crosses the gill membranes of fish, and presumably mussel gills as well. Because of this, it is considered the most toxic form of ammonia. A primary function of the gills is to rid the body of waste material in the form of ammonia. If enough un-ionized ammonia is in the surrounding water, ammonia will diffuse into the organism, creating a build up of ammonia. Ammonia build up can occur to such an extent that it becomes lethal to the organism.

Calfee and Little (2003) tested Phos-Check D75-R on rainbow trout, reporting a 96 hour LC50 of 168 mg/l (between 142 and 194 mg/l). Although there are no data to quantify the toxic effects of fire retardant chemicals on freshwater mussels, ammonia is the likely toxic component of Phos-Check retardants. Augspurger et al. (2003) developed protective water quality ammonia limits for freshwater mussels, ranging from 0.3 to 1.0 mg/L total ammonia at pH 8 at 25C. Toxic effects are expected to increase at higher pH levels. Typically, streams and creeks in the GWJ range in average pH from 7.5 - 8.5.

Environmental Persistence

Little and Calfee (2002) reported that soil composition plays a significant role in the chemical persistence and weathering of fire retardants in runoff. Retardants used on soils that are rocky or sandy are more persistent and toxic than those used on high organic soils. During toxicity tests using fathead minnows (*Pimephales promelas*), short-term weathering increased mortality from 0% at 24 hours to 55% at 96 hours of exposure on high organic soil. Weathering on low organic soils ranged from 0 to 80%, and on sand from 25 to 100%. However, mortality decreased after longer weathering on the high and low organic soils. The mortality rate of D75-R decreased 55% after 7 days of weathering and dropped to 15% after 28 to 45 days of weathering. This study classified high organic soils as loamy forest soils with an organic matter content of 3.6% and low organic soils had an organic matter of 1.4%. Typically, the surface soil has high organic matter in the GWJ (Tom Bailey, USFS pers. comm. 2008). Due to the high organic content, we expect application of the fire retardant, PhosCheckD75-R, would result in 15% mortality even after 28-45 days. Under a worst case scenario, ammonia concentrations can remain at lethal levels over 6 stream miles for fish (Norris and Webb 1989).

Dilution

Little and Calfee (2002) assumed the minimum recommended fire retardant application rate of 1 gallon per 100 square feet then calculated the dilution factor needed to reach sublethal concentrations for fish. They determined field applications of Phos-CheckD75-R would have to be diluted by a factor of greater than 5,000.

The mainstem reaches of the Powell, Clinch, North Fork Holston, and South fork Holston Rivers are considered medium sized rivers. In the event that fire retardant enters extreme headwater tributaries of the upper Tennessee River system (ephemeral, intermittent streams, and 1st and 2nd order streams), normal instream flow rates (Table 4) within the mainstem reaches would be sufficient to adequately dilute fire retardant chemicals levels by a factor greater than 5000. This scenario would be similar for the mainstem reaches of the James River. Conversely, smaller tributaries, specifically Potts and Johns Creek of the upper James River, would likely receive toxic levels of fire retardant chemicals if application were to occur in upper tributaries within those watersheds.

Table 5. Daily flow statistics in cubic feet per second based on historic USGS gage station data.

Water body	Minimum	Median	Mean	Maximum
Powell River	46	218	528	3800
Clinch River	60	695	1460	22200
North Fork Holston River	30	286	565	7190
Middle Fork Holston River	29	162	280	2600
South Fork Holston River	85	481	780	7390
Upper James River mainstem	269	1050	1960	10100
Potts Creek	15	114	200	1880
Johns Creek	17	141	237	1870
South Fork Roanoke River	10	102	118	305

Analysis for Effects of the Action

Direct Effects – Direct impact to the freshwater mussels associated with this project include the potential to kill or injure freshwater mussels from ammonia toxicity derived from fire retardant chemicals that have been applied directly or indirectly to habitat. Fire retardants may potentially enter and accumulated in the water column through runoff if precipitation follows shortly after application of fire retardants. Water bodies contaminated by fire retardant chemicals could result in both acute and chronic toxic affects to the mussels. Toxicity would result from increased un-ionized and total ammonia levels and would depend on the organic level of the soil, the proximity of the application, the amount that enters the water column, the concentration of the retardant, and the volume and velocity of the stream. Acute toxicity could occur if ambient concentrations of ammonia exceeded 0.3 to 1.0 mg/L total ammonia at pH 8 at 25C within mussel habitat. Chronic toxicity may occur depending on the persistence of the retardant in the environment. Based on the high organic level of the soil surface in the GWJ, the Service expects toxic effects of the retardant to persist up to 45 days. There are many variables that factor into the toxicity level of the retardant to the mussels. Although mussels can close their valves to potentially avoid some toxic exposure, nothing is known about this behavior with respect to Phos-Check chemicals.

Indirect Effects - Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). Indirect impacts to federally listed mussels associated with this project may include altering nutrient and food base that the mussels are dependent upon.

Conclusion

After reviewing the current status of the James spiny mussel, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that aerial

application of fire retardant is likely to jeopardize the continued existence of the spiny mussel. No critical habitat has been designated for this species; therefore, none will be affected.

This determination is based on the following: 1) historic and predicted future use of retardants on this National Forest has shown application within 2.1 stream miles of known James spiny mussel populations in Johns and Potts Creeks; 2) under a reasonable worst case scenario of retardant use within the Johns and Potts Creek watersheds, the James spiny mussel would be likely to receive toxic levels of fire retardant; 3) approximately 60% of the species' entire population occurs in the Upper James River and Maury River watersheds, where FS ownership accounts for 42% and 28% of the land base, respectively; 4) 40-50% of the entire James spiny mussel population occurs within Johns and Potts Creeks, thus making these populations vulnerable to extirpation from retardant drops; 5) the loss of or serious reduction in either the Johns Creek or Potts Creek population could cause significant loss of the overall genetic diversity of the species; 6) the loss of or serious reduction in either of these populations could result in loss of one half of the entire species' reproductive output; 7) loss of either of these populations would significantly reduce the size and distribution of the species, including loss of an important source population. Impacts at this magnitude to any one of these attributes (reproduction, numbers, or distribution) would appreciably reduce the likelihood of both survival and recovery and would leave the species much more vulnerable to extinction.

Fine-lined pocketbook (*Hamiota altilis*)

Alabama moccasinshell (*Medionidus acutissimus*)

Coosa moccasinshell (*M. parvulus*)

Southern pigtoe (*Pleurobema georgianum*)

Southern clubshell (*P. decisum*)

Triangular kidneyshell (*Ptychobranthus greenii*)

Effects of the Action

Effects of Long-term Fire Retardants on Aquatic Species

The US Forest Service (USFS) lists eight long-term fire retardants as approved for use in fighting wildland fires:

Phos-Chek D75-R	Phos-Chek 259-R
Phos-Chek D75-F	Phos-Chek 259-F
Phos-Chek G75-F	Phos-Chek LV-R
Phos-Chek G75-W	Phos-Chek LC-95A-R

These products are supplied as either dry or wet concentrates and contain ammonium salts as the active fire retardant ingredient (from 7.6 to 11.3 percent of the individual product). These products also contain some or all of the following ingredients: gum thickeners, viscosity stabilizers, bactericides, corrosion inhibitors, and coloring agents (www.PhosChek.com 2008).

Normal use of these fire retardants involves mixing the concentrate with water (1.12 lb/gal to 1.60 lb/gal for the dry concentrates and 3.6:1 to 5.5:1 for the wet concentrates) (www.PhosChek.com 2008) and applying the retardant mixture ahead of a fire via fixed-wing airtanker (400 to 3,600 gallon capacity), helicopter (100 to 3,000 gallon capacity), or ground apparatus. Application rates vary from 1 to >6 gallons of mixed retardant per 100 ft² (435 to 2,600 gallons per acre) depending on vegetation type and other conditions (Labat Environmental 2007).

The primary environmental hazard associated with the use of these fire retardants is the toxicity of ammonia to aquatic organisms (Buhl and Hamilton 1998, 2000). The ammonium salts in fire retardants readily dissolve in water and form two chemical species, NH_3 (considered the most toxic form) and NH_4^+ . The chemical equilibrium of the two forms is highly dependant on pH and, to a lesser extent, temperature of the receiving water body, with higher pH and temperature causing a higher proportion of total ammonia forming the toxic NH_3 (USEPA 1999). Because of these and other factors, direct comparisons of ammonia toxicity data is problematic and must be done with care.

Several scientific studies assess the aquatic toxicity of ammonia-based fire retardants, including three approved for use by the USFS: Phos-Chek D75-F, D75-R, and 259-F; the other five approved compounds have not been tested. The studies show the LC_{50} (the concentration that causes mortality to 50 percent of the test organisms) for rainbow trout (*Oncorhynchus mykiss*) ranges from 102 to 237 mg/L (24 to 96 hour exposure scenarios). The most sensitive life stage tested was swim-up fry exposed to 102 mg/L Phos-Chek 259-F for 24 hours (Labat Environmental 2007).

Sublethal effects of fire retardants on aquatic species have not been studied; however, low-level concentrations of ammonia are known to cause various physiological responses in fish and freshwater mussels. Responses may include loss of equilibrium, increased respiratory activity and heart rate, reduction in growth rate, and increased susceptibility to disease, among others (Wang *et al.* 2007a, 2007b; Wicks 2002; Shingles, *et al.* 2001; Carballo 1995).

The potential for mortality due to introduction of an approved fire retardant into an aquatic system is difficult to predict, but factors to consider include:

- Sensitivity of the resident organisms: Aquatic species differ in their sensitivity to ammonia. Coldwater fish, especially the salmonids, darters (genus *Etheostoma*), and shiners (genus *Notropis*) are highly sensitive to ammonia (USEPA 1999). Certain freshwater mussels are also very intolerant of ammonia exposure (Augsberger *et al.* 2003). Early life stages (swim-up fry for trout and glochidia for mussels) are typically the most sensitive to ammonia.
- Quantity of retardant introduced into the stream: All things being equal, a higher concentration of fire retardant in a stream will cause higher mortality over a larger area.
- Stream flow: Larger streams with higher flows have greater capacity for diluting a given amount of fire retardant and lessening the potential for toxicity.
- Ambient water quality: The potential for toxicity increases with higher pH, lower dissolved oxygen, higher temperature, and higher nitrogen loading of the receiving water.
- Stream morphology: Assuming similar flows, a narrow, deep stream will likely have a shorter zone of mortality than a broad, shallow stream. Additionally, streams with smooth, straight channels are likely to have longer mortality zones than those with many riffles and pools, which tend to cause the peak concentration to mix and spread out (Norris, *et al.* 1983).
- Vegetative cover: Dense canopy cover may reduce or slow the deposition of air-dropped fire retardants into the underlying water.

In 2007, the USFS funded an ecological risk assessment to examine the effects of wildland fire retardants on terrestrial and aquatic species (Labat Environmental 2007). Seven of the eight approved fire retardants were reviewed (Phos-Chek LC-95A-R is a new product and was not included). Several different exposure scenarios were modeled to assess risk to aquatic species: risk from runoff, risk from accidental application across a stream, and risk from an accidental spill into a stream. Streams were described as either small (6,400 acre drainage basin, 12cfs flow) or large (147,200-acre drainage, 350cfs flow). For this report, risk was defined as “the identified exposure level [that] could

be associated with loss of at least half of a local population of non-sensitive species or puts individual animals of sensitive species at risk of mortality” (Labat Environmental 2007).






Models indicated that all seven of the approved fire retardants assessed for the USFS posed a risk to sensitive (e.g., threatened and endangered) aquatic species if they are applied across a small stream. The risk assessment also determined that significant risk existed if any of the retardants were accidentally spilled into a small or large stream (assumed spill volumes included a 2,000-gal tank of mixed, diluted retardant). Toxicity and dilution of fire retardants in medium streams (6400-147,200-acre drainage basin [10-230 square miles] and 12-350 cfs flow) were not evaluated.

Earlier studies by Norris and Webb (1989) documented the downstream affects of aerial retardant application in aquatic systems; their simulations of retardant dispersal in streams 2.4-31-feet wide showed fish mortality associated with a 2114-gallon drop of fire retardant might occur more than 6.2 miles below the point of chemical entry, depending on

- Orientation of the line of flight to the stream,
- Size of load dropped and number of loads dropped on the same stream,
- Timing and placement of subsequent loads relative to the first load,
- Site characteristics, including stream shape and vegetative canopy, and
- Stream flow characteristics.

Equipment currently used in fire operations may carry over 3000 gallons of retardant, or 50% more than the amount of retardant used in Norris and Webb’s (1988) simulations.

Table 6. Fish mortality related to orientation of stream relative to the aerial drop of fire retardants and to amount of retardant dropped. A standard drop was defined as 4000 liters (from Norris and Webb 1988).

Application zone and stream direction	Angle between long axis zone and stream ¹	Distance over which 100 pct mortality occurs	
		Standard drop	Standard drop times two
	90	50	480
	67.5	50	560
	45.0	100	1000
	22.5	240	>1000
	0	1000	>1000

¹The mortality zone, where fish kills of 0-100%) might occur increased by a factor of 10 or more when models simulated the effects of two standard drops applied to the same stream.

Effects of Fire Retardant Application on Aquatic Species in the Chattahoochee and Cherokee National Forests

Headwater and tributary systems to the Conasauga River, Etowah River, and Coosawattee River drain portions of the Chattahoochee and Cherokee National Forests in northwest Georgia and southeast Tennessee. Six listed mussel species occur in these river systems on or adjacent to the National Forests:

- Fine-lined pocketbook (*Hamiota altilis*) – threatened
- Alabama moccasinshell (*Medionidus acutissimus*) – threatened
- Coosa moccasinshell (*M. parvulus*) – endangered
- Southern pigtoe (*Pleurobema georgianum*) – endangered
- Southern clubshell (*P. decisum*) – endangered
- Triangular kidneyshell (*Ptychobranhus greenii*) – endangered

Many reaches in the Conasauga, Etowah, and Coosawattee basins that support listed fish and mussels drain an area less than 230 square miles, a size that places them in Labat Environmental's (2007) medium stream category (Table 2). During droughts, however, low flows in many reaches more closely approximate flows in Labat Environmental's (2007) small streams. For example, flows in Holly Creek, at the gage downstream of known listed fish and mussel habitat, were only 0.4 cfs in September 2000, with an average low monthly flow in October 2000 of 2.6 cfs. Lowest daily flows in the Conasauga and Etowah at the gages at Eton and Dawsonville, in the middle of most listed fish and mussel ranges in each basin, were only 16 and 30 cfs in September 2007. USGS gage data

indicate the lowest flows for most gaged streams in these basins typically occurred during the July-September fire season.

Table 7. Flow data at USGS gage stations within the range of listed aquatic species in the Chattahoochee and Cherokee National Forests, Georgia and Tennessee.

Basin	Drainage Area (mi ²)	Current Flow (cfs) (1/29/08)	Long-term Median flow (cfs)	Lowest Ave. Annual Flow (cfs)	Year	Lowest Ave. Monthly Flow (cfs)	Month/Year	Lowest Daily Flow (cfs) (est)	Date
Conasauga									
Holly Creek at Chatsworth	64	17	120	32.2	2007	2.6	Oct. 2000	0.4	Sept. 2000
Conasauga River at Eton	252	132	494	154.2	2007	34.7	Aug. 2007	16	Sept. 2007
Coosawattee									
Coosawattee River at Ellijay	236	120	571	207.4	1988	75.8	Sept. 2007	54	Sept. 2007
Etowah									
Etowah River near Dahlonega	69.7	64	New gage – data not available					21	Sept. 2007
Etowah River at 9 near Dawsonville	131	107	271	193.8	2006	86.8	Aug. 2006	30	Sept. 2002
Amicalola River near Dawsonville	89	89	211	136.3	1941	64.4	Aug. 2006	32	July 2007
Etowah River at Canton	613	334	1260	510.2	1986	135	Sept. 2007	80	Oct. 2002 2007

Since we had no data on dilution of fire retardants in medium streams, we based our effects analyses and jeopardy determinations on a worse-case scenario that assumed (1) fire retardants were not diluted and remained lethal to listed fish and mussels in medium streams and (2) multiple drops of retardant could occur in one or more headwater tributary streams to reaches with listed species, amplifying toxicity and increasing the length of downstream habitat where impacts would be expected (as described by Norris and Webb 1989). We used GIS mapping to determine the point on the mainstem Conasauga, Etowah, and Coosawattee Rivers, as well as major tributaries with listed species, where the upstream drainage basin exceeded 147,200 acres. Application of fire retardant to aquatic habitats within this upstream drainage basin was assumed to result in take of listed fish and mussels, and their eggs, larvae, and glochidea downstream from the entry site to the point where the stream was large enough to sufficiently dilute the retardant to reduce the threat of mortality (i.e., 147,200-acre drainage basin). GIS identified the vulnerable reaches as

- The Conasauga mainstem from the headwaters in the Chattahoochee Forest, through the Cherokee National Forest and private lands in Tennessee, to the confluence of Sumac Creek

in Georgia (total of 126,457-acre upstream drainage basin, before Sumac Creek's flows are added to the Conasauga River; Fig. 1).

- Holly Creek and tributaries in the Conasauga basin from the headwaters in the Chattahoochee National Forest to the confluence with the Conasauga River (total drainage area of 69,200 acres) (Fig. 1).
- The Etowah mainstem from the headwaters in the Chattahoochee National Forest in Georgia downstream to the confluence with Amicalola River, Dawson County (total of 114,062-acre upstream drainage basin, before Amicalola's flows are added to the Etowah River; Fig. 2).
- Amicalola River and tributaries in the Etowah Basin from the headwaters in the Chattahoochee National Forest to the confluence with the Etowah River (total drainage area of 62,595 acres) (Fig. 2)
- The Coosawattee basin from tributary headwaters in the Chattahoochee National Forest to the confluence of the Cartecay and Ellijay Rivers (Fig. 3).
- Mountaintown Creek from its headwaters in the Chattahoochee National Forest to its confluence with the Coosawattee River (Fig. 3).

There is reasonable expectation that application of fire retardants in these vulnerable reaches will:

- Kill, harm, or harass all listed mussel species in the Conasauga River mainstem between the application point and the mainstem's confluence with Sumac Creek
- kill, harm, or harass all listed mussel species in the Holly Creek system between the application point and the confluence with the Conasauga River;
- kill, harm, or harass listed mussel glochideal in the above areas;

Direct mortality of listed mussels is anticipated, as well as sub-lethal physiological responses that affect survival (harass). The fire retardants are likely to kill macroinvertebrate food items in the above areas and to kill host fishes for listed mussel species in the above areas, resulting in significant habitat degradation that affects foraging and breeding (harm). Extirpation of populations in areas of highest mortality may reduce species range in upstream areas that have natural or manmade dams, falls, or other knick points that prevent species recolonization.

Fig. 2. The shaded 12-digit HUCs in the Conasauga River and Holly Creek watersheds were considered vulnerable to fire retardant application on the National Forests (cross-hatched). The Conasauga mainstem basins are shaded light brown, and Holly Creek is shaded green. Other shaded basins are tributaries that contribute to flows in the Conasauga mainstem in the vulnerable reach.

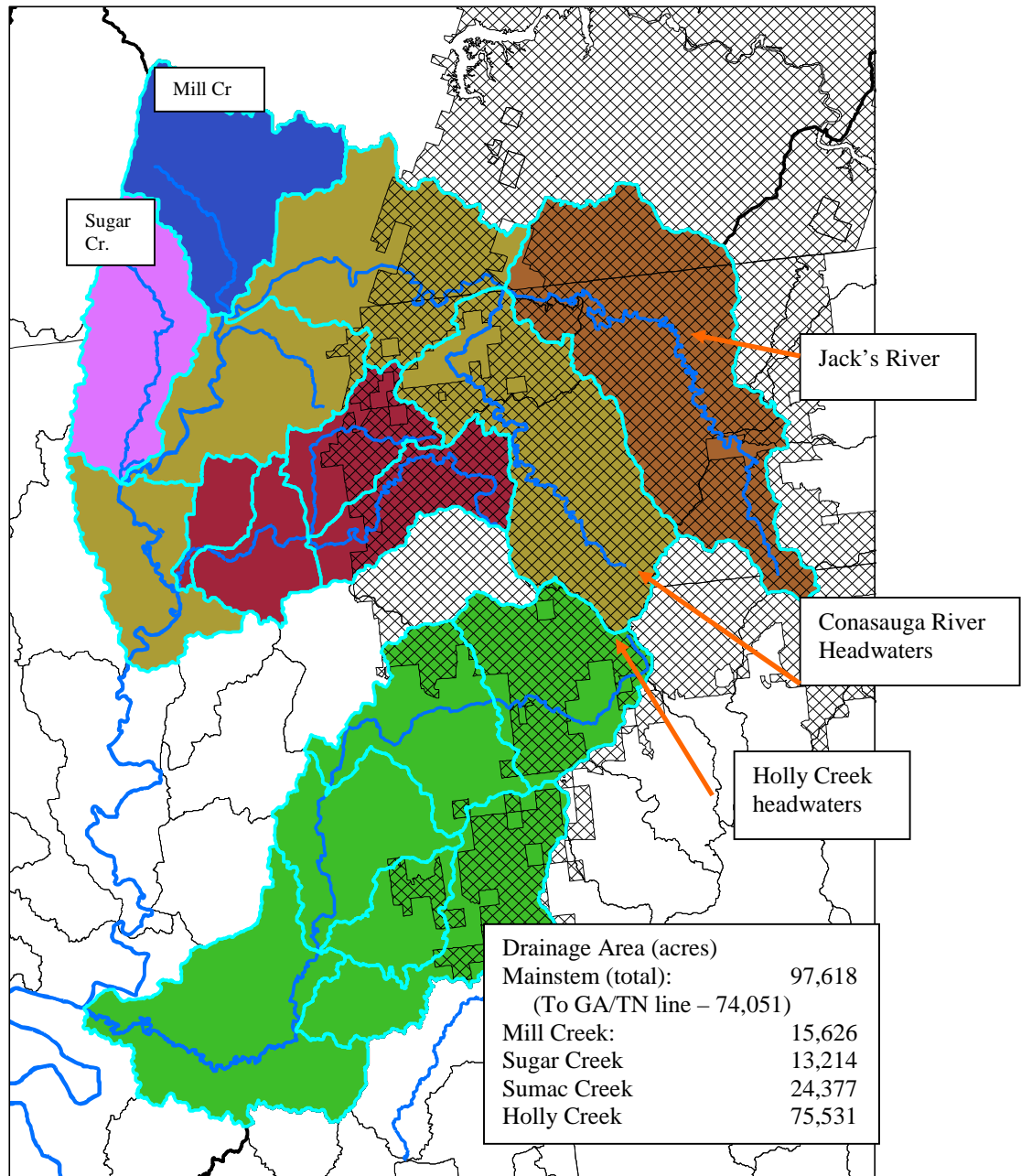


Fig. 3. The shaded 12-digit HUCS in the Etowah River (shaded red) and Amicalola River (shaded green) were considered vulnerable to fire retardant application on the National Forests (cross-hatched).

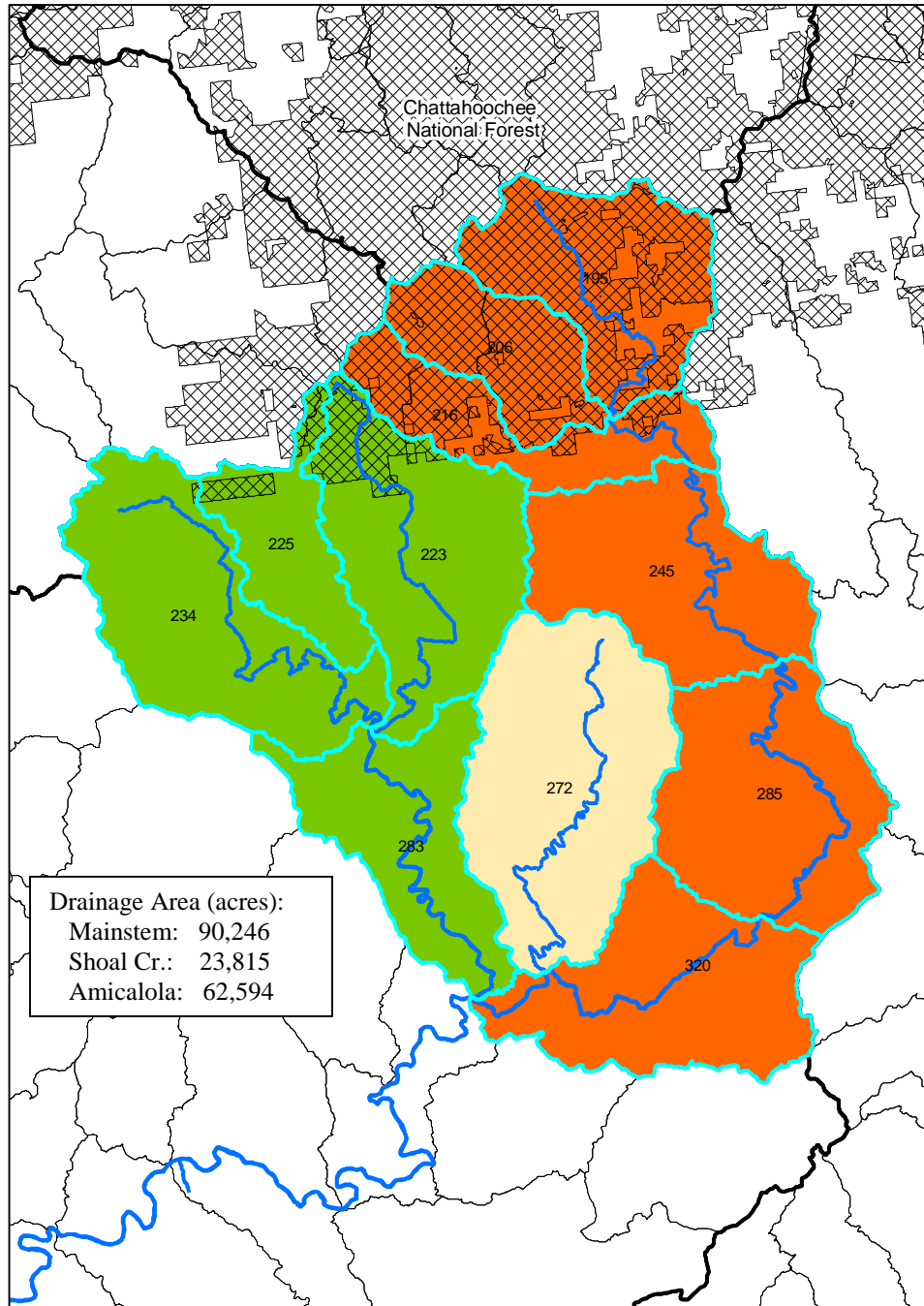
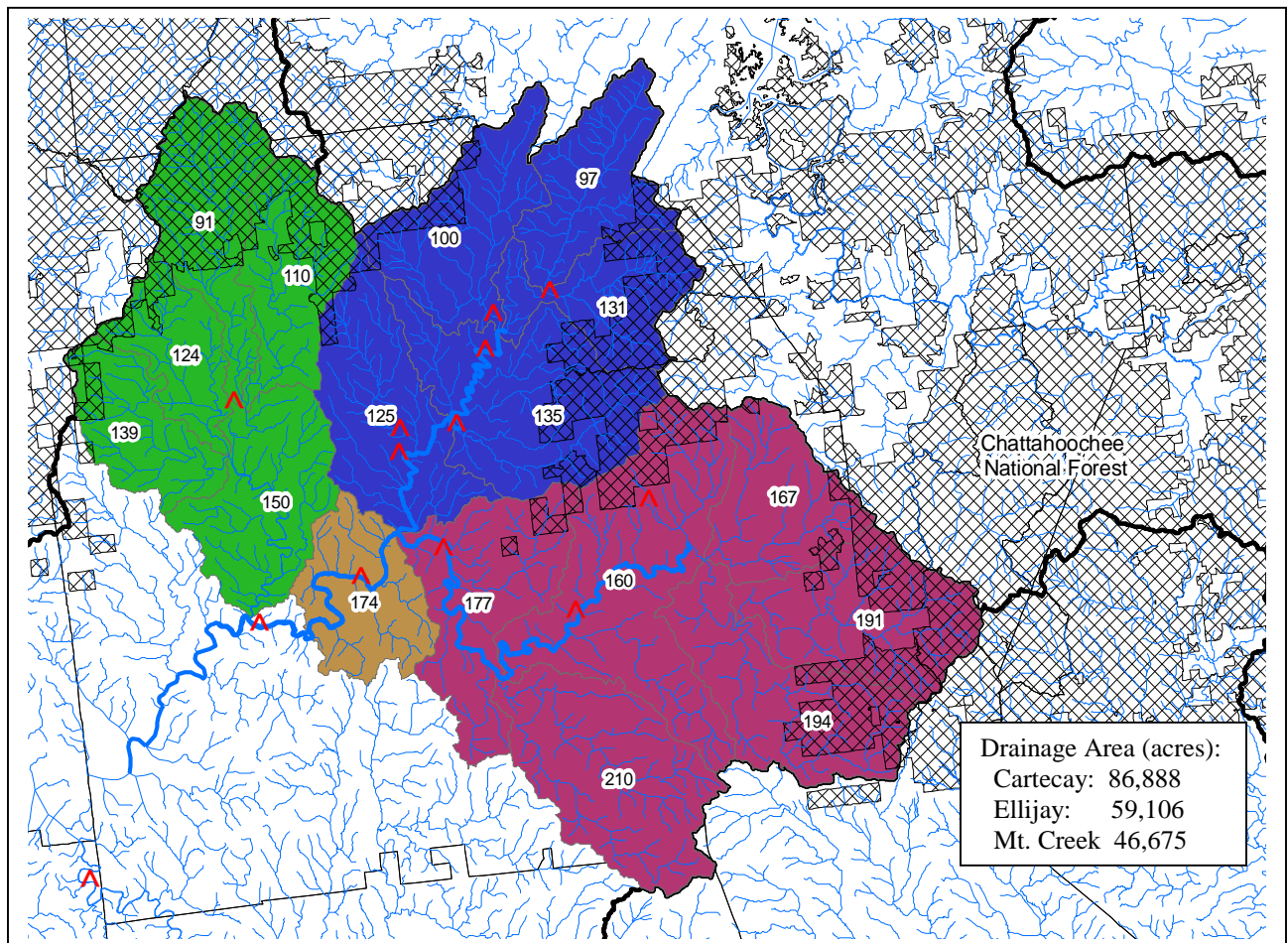


Fig. 4. The shaded 12-digit HUICS in the Cartecay River (red shading), Ellijay River (blue shading), and Mountaintown Creek (shaded green) watersheds were considered vulnerable to fire retardant application on the National Forests (cross-hatched). The brown area is the most upstream 12-digit HUC of the Coosawattee River, formed by the confluence of the Cartecay and Ellijay Rivers.



Several of the above listed species are also present in Alabama, and are included in the discussions below. Fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future. In addition, National Forests in Alabama lack air tanker facilities in the region, making it is very unlikely that fire retardants will ever be used in the vicinity of federally-listed species or any designated critical habitat (Dagmar Thurmond, USFS biologist, pers. comm. 2008).

Conclusion

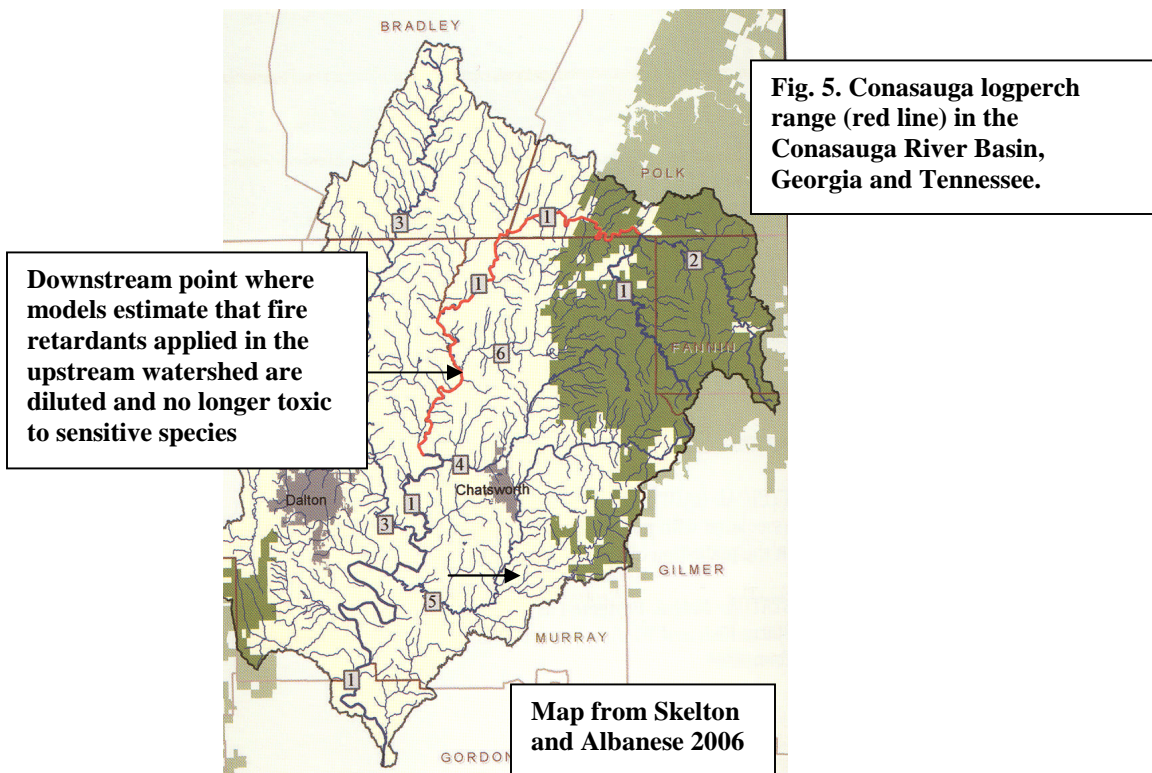
Jeopardy Determinations

After reviewing the current status of these species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is likely to jeopardize the continued existence of the Coosa moccasinshell, and southern pigtoe.

Coosa moccasinshell: The Coosa moccasinshell is known to occur only in the Conasauga River in Georgia and Tennessee and in Holly Creek. All other historical habitat is severely altered or isolated

by dams and impounded waters. Johnson et al. (2005) collected this species at only 2 of 7 survey sites in Holly Creek and 3 of 31 survey sites in the Conasauga River, all in Tennessee upstream of Wilsons Bend and the Ball Play Creek confluence, about a mile downstream of the Cherokee National Forest boundary. Records from 1998 and 1999 document Coosa moccasinshell at sites near Tennessee/Georgia state line, but Johnson et al. did not locate individuals during their survey 6 years later. In Alabama, the species is thought to have been extirpated from the Black Warrior river basin and other streams in Alabama and may only exist in headwater streams in Georgia and Tennessee. Mirarchi et. al (2004a) consider this species to be extirpated from Alabama. Talladega National Forest contains critical habitat for the Coosa moccasinshell.

The proposed action is expected to have little to no impact to the Coosa moccasinshell in Alabama. Because the Coosa moccasinshell is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the Coosa moccasinshell will be impacted by the proposed action. Similarly, it is very unlikely that fire retardants will ever be used in the vicinity of designated critical habitat on National Forest lands in Alabama. However, because of the status of this species in Georgia and Tennessee, the Service has determined jeopardy due to potential for application of fire retardant on the Chattahoochee or Cherokee National Forests in the headwaters of the Conasauga River or Holly Creek to extirpate one or both of the only populations of Coosa moccasinshell found during the most recent, comprehensive range-wide survey of the species.



Southern Pigtoe: The Southern pigtoe currently is known from the Conasauga River, Holly Creek, and four creeks in Alabama. Populations are rare, small and localized. Johnson et al. (2005) collected Southern pigtoe at the confluence of the Conasauga and Jacks Rivers at the Chattahoochee/Cherokee National Forest boundary and at the Minnewauga Creek confluence at the

western Cherokee National Forest boundary, as well as at other locations in Holly Creek and the mainstem Conasauga in Tennessee and Georgia. Warren et al. (2004) estimated the Shoal Creek population in Alabama consisted of 800 individuals in an isolated 9.7 km stream reach; this likely is the largest remaining population of the species. Within the Talladega National Forest, the mussel is found both in Shoal Creek, and downstream of the Forest on Hatchet Creek (Mirarchi, et. al 2004a). Mirarchi et. al (2004a) consider this species a Priority 1 species in Alabama's Comprehensive Wildlife Conservation Strategy, recognizing its relative rarity in Alabama. If fire retardants were ever to be used in proximity to the remaining populations of this mussel on the Talladega National Forest, impacts from fire retardant toxicity potentially could be significant because of the small number of mussels remaining. Talladega National Forest contains critical habitat for the southern pigtoe.

Since the National Forests in Alabama have not used fire retardant as part of their firefighting strategy in the past, and have written that they do not intend to do so in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008) because of the habitat types involved as well as the lack of air tanker facilities in the region, it is very unlikely that fire retardants will ever be used in the vicinity of the species or its designated critical habitat on National Forest lands.

However, application of fire retardant on the Chattahoochee or Cherokee National Forests in the headwaters of the Conasauga River could take all Southern pigtoe in a reach that extends over half the species' range in the mainstem. Release of these chemicals into tributaries of the Conasauga could have varying impact on Southern pigtoe populations, depending on where the tributary flows into the Conasauga. Application of retardant in Holly Creek or its tributaries could take all Southern pigtoe in the stream below the entry point, but would not affect mainstem populations.

The Service has determined jeopardy due to potential for retardant application on the Chattahoochee and/or Cherokee National Forests, in the headwaters of the Conasauga River, to (1) take the majority of one of only five known Southern pigtoe metapopulations and (2) reduce the species' genetic diversity due to likely loss of rare alleles in the metapopulation. Recolonization of habitat in the Conasauga River, if populations are extirpated due to retardant application may occur over time. Several shiners are host fish for this mussel (P. Johnson, as cited by Hartsfield 2006); data are not available on dispersal ability of these shiners, but Johnston (2000) found that the average distance moved by blue shiners over a two-year study was less than 430 feet. Dispersal may be limited by fish passage barriers in the Conasauga that we have not identified or that develop in the future.

Impacts to Critical Habitat:

Please refer to the critical habitat designations for the six listed mussel species (69 FR 40083) for detailed information about the status of critical habitat. Critical habitat has been designated for all six listed mussel species in the Conasauga River from Murray County Road 2 downstream to its confluence with the Coosawattee River; Holly Creek from the confluence with Rock Creek at Murray County Road 75 downstream to its confluence with the Conasauga River; and the Coosawattee River in Gordon County downstream to its confluence with the Conasauga River.

The primary constituent elements essential for the conservation of the species include those habitat components that support feeding, sheltering, reproduction, and physical features for maintaining the natural processes that support these habitat components. The primary constituent elements essential for the conservation of the southern clubshell (*Pleurobema decisum*), triangular kidneyshell (*Ptychobranhus greenii*), Alabama moccasinshell (*Medionidus acutissimus*), Coosa moccasinshell (*Medionidus parvulus*), southern pigtoe (*Pleurobema georgianum*), and fine-lined pocketbook (*Lampsilis altilis*) include: (i) Geomorphically stable stream and river channels and banks; (ii) A

flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of mussels and their fish hosts in the river environment; (iii) Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; (iv) Sand, gravel, and/or cobble substrates with low to moderate amounts of fine sediment, low amounts of attached filamentous algae, and other physical and chemical characteristics necessary for normal behavior, growth, and viability of all life stages; (v) Fish hosts, with adequate living, foraging, and spawning areas for them; and, (vi) Few or no competitive nonnative species present.

The fire retardants proposed for use would degrade water quality such that it is toxic to macroinvertebrates and other forage species for the host fish for the listed mussels. Application of these chemicals to vulnerable areas in Fig. 1, 2, or 3 will degrade the water quality necessary to support normal behavior, growth, and the viability of all life stages; and will kill fish hosts and temporarily eliminate living, foraging, and spawning areas supporting fish hosts. Effects to water quality, cobble habitat covered by *Podostemum*, and forage species could result in the extirpation of populations in areas of highest mortality and could diminish or eliminate the function and conservation role of the affected critical habitat.

After reviewing the current status of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is likely to destroy or adversely modify critical habitat for the fine-lined pocketbook, Alabama moccasinshell, Coosa moccasinshell, southern pigtoe, southern clubshell, and triangular kidneyshell.

Laguna Mountains Skipper

(Pyrgus ruralis lagunae)

Known only from a few localities in the Laguna Mountains and Palomar Mountain in eastern San Diego County, the skipper is highly vulnerable to potentially significant effects from fire retardant applications. Recent monitoring data indicate that only small numbers of individuals are thought to exist in those locales where the skipper is still extant. For example, surveys conducted almost annually in the Laguna Mountains have not detected skippers since 1999. Surveys conducted by the Service on Palomar Mountain in 2007 found less than a total of 100 individuals distributed in seven montane meadow systems, primarily along drier forest-meadow edges. The largest of these populations occurs on USFS lands, but all the others are vulnerable to retardant applications as well, since they are adjacent to USFS lands and would be covered under the mutual aid agreement between the State and Federal landowners in the area.

Based on the general effects of the action described above for plant species, a fire retardant drop would be expected to promote the spread or increase the density of non-native invasive plants, and potentially kill adults or larvae of the skipper due to physical or presumed deleterious physiological effects. Adults would be vulnerable during their second flight season from June through August, while larvae would be vulnerable then as well as in the fall. We do not anticipate that fires and use of retardants would occur prior to or during the first flight season—typically from late March through early June—coinciding with peak pupation. Since non-native plants are widely and densely distributed in skipper habitat, and are thought to limit the distribution and abundance of *Horkelia clevelandii*, the skipper's primary larval host plant, an increase in weed competition is likely to adversely affect the skipper.

The forests on Palomar Mountain have been subject to fire suppression practices for many decades and current forest conditions pose a severe fire danger. As a result, the USFS and other local, State agencies, along with the USFS, have begun a focused fuels reduction program to thin the overstocked forests on the mountain. However, funding levels have not been sufficient to treat more than a small percentage of the forest, and the overall fire risk is still considered high to extreme. One of the skipper populations on adjoining State Park lands partially burned and was subjected to retardant drops from the Poomacha Fire in fall 2006; monitoring this spring will help document any adverse effects. With (1) only seven skipper occurrences documented since 1999, all on or near intermixed USFS lands, and (2) mutual aid agreements in place to conduct interagency fire fighting programs on neighboring land ownerships, the loss or degradation of any of these occurrences due to an infestation of invasive non-native plants, or deleterious physiological effects of retardant on the various life stages of the skipper, would represent an appreciable reduction in the reproduction, numbers, and distribution of the Laguna Mountains skipper.

Conclusion

Due to the potential for these effects to arise from a fire retardant drop in the habitat of the skipper, we conclude that this activity would reduce appreciably the likelihood of the species' survival and recovery in the wild and is likely to jeopardize its continued existence.

Quino Checkerspot Butterfly

(Euphydryas editha quino)

The Recovery Plan for the Quino identifies six recovery units that contain one metapopulation for the species. Two of these recovery units are within or near either the Cleveland National Forest (CNF) or the San Bernardino National Forest (SBNF).

Quino is found in association with topographically diverse open woody canopy landscapes containing low to moderate levels of non-native vegetation compared to disturbed lands with higher non-native infestation levels, and is generally restricted to open grassland and sunny openings within open shrubland habitats. Within these areas, Quino may be preferentially selecting sites where exposure to winter sun is greatest. Female butterflies deposit eggs on plants located in full sun, preferably surrounded by bare ground or sparse, low vegetation. This butterfly is generally found at sites where high densities of the host plants occur. The FS will use open meadows or other sparsely vegetated areas as anchor points for retardant application; therefore, it is highly likely that Quino habitat will be subject to drops of fire retardant.

Data on the potential toxicity of fire retardants to larvae of sensitive invertebrates are lacking but presumed to be deleterious physiologically. Based on the general effects of the action described above for plant species, a fire retardant drop would be expected to promote the spread or increase the density of non-native invasive plants leading to invasion of non-native species and habitat degradation, known threats to several Quino populations. Further, retardant drops could potentially kill adults, larvae, and pupae of the Quino and reduce oviposition. Therefore, two of the known Quino metapopulations proximate to USFS lands would be vulnerable to retardant applications. The metapopulation occurring on the SBNF is critical to the recovery and distribution of the species as this population represents a range shift north and upward in elevation in response to climate change. This is seen as a benefit for the species as it is shifting out of the areas experiencing the most development and moving into National Forest lands where it has some protection from known threats.

Loss or degradation to these two populations of Quino represents an appreciable reduction in the reproduction, numbers, and distribution of Quino.

Conclusion

Due to the potential for these effects to arise from a fire retardant drop in the habitat of Quino, we conclude that this activity would reduce appreciably the likelihood of the species' survival and recovery in the wild and is likely to jeopardize its continued existence.

Proposed critical habitat occurs on the CNF and SBNF, Unit 6 and Unit 7 respectively (73 FR 3328). Based on the effects of the action for plants, as described above, fire retardant drops in these units can promote the spread or increase the density of non-native invasive plants. Therefore, these two critical habitat units, which represent 15 percent of Quino proposed critical habitat, may no longer be able to provide the primary constitute elements essential to the conservation of the species, resulting in the destruction or adverse modification of critical habitat.

Critical Habitat Adverse Modification

Laguna Mountains Skipper Designated Critical Habitat

Known only from a few localities in the Laguna Mountains and Palomar Mountain in eastern San Diego County, the skipper is highly vulnerable to potentially significant effects from fire retardant applications. Recent monitoring data indicate that only small numbers of individuals are thought to exist in those locales where the skipper is still extant. For example, surveys conducted almost annually in the Laguna Mountains have not detected skippers since 1999. Surveys conducted by the Service on Palomar Mountain in 2007 found less than a total of 100 individuals distributed in seven montane meadow systems, primarily along drier forest-meadow edges. The largest of these populations occurs on USFS lands, but all the others are vulnerable to retardant applications as well, since they are adjacent to USFS lands and would be covered under the mutual aid agreement between the State and Federal landowners in the area.

Based on the general effects of the action described above for plant species, a fire retardant drop would be expected to promote the spread or increase the density of non-native invasive plants, and potentially kill adults or larvae of the skipper due to physical or presumed deleterious physiological effects. Adults would be vulnerable during their second flight season from June through August, while larvae would be vulnerable then as well as in the fall. We do not anticipate that fires and use of retardants would occur prior to or during the first flight season—typically from late March through early June—coinciding with peak pupation. Since non-native plants are widely and densely distributed in skipper habitat, and are thought to limit the distribution and abundance of *Horkelia clevelandii*, the skipper's primary larval host plant, an increase in weed competition is likely to adversely affect the skipper.

The forests on Palomar Mountain have been subject to fire suppression practices for many decades and current forest conditions pose a severe fire danger. As a result, the USFS and other local, State agencies, along with the USFS, have begun a focused fuels reduction program to thin the overstocked forests on the mountain. However, funding levels have not been sufficient to treat more than a small percentage of the forest, and the overall fire risk is still considered high to extreme. One of the skipper populations on adjoining State Park lands partially burned and was subjected to retardant drops from the Poomacha Fire in fall 2006; monitoring this spring will help document any adverse effects. With (1) only seven skipper occurrences documented since 1999, all on or near intermixed

USFS lands, and (2) mutual aid agreements in place to conduct interagency fire fighting programs on neighboring land ownerships, the loss or degradation of any of these occurrences due to an infestation of invasive non-native plants, or deleterious physiological effects of retardant on the various life stages of the skipper, would represent an appreciable reduction in the reproduction, numbers, and distribution of the Laguna Mountains skipper.

Conclusion

Due to the potential for these effects to arise from a fire retardant drop in the habitat of the skipper, we conclude that this activity would likely significantly adversely affect the primary constituent elements needed to maintain extant skipper populations, and would thereby destroy or adversely modify designated critical habitat.

Quino Checkerspot Butterfly

(Euphydryas editha quino)

The Recovery Plan for the Quino identifies six recovery units that contain one metapopulation for the species. Two of these recovery units are within or near either the Cleveland National Forest (CNF) or the San Bernardino National Forest (SBNF).

Quino is found in association with topographically diverse open woody canopy landscapes containing low to moderate levels of non-native vegetation compared to disturbed lands with higher non-native infestation levels, and is generally restricted to open grassland and sunny openings within open shrubland habitats. Within these areas, Quino may be preferentially selecting sites where exposure to winter sun is greatest. Female butterflies deposit eggs on plants located in full sun, preferably surrounded by bare ground or sparse, low vegetation. This butterfly is generally found at sites where high densities of the host plants occur. The FS will use open meadows or other sparsely vegetated areas as anchor points for retardant application; therefore, it is highly likely that Quino habitat will be subject to drops of fire retardant.

Data on the potential toxicity of fire retardants to larvae of sensitive invertebrates are lacking but presumed to be deleterious physiologically. Based on the general effects of the action described above for plant species, a fire retardant drop would be expected to promote the spread or increase the density of non-native invasive plants leading to invasion of non-native species and habitat degradation, known threats to several Quino populations. Further, retardant drops could potentially kill adults, larvae, and pupae of the Quino and reduce oviposition. Therefore, two of the known Quino metapopulations proximate to USFS lands would be vulnerable to retardant applications. The metapopulation occurring on the SBNF is critical to the recovery and distribution of the species as this population represents a range shift north and upward in elevation in response to climate change. This is seen as a benefit for the species as it is shifting out of the areas experiencing the most development and moving into National Forest lands where it has some protection from known threats. Loss or degradation to these two populations of Quino represents an appreciable reduction in the reproduction, numbers, and distribution of Quino.

Proposed critical habitat occurs on the CNF and SBNF, Unit 6 and Unit 7 respectively (73 FR 3328). Based on the effects of the action for plants, as described above, fire retardant drops in these units can promote the spread or increase the density of non-native invasive plants. Therefore, these two critical habitat units, which represent 15 percent of Quino proposed critical habitat, may no longer be able to provide the primary constituent elements essential to the conservation of the species.

Conclusion

Due to the potential for these effects to arise from a fire retardant drop in designated critical habitat and significantly adversely affect the function of two units, we conclude that this activity will in the destruction or adverse modification of designated critical habitat.

Fishes

Little Colorado spinedace (*Lepidomeda vittata*)

Accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a waterway. Because site specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to spinedace occupied and critical habitat.

Currently there are a total of eight drainages within the East Clear Creek, Nutrioso (shared with private in-holding), and Chevelon Creek watersheds known to be occupied by spinedace, and 44 miles of critical habitat (with the majority on FS lands). There are an additional three occupied areas (one on Chevelon Creek and two on the Little Colorado River) within the range of the species. Based on available information, suitable habitat for the spinedace is characterized by clear, flowing pools with slow to moderate currents, moderate depths, and gravel substrates (Miller 1963, Minckley and Carufel 1967). As with most aquatic habitats in the southwest, the Little Colorado River basin contains a variety of aquatic habitat types and is prone to rather severe seasonal and yearly fluctuations in water quality and quantity. Severe seasonal fluctuation such as drought affects stream flow; therefore, typically within most of these drainages on FS land intermittent, perennial pools are the habitat occupied by spinedace populations. These factors play a significant role in determining potential adverse effects to the species from retardant drops.

To date there have been 27 formal consultations with actions affecting the spinedace. Of those, nine did not anticipate take; five anticipated take to a percentage of the population and/or number of individuals; and, thirteen anticipated take but concluded that it was not quantifiable and therefore surrogate measures were provided. Although take has been associated with projects on FS lands, on-going wildland fire use projects on the Apache-Sitgreaves and Coconino NFs are expected to reduce the potential for high-severity wildland fires and will likely reduce the extreme suppression actions that may require the use of retardants near occupied streams on these national forests.

Current status for occupied drainages on National Forest System lands is as follows:

Chevelon Creek: In July 2007, approximately 95 spinedace from the Chevelon Creek source population were stocked into five pools along West Chevelon Creek on the Apache-Sitgreaves National Forest. The spinedace continues to occupy a small section of Chevelon Creek on private property.

Nutrioso/Rudd Creeks: In spring 2005, Nutrioso and Rudd creeks were surveyed. A single spinedace was captured in Rudd Creek and a total of seven spinedace were in Nutrioso Creek upstream of Nelson Reservoir. No spinedace were found below the reservoir, but many fathead minnow and green sunfish were captured. Surveys conducted in April 2006 in Nutrioso Creek located 128 spinedace, upstream of Nelson Reservoir. The largest concentration of spinedace was

found on the EC Bar Ranch (private in-holding). No spinedace were located downstream of Nelson Reservoir (in Nutrioso Creek) or in Rudd Creek. However, in June 2006, AGFD located 415 spinedace in a drying pool in Nutrioso Creek that were moved into a more permanent pool on the EC Bar Ranch, and 74 spinedace in Rudd Creek.

East Clear Creek Watershed: Spinedace currently occupy habitat in West Leonard Canyon (two pools), Leonard Canyon (two pools, including Dines Tank), Bear Canyon, Dane Canyon, and Yeager Canyon (50 fish stocked in summer 2007). The populations are all relatively small, both in numbers and distribution, due to limited habitat.

In summary the status of the spinedace populations has decreased since 1993. The overall population currently consists of small, fragmented populations that are not all self-sustaining (i.e., fish are stocked and moved yearly). In addition, habitat loss and the continued expansion of nonnative species continue to threaten the existence of spinedace in currently occupied habitats.

Seven of the eleven populations are on Forest Service lands, and therefore may be subject to fire retardant drops during fire management activities conducted by the Forest Service. The Chevelon Creek population, located downstream of the Apache-Sitgreaves Forest on private land, and the AGFD properties on the Little Colorado River may also be impacted by actions implemented on FS land.

Effects of the Action

We believe that the proposed action is likely to adversely affect the spinedace for the following reasons:

- The information above outlines the potential adverse effects to aquatic species. The current status of the spinedace rangewide indicates it has a reduced ability to absorb additional adverse effects such as those that may occur with the proposed action. Spinedace are currently much reduced in distribution, and there are currently only eight occupied drainages on Forest Service lands and three additional locations off Forest Service lands. While the proposed action is only one action, the accumulation of various threats and previous actions has eroded the population baseline and placed the species at greater risk of extinction.
- The proposed action has the ability to eliminate or substantially affect one or more of the remaining populations. Eight of the remaining populations are within the proposed action area, as are two of three critical habitat units. Each of these populations is small, increasing the likelihood of extirpating a population should fire retardant enter the stream in which they occur.
- The proposed action has the ability to substantially affect those populations that are most needed for survival and recovery of the species. Only one of the populations on FS lands is currently considered self-sustaining (West Chevelon Creek), and that population occupies only a few pools. All eight of the populations that occur on FS lands, are likely to be in areas affected by forest fires, and potentially by application of retardant.
- The life of the proposed action has not been defined, so direct or cumulative impacts from the action may occur over a long period of time, increasing the likelihood for adverse effects to be felt by the populations on Forest Service lands.

- The proposed action area includes lands known to be at high-risk for high-severity fire per LANDFIRE maps and current FS NEPA decisions (e.g., East Clear Creek Watershed Health Project, Nutrioso Fuels Reduction Project, Eager Fuels Reduction Project). From 1983 to 2006, there were a total of 4,103 fire starts in the watersheds surrounding occupied spinedace habitat. Of those, 22 fires were greater than 100 acres in size. Seven of those occurred within 1.0 mile of occupied streams.

Critical Habitat

We believe the proposed action is likely to adversely affect critical habitat as well. The primary constituent element for spinedace critical habitat is clean, permanent, flowing water with pools and a fine gravel or silt-mud substrate. Introduction of retardant would adversely affect the water quality and would make the critical habitat less suitable, and potentially lethal, for spinedace.

It is also important to note that, should retardant be applied, it is because of a fire, typically high-severity, in the area. The effects of that fire, while not under consultation here, would compound adverse effects to habitat. Loss of vegetation and soil to burning could result in increased ash and sediment inputs to the stream, as well as increased water temperatures, all of which affect the primary constituent elements for the various life stages (i.e., adult, juvenile, larval) of spinedace. Cumulatively, the impacts of the retardant and the fire activity could be catastrophic and result in extirpation of a population or portions of a population within the fire area.

Conclusion

After reviewing the current status of spinedace, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is likely to jeopardize the continued existence of spinedace but is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

Spinedace

1. The proposed action does not have a timeframe and the species is currently experiencing numerous threats including ongoing drought conditions;
2. Direct (accidental delivery, drift, run-off) application of fire retardant to any one spinedace population on FS lands would likely eliminate the affected population;
3. At this time, only one of the populations on FS lands (West Chevelon Creek) is considered self-sustaining, and the entire species is at great risk of extinction.

Spinedace Critical Habitat

1. The environmental persistence of the Phos-Chek chemicals will cause short-term adverse effects to the aquatic environment; however, the effects will dissipate over time and will not render the affected area unsuitable for spinedace establishment in the future.

Spikedace (*Meda fulgida*)

As described above in the general effects discussion for Arizona native fish species accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a

waterway. Because site specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to spikedace occupied and critical habitat.

Spikedace remain in limited portions of the upper Verde and upper Gila rivers and Aravaipa and Eagle creeks in Arizona and New Mexico (Barber and Minckley 1966, Minckley 1973, Anderson 1978, Marsh *et al.* 1990, Sublette *et al.* 1990, Jakle 1992, Knowles 1994, Rinne 1999). Critical habitat for spikedace includes portions of the upper Verde, lower Gila, lower San Pedro, and upper Gila rivers, portions of the West, Middle, and East forks of the Gila River, and Aravaipa and Eagle creeks.

Spikedace are considered to occur in five populations: Aravaipa Creek, Eagle Creek, and the Verde River in Arizona, and the Upper Gila and Gila Forks populations in New Mexico. They are common only in Aravaipa Creek and the Upper Gila River. There are small spikedace populations in the Verde River, Eagle Creek, and the three forks of the Gila River. These populations are already at risk, with decreasing spikedace detections over time. The last detections for spikedace in each of these systems was 1999 for the Verde River; 1989 for Eagle Creek; 2005 for the West Fork Gila River; 1995 for the Middle Fork Gila River; and 2000 for the East Fork Gila River.

With the exception of Aravaipa Creek, each of the five spikedace populations occurs at least in part on Forest Service lands. The upper Verde River population occurs almost entirely on the Prescott and Coconino national forests. The Eagle Creek population occurs in part on the Apache-Sitgreaves National Forest, with Eagle Creek meandering back and forth across the boundary between the Apache-Sitgreaves National Forest and the San Carlos Apache Tribal lands. The Upper Gila population is centered on one portion of the Gila National Forest, while the West, Middle, and East forks of the Gila River occur entirely within its boundaries. In summary, the status of spikedace is declining rangewide. Four of the five remaining populations are on Forest Service lands, and therefore may be subject to fire retardant drops during fire management activities conducted by the Forest Service.

Critical habitat for spikedace includes portions of the Verde River, upper Gila River, and Aravaipa Creek. As with loach spikedace populations, the majority of critical habitat (all except Aravaipa Creek, the lower Gila River, and the lower San Pedro River) occurs on Forest Service lands.

Effects of the Action

We believe that the proposed action is likely to adversely affect the spikedace for the following reasons:

- The information above outlines the potential adverse effects to aquatic species. The baseline of spikedace indicates it has a reduced ability to absorb additional adverse effects such as those that may occur with the proposed action. Spikedace are currently much reduced in distribution, occupying approximately 10 to 15 percent of its historical range, and there are only five remaining populations, of which three have small, declining populations. The accumulation of various threats and previous actions has eroded the species' baseline and placed the species at greater risk of extinction. Other threats to the species, including the spread of invasive aquatic species, drought, and wildfire have already impacted the species, and are ongoing.

- The proposed action has the ability to substantially affect large portions of the remaining populations. Four of the five remaining populations occur all or in part within the proposed action area, as are all critical habitat complexes except for Aravaipa Creek, the lower Gila River, and the lower San Pedro River.
- The proposed action has the ability to substantially affect the Upper Gila population, which is the largest remaining population of spikedace. In addition, three at-risk populations (Gila Forks, Eagle Creek, and Verde River) are also likely to be adversely affected by the proposed action.
- The life of the proposed action has not been defined, so impacts from the action may occur over a long period of time, increasing the likelihood for adverse effects to be felt by the populations on Forest Service lands.
- Efforts at captive propagation have not yet met with success. While captive propagation is being attempted, the success of this recovery effort is not yet known. The ability to recover the species may well rest on captive propagation and reintroduction efforts. The primary sources of fish stock for those efforts is in the Upper Gila River and Aravaipa Creek populations, of which the Upper Gila is within the proposed action area. Should that population be adversely affected, recovery of the species will be severely curtailed.
- The proposed action area includes lands known to incur substantial wildfire activity during the fire season each year, as follows:

Population	No. Fires 100+ acres in size on Forest Service lands between 1980 and 2006	No. Fires 100+ Acres in Size on Forest Service Lands Within 1.0 Mile of a Population Stream
Eagle Creek	11	1
Gila River Forks	10	0
Verde River	3	0
Upper Gila River	122	19
TOTALS	146	20

Numerous fires have occurred within the watersheds of Aravaipa Creek, the lower Gila River, and the lower San Pedro River; however, these areas are not on Forest Service lands and therefore not part of this consultation.

Critical Habitat

We believe the proposed action is likely to adversely affect critical habitat. The first primary constituent element for spikedace critical habitat is permanent, flowing water with no or minimal pollutant levels. Introduction of retardant would adversely affect this constituent element and, as described above, would make the critical habitat less suitable, and potentially lethal, for spikedace. We anticipate these effects to be short-term in nature.

In addition to water quality, application of retardant could affect the prey base for spikedace. Primary constituent element 3 notes that spikedace require an abundant aquatic insect food base. Spikedace are insectivores that obtain their food at the surface and within the water column of the stream (Barber and Minckley 1983). Spikedace are highly dependent on aquatic insects, with mayflies, caddisflies, true flies, stoneflies, and dragonflies constituting the bulk of their diet (Propst et al. 1986, Anderson 1978, Schreiber 1978). Mayflies, which constituted the largest percentage of prey items for spikedace, spend their immature stages in fresh water, and therefore may also be adversely affected by retardant. Considering the toxicity studies of Phos-Chek to algae and benthic macroinvertebrates were shown to have adverse effects to primary producers and aquatic invertebrates (MacDonald et al. 1995), were lethal to 50 percent of mayflies (Poulton et al. 1997), and the toxicity of field applications are likely higher than the lab studies (for accidental retardant delivery); the application of retardants to spikedace critical habitat will likely alter the biodiversity and trophic dynamics in the stream and will result in short-term adverse effects to the food base for spikedace.

It is also important to note that, should retardant be applied, it is because of a fire in the area. The effects of that fire, while not under consultation here, would compound adverse effects to habitat. Loss of vegetation to burning could result in increased ash and sediment inputs to the stream, as well as increased water temperatures, all of which effect the primary constituent elements for the various life stages (i.e., adult, juvenile, larval) of spikedace. Cumulatively, the impacts of the retardant and the fire activity could be catastrophic and result in extirpation of a population or portions of a population within the fire area.

Conclusion

After reviewing the current status of the spikedace, the environmental baseline for the action area, the effects of the proposed application of fire retardants on Forest Service managed lands, it is our biological opinion that the action, as proposed, is likely to jeopardize the continued existence of the spikedace. As noted above, there are five remaining spikedace populations, with two of those considered stable. Of those two, the Gila River population is on Forest Service lands. Because the Gila River population represents one of two remaining, stable populations for the entire species, loss of all or part of this population would significantly reduce the likelihood that the species will survive. In addition, the Gila River population serves as one of two source populations for future recovery actions, so loss of all or a part of the population would significantly reduce the likelihood of recovery of the species.

With respect to critical habitat, we anticipate that application of retardant, through accidental placement in the stream, drift, or surface runoff could adversely affect primarily constituent elements of that habitat, including water quality and prey base. However, we anticipate that such an effect, while having serious ramifications to the individual fish affected, would have a short-term, non-permanent effect on the habitat itself. Approximately 180 miles of critical habitat were designated along the Gila River, Verde River, and three forks area, with a total of 260 miles designated overall. We anticipate that adverse effects would be somewhat localized and of short duration, and would therefore not appreciably diminish the value of critical habitat for spikedace. Therefore, we conclude that the proposed action does not rise to the level of adverse modification.

Sonora chub (*Gila ditaenia*)

As described above in the general effects discussion for Arizona native fish species accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a waterway. Because site specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to Sonora chub occupied and critical habitat.

All waters occupied by this species in the U.S. are within the Coronado NF. The majority of the extant range and habitat of the Sonora chub in the U.S. occurs in Sycamore/Penasco canyons. Flow within the occupied portion of Sycamore Canyon is intermittent except during the rainy season. The species also occurs in California Gulch, this population is considered ephemeral. The limited distribution of Sonora chub in the U.S. places inordinate importance on the quality of habitat in Sycamore Creek (U.S. Fish and Wildlife Service 1992:14) and California Gulch. Retardants introduced into Sycamore Creek or California Gulch would adversely affect the quality of pool habitat and/or flowing portions of the streams.

The Sycamore drainage has been highly modified by human activities, including grazing, mining, recreation, and the introduction of exotic taxa. It regularly sustains large floods and severe droughts. Sonora chub in California Gulch have gone through periods of drought and recolonization after dispersal from permanent pools. Recolonization is dependent on individuals that survive dry periods. This species has an amazing capacity for reproduction and recruitment as its habitat expands; it can seemingly explode from a small number of individuals occupying newly-wetted habitats in just a few weeks or months. According to the 1992 recovery plan for this species, distribution of Sonora chub in the U.S. is intact and should remain secure, barring major environmental change (C.O. Minckley 1983, Minckley 1985). A series of environmental perturbations, such as retardant drops, made worse by degraded watershed conditions (by human activities, grazing, mining, etc.) could cumulatively result in extirpation of the species from the U.S. These factors play a significant role in determining potential adverse effects to the species from retardant drops.

Effects of the Action

We believe that the proposed action is likely to adversely affect the U.S. population of Sonora chub for the following reasons:

- The information above outlines the potential adverse effects to aquatic species. The baseline of Sonora chub indicates it has a reduced ability to absorb additional adverse effects such as those that may occur with the proposed action. Sonora chub are currently much reduced in distribution, and there are only two remaining populations in the U.S. While the proposed action is only one action, the accumulation of various threats and previous actions has eroded the population baseline and placed the species at greater risk of extinction.
- The proposed action has the ability to eliminate or substantially affect one or more of the remaining populations. Both populations are within the proposed action area, as are all critical habitat complexes.
- Both populations occur on FS lands, are vulnerable to forest fires, and potentially by application of retardant. Fire retardant has the ability to substantially affect the small streams where the species persist in the U.S.
- The life of the proposed action has not been defined, so direct or cumulative impacts from the

action may occur over a long period of time, increasing the likelihood for adverse effects to be felt by the populations on Forest Service lands.

- The proposed action area includes lands known to incur wildfire activity during the fire season. To date, five fires larger than 100 acres on FS lands occurred within the watershed for Sycamore Creek and California Gulch. Two were within a one mile buffer of the streams occupied by the fish and another just outside the buffer.

Critical Habitat

We believe the proposed action is likely to adversely affect critical habitat as well. Primary constituent elements were not identified in the 1986 Final Rule. However, habitat characteristics important to Sonora chub include clean permanent water with pools and intermediate riffle areas and/or intermittent pools maintained by bedrock or by subsurface flow in areas shaded by canyon walls. Introduction of retardant would adversely affect the water quality and would make the habitat less suitable, and potentially lethal, for Sonora chub in the U.S.

It is also important to note that, should retardant be applied, it is because of a fire in the area. The effects of that fire, while not under consultation here, would compound adverse effects to habitat. Loss of vegetation to burning could result in increased ash and sediment inputs to the stream, as well as increased water temperatures, all of which affect the primary constituent elements for the various life stages (i.e., adult, juvenile, larval) of Sonora chub. Cumulatively, the impacts of the retardant and the fire activity could be catastrophic and result in extirpation of a population or portions of a population within the fire area.

Conclusion

After reviewing the current status of the Sonora chub, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's biological opinion that the proposed action is likely to jeopardize the continued existence of the U.S. population of Sonora chub, but is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

Sonora chub

1. The proposed action does not have a timeframe;
2. Direct (accidental delivery, drift, run-off) application of fire retardant to Sonora chub located in a permanent pool (during severe drought conditions) would significantly reduce the survival and recovery of the species;
3. There are only two remaining populations in the U.S., both in a reduced state, susceptible to numerous stressors, and vulnerable to extinction.

Sonora chub Critical Habitat

1. The environmental persistence of the Phos-Chek chemicals will cause short-term adverse effects to the aquatic environment; however, the effects will dissipate over time and will not render the affected area unsuitable for Sonora chub establishment in the future.

Loach minnow (*Tiaroga cobitis*)

Loach minnow remains in limited portions of the upper Gila, San Francisco, Blue, Black, and White rivers and Aravaipa Creek and Eagle creeks in Arizona and New Mexico (Barber and Minckley 1966, Silvey and Thompson 1978, Propst *et al.* 1985, Propst *et al.* 1988, Marsh *et al.* 1990, Bagley *et al.* 1995, USBLM 1995, Bagley *et al.* 1996).

Loach minnow are common only in Aravaipa Creek and the Blue River and some tributary streams in Arizona, and in limited portions of the San Francisco, upper Gila, and some tributary streams rivers in New Mexico (U.S. Fish and Wildlife Service 2000). With the exception of Aravaipa Creek, each of these populations occurs almost entirely on Forest Service lands on the Apache-Sitgreaves (Blue River, lower San Francisco River) or Gila (upper San Francisco and upper Gila rivers) National Forests, or on small private inholdings within the Forests' boundaries.

There is a small loach minnow population in Eagle Creek, which occurs in part on the Apache-Sitgreaves National Forest. This population is already at risk, with the last loach minnow detection from 1997. There is an additional, small population in the East Fork Black and North Fork East Fork Black rivers and tributary Boneyard Creek, all of which are entirely within the Apache-Sitgreaves National Forest. This population is also at risk, with detections last occurring in 2004 for East Fork Black and the North Fork East Fork Black, and 1996 for Boneyard Creek. An additional population occurs within the Fort Apache Indian Reservation. The status of that population is unknown at this time.

In summary, the status of loach minnow is declining rangewide. Six of the eight remaining populations are on Forest Service lands, and therefore may be subject to fire retardant drops during fire management activities conducted by the Forest Service. As recently as 2004, fire retardant was used on the Three Forks Fire, with retardant entering the East Fork Black and North Fork East Fork Black River system in 2004.

Critical habitat for loach minnow includes portions of the Black, middle Gila, San Francisco, Blue, and upper Gila rivers and Eagle and Aravaipa creeks, and several tributaries of those streams. As with loach minnow populations, the majority of critical habitat (all except Aravaipa Creek) occurs on Forest Service lands.

Effects of the Action

We believe that the proposed action is likely to adversely affect the loach minnow for the following reasons:

- The information above outlines the potential adverse effects to aquatic species. The baseline of loach minnow indicates it has a reduced ability to absorb additional adverse effects such as those that may occur with the proposed action. Loach minnow are currently much reduced in distribution, occupying approximately 15 to 20 percent of its historical range, and there are only eight remaining populations. While the proposed action is only one action, the accumulation of various threats and previous actions has eroded the population baseline and placed the species at greater risk of extinction.
- The proposed action has the ability to substantially affect large portions of the remaining populations. Six of the eight remaining populations are within the proposed action area, as are all critical habitat complexes except for Aravaipa Creek.

- The proposed action has the ability to substantially affect those populations that are most needed for survival and recovery of the species. There are only four populations that are considered to be common or stable (Aravaipa Creek, Blue River, Gila River, San Francisco River). Three of these populations, or 75% of the remaining fish in stable populations, are on Forest Service lands, and are likely to be in areas affected by forest fires, and potentially by application of retardant.
- The life of the proposed action has not been defined, so impacts from the action may occur over a long period of time, increasing the likelihood for adverse effects to be felt by the populations on Forest Service lands.
- The proposed action area includes lands known to incur substantial wildfire activity during the fire season each year, as follows:

Population	No. Fires 100+ acres in size on Forest Service lands between 1980 and 2006	No. Fires 100+ Acres in Size on Forest Service Lands Within 1.0 Mile of a Population Stream
Blue, San Francisco, and Tularosa rivers	41 in Arizona 55 in New Mexico	3 in Arizona 2 in New Mexico
Eagle Creek	11	1
East Fork and North Fork East Fork Black River	11	1
Upper Gila River	122	19
Three Forks Gila River	10	0
TOTALS	250	26

Numerous fires have occurred within the watersheds of Aravaipa Creek, the lower Gila River, and the lower San Pedro River; however, these areas are not on Forest Service lands and therefore not part of this consultation.

Critical Habitat

We believe the proposed action is likely to adversely affect critical habitat as well. The first primary constituent element for loach minnow critical habitat is permanent, flowing water with no or minimal pollutant levels. Introduction of retardant would adversely affect this constituent element and, as described above, would make the critical habitat less suitable, and potentially lethal, for loach minnow.

In addition to water quality, application of retardant could affect the prey base for loach minnow. Primary constituent element 3 notes that loach minnow require an abundant aquatic insect food base. Loach minnow are opportunistic insectivores that obtain their food from riffle-dwelling larval mayflies, black flies, and true flies, as well as from larvae of other aquatic insect groups such as caddisflies and stoneflies (Propst et al. 1988, Propst and Bestgen 1991). Considering the toxicity studies of Phos-Chek to algae and benthic macroinvertebrates were shown to have adverse effects to primary producers and aquatic invertebrates (MacDonald et al. 1995), were lethal to 50 percent of mayflies (Poulton et al. 1997), and the toxicity of field applications are likely higher than the lab

studies (for accidental retardant delivery); the application of retardants to loach minnow critical habitat will likely alter the biodiversity and trophic dynamics in the stream and will result in short-term adverse effects to the food base for loach minnow.

It is also important to note that, should retardant be applied, it is because of a fire in the area. The effects of that fire, while not under consultation here, would compound adverse effects to habitat. Loss of vegetation to burning could result in increased ash and sediment inputs to the stream, as well as increased water temperatures, all of which effect the primary constituent elements for the various life stages (i.e., adult, juvenile, larval) of loach minnow. Cumulatively, the impacts of the retardant and the fire activity could be catastrophic and result in extirpation of a population or portions of a population within the fire area.

Conclusion

After reviewing the current status of the loach minnow, the environmental baseline for the action area, and the effects of the proposed application of fire retardants on Forest Service managed lands, it is our biological opinion that the action, as proposed, is likely to jeopardize the continued existence of the loach minnow. As noted above, there are eight remaining loach minnow populations, with four of those considered stable. Of those four, the Gila, San Francisco, and Blue River populations are on Forest Service lands. Because these populations represent three of the four remaining, stable populations for the entire species, loss of all or part of these populations would significantly reduce the likelihood that the species will survive. In addition, the Gila River population serves as one of two primary source populations for future recovery actions, so loss of all or a part of the population would significantly reduce the likelihood of recovery of the species.

With respect to critical habitat, we anticipate that application of retardant, through accidental placement in the stream, drift, or surface runoff could adversely affect primarily constituent elements of that habitat, including water quality and prey base. However, we anticipate that such an effect, while having serious ramifications to the individual fish affected, would have a short-term, non-permanent effect on the habitat itself. Approximately 423 miles of critical habitat were designated for loach minnow. We anticipate that adverse effects would be somewhat localized and of short duration, and would therefore not appreciably diminish the value of critical habitat for spikedace. Therefore, we conclude that the proposed action does not rise to the level of adverse modification.

Blue shiner (*Cyprinella caerulea*) – threatened

Etowah darter (*Etheostoma etowahae*) – endangered

Cherokee darter (*E. scotti*) - threatened

Amber darter (*Percina antesella*) – endangered

Goldline darter (*P. aurolineata*) – threatened

Conasauga logperch (*Percina jenkinsi*) – endangered

Effects of the Action

Effects of Long-term Fire Retardants on Aquatic Species

The US Forest Service (USFS) lists eight long-term fire retardants as approved for use in fighting wildland fires:

Phos-Chek D75-R

Phos-Chek 259-R

Phos-Chek D75-F

Phos-Chek 259-F

Phos-Chek G75-F

Phos-Chek LV-R

These products are supplied as either dry or wet concentrates and contain ammonium salts as the active fire retardant ingredient (from 7.6 to 11.3 percent of the individual product). These products also contain some or all of the following ingredients: gum thickeners, viscosity stabilizers, bactericides, corrosion inhibitors, and coloring agents (www.PhosChek.com 2008).

Normal use of these fire retardants involves mixing the concentrate with water (1.12 lb/gal to 1.60 lb/gal for the dry concentrates and 3.6:1 to 5.5:1 for the wet concentrates) (www.PhosChek.com 2008) and applying the retardant mixture ahead of a fire via fixed-wing airtanker (400 to 3,600 gallon capacity), helicopter (100 to 3,000 gallon capacity), or ground apparatus. Application rates vary from 1 to >6 gallons of mixed retardant per 100 ft² (435 to 2,600 gallons per acre) depending on vegetation type and other conditions (Labat Environmental 2007).

The primary environmental hazard associated with the use of these fire retardants is the toxicity of ammonia to aquatic organisms (Buhl and Hamilton 1998, 2000). The ammonium salts in fire retardants readily dissolve in water and form two chemical species, NH₃ (considered the most toxic form) and NH₄⁺. The chemical equilibrium of the two forms is highly dependant on pH and, to a lesser extent, temperature of the receiving water body, with higher pH and temperature causing a higher proportion of total ammonia forming the toxic NH₃ (USEPA 1999). Because of these and other factors, direct comparisons of ammonia toxicity data is problematic and must be done with care.

Several scientific studies assess the aquatic toxicity of ammonia-based fire retardants, including three approved for use by the USFS: Phos-Chek D75-F, D75-R, and 259-F; the other five approved compounds have not been tested. The studies show the LC₅₀ (the concentration that causes mortality to 50 percent of the test organisms) for rainbow trout (*Oncorhynchus mykiss*) ranges from 102 to 237 mg/L (24 to 96 hour exposure scenarios). The most sensitive life stage tested was swim-up fry exposed to 102 mg/L Phos-Chek 259-F for 24 hours (Labat Environmental 2007).

Sublethal effects of fire retardants on aquatic species have not been studied; however, low-level concentrations of ammonia are known to cause various physiological responses in fish and freshwater mussels. Responses may include loss of equilibrium, increased respiratory activity and heart rate, reduction in growth rate, and increased susceptibility to disease, among others (Wang *et al.* 2007a, 2007b; Wicks 2002; Shingles, *et al.* 2001; Carballo 1995).

The potential for mortality due to introduction of an approved fire retardant into an aquatic system is difficult to predict, but factors to consider include:

- Sensitivity of the resident organisms: Aquatic species differ in their sensitivity to ammonia. Coldwater fish, especially the salmonids, darters (genus *Etheostoma*), and shiners (genus *Notropis*) are highly sensitive to ammonia (USEPA 1999). Certain freshwater mussels are also very intolerant of ammonia exposure (Augsberger *et al.* 2003). Early life stages (swim-up fry for trout and glochidia for mussels) are typically the most sensitive to ammonia.
- Quantity of retardant introduced into the stream: All things being equal, a higher concentration of fire retardant in a stream will cause higher mortality over a larger area.
- Stream flow: Larger streams with higher flows have greater capacity for diluting a given amount of fire retardant and lessening the potential for toxicity.
- Ambient water quality: The potential for toxicity increases with higher pH, lower dissolved oxygen, higher temperature, and higher nitrogen loading of the receiving water.

- Stream morphology: Assuming similar flows, a narrow, deep stream will likely have a shorter zone of mortality than a broad, shallow stream. Additionally, streams with smooth, straight channels are likely to have longer mortality zones than those with many riffles and pools, which tend to cause the peak concentration to mix and spread out (Norris, et al. 1983).
- Vegetative cover: Dense canopy cover may reduce or slow the deposition of air-dropped fire retardants into the underlying water.

In 2007, the USFS funded an ecological risk assessment to examine the effects of wildland fire retardants on terrestrial and aquatic species (Labat Environmental 2007). Seven of the eight approved fire retardants were reviewed (Phos-Chek LC-95A-R is a new product and was not included). Several different exposure scenarios were modeled to assess risk to aquatic species: risk from runoff, risk from accidental application across a stream, and risk from an accidental spill into a stream. Streams were described as either small (6,400 acre drainage basin, 12cfs flow) or large (147,200-acre drainage, 350cfs flow). For this report, risk was defined as “the identified exposure level [that] could be associated with loss of at least half of a local population of non-sensitive species or puts individual animals of sensitive species at risk of mortality” (Labat Environmental 2007).






Models indicated that all seven of the approved fire retardants assessed for the USFS posed a risk to sensitive (e.g., threatened and endangered) aquatic species if they are applied across a small stream. The risk assessment also determined that significant risk existed if any of the retardants were accidentally spilled into a small or large stream (assumed spill volumes included a 2,000-gal tank of mixed, diluted retardant). Toxicity and dilution of fire retardants in medium streams (6400-147,200-acre drainage basin [10-230 square miles] and 12-350 cfs flow) were not evaluated.

Earlier studies by Norris and Webb (1989) documented the downstream affects of aerial retardant application in aquatic systems; their simulations of retardant dispersal in streams 2.4-31-feet wide showed fish mortality associated with a 2114-gallon drop of fire retardant might occur more than 6.2 miles below the point of chemical entry, depending on

- Orientation of the line of flight to the stream,
- Size of load dropped and number of loads dropped on the same stream,
- Timing and placement of subsequent loads relative to the first load,
- Site characteristics, including stream shape and vegetative canopy, and
- Stream flow characteristics.

Equipment currently used in fire operations may carry over 3000 gallons of retardant, or 50% more than the amount of retardant used in Norris and Webb’s (1988) simulations.

Table 8. Fish mortality related to orientation of stream relative to the aerial drop of fire retardants and to amount of retardant dropped. A standard drop was defined as 4000 liters (from Norris and Webb 1988).

Application zone and stream direction	Angle between long axis zone and stream ¹	Distance over which 100 pct mortality occurs	
		Standard drop	Standard drop times two
	90	50	480
	67.5	50	560
	45.0	100	1000
	22.5	240	>1000
	0	1000	>1000

¹The mortality zone, where fish kills of 0-100%) might occur increased by a factor of 10 or more when models simulated the effects of two standard drops applied to the same stream.

Effects of Fire Retardant Application on Aquatic Species in the Chattahoochee and Cherokee National Forests

Headwater and tributary systems to the Conasauga River, Etowah River, and Coosawattee River drain portions of the Chattahoochee and Cherokee National Forests in northwest Georgia and southeast Tennessee. Six listed fish species occur in these river systems on or adjacent to the National Forests:

- Blue shiner (*Cyprinella caerulea*) – threatened
- Etowah darter (*Etheostoma etowahae*) – endangered
- Cherokee darter (*E. scotti*) - threatened
- Amber darter (*Percina antesella*) – endangered
- Goldline darter (*P. aurolineata*) – threatened
- Conasauga logperch (*Percina jenkinsi*) – endangered

Many reaches in the Conasauga, Etowah, and Coosawattee basins that support listed fish drain an area less than 230 square miles, a size that places them in Labat Environmental’s (2007) medium stream category (Table 9). During droughts, however, low flows in many reaches more closely approximate flows in Labat Environmental’s (2007) small streams. For example, flows in Holly Creek, at the gage downstream of known listed fish and mussel habitat, were only 0.4 cfs in September 2000, with an average low monthly flow in October 2000 of 2.6 cfs. Lowest daily flows in the Conasauga and Etowah at the gages at Eton and Dawsonville, in the middle of most listed fish and mussel ranges in each basin, were only 16 and 30 cfs in September 2007. USGS gage data

indicate the lowest flows for most gaged streams in these basins typically occurred during the July-September fire season.

Table 9. Flow data at USGS gage stations within the range of listed aquatic species in the Chattahoochee and Cherokee National Forests, Georgia and Tennessee.

Basin	Drainage Area (mi ²)	Current Flow (cfs) (1/29/08)	Long-term Median flow (cfs)	Lowest Ave. Annual Flow (cfs)	Year	Lowest Ave. Monthly Flow (cfs)	Month/Year	Lowest Daily Flow (cfs) (est)	Date
Conasauga									
Holly Creek at Chatsworth	64	17	120	32.2	2007	2.6	Oct. 2000	0.4	Sept. 2000
Conasauga River at Eton	252	132	494	154.2	2007	34.7	Aug. 2007	16	Sept. 2007
Coosawattee									
Coosawattee River at Ellijay	236	120	571	207.4	1988	75.8	Sept. 2007	54	Sept. 2007
Etowah									
Etowah River near Dahlonega	69.7	64	New gage – data not available					21	Sept. 2007
Etowah River at 9 near Dawsonville	131	107	271	193.8	2006	86.8	Aug. 2006	30	Sept. 2002
Amicalola River near Dawsonville	89	89	211	136.3	1941	64.4	Aug. 2006	32	July 2007
Etowah River at Canton	613	334	1260	510.2	1986	135	Sept. 2007	80	Oct. 2002 2007

Since we had no data on dilution of fire retardants in medium streams, we based our effects analyses and jeopardy determinations on a worse-case scenario that assumed (1) fire retardants were not diluted and remained lethal to listed fish and mussels in medium streams and (2) multiple drops of retardant could occur in one or more headwater tributary streams to reaches with listed species, amplifying toxicity and increasing the length of downstream habitat where impacts would be expected (as described by Norris and Webb 1989). We used GIS mapping to determine the point on the mainstem Conasauga, Etowah, and Coosawattee Rivers, as well as major tributaries with listed species, where the upstream drainage basin exceeded 147,200 acres. Application of fire retardant to aquatic habitats within this upstream drainage basin was assumed to result in take of listed fish and their eggs, and larvae downstream from the entry site to the point where the stream was large enough to sufficiently dilute the retardant to reduce the threat of mortality (i.e., 147,200-acre drainage basin). GIS identified the vulnerable reaches as

- The Conasauga mainstem from the headwaters in the Chattahoochee Forest, through the Cherokee National Forest and private lands in Tennessee, to the confluence of Sumac Creek

in Georgia (total of 126,457-acre upstream drainage basin, before Sumac Creek's flows are added to the Conasauga River; Fig. 1).

- Holly Creek and tributaries in the Conasauga basin from the headwaters in the Chattahoochee National Forest to the confluence with the Conasauga River (total drainage area of 69,200 acres) (Fig. 1).
- The Etowah mainstem from the headwaters in the Chattahoochee National Forest in Georgia downstream to the confluence with Amicalola River, Dawson County (total of 114,062-acre upstream drainage basin, before Amicalola's flows are added to the Etowah River; Fig. 2).
- Amicalola River and tributaries in the Etowah Basin from the headwaters in the Chattahoochee National Forest to the confluence with the Etowah River (total drainage area of 62,595 acres) (Fig. 2)
- The Coosawattee basin from tributary headwaters in the Chattahoochee National Forest to the confluence of the Cartecay and Ellijay Rivers (Fig. 3).
- Mountaintown Creek from its headwaters in the Chattahoochee National Forest to its confluence with the Coosawattee River (Fig. 3).

There is reasonable expectation that application of fire retardants in these vulnerable reaches will:

- Kill, harm, or harass all listed fish species in the Conasauga River mainstem between the application point and the mainstem's confluence with Sumac Creek
- kill, harm, or harass all listed fish species in the Holly Creek system between the application point and the confluence with the Conasauga River;
- kill, harm, or harass all listed fish species in the Etowah River mainstem between the application point and the mainstem's confluence with Shoal Creek, Dawson County;
- kill, harm, or harass all listed fish species in the Amicalola River system between the application point and the confluence with the Etowah River;
- kill, harm, or harass listed fish eggs and larvae in the above areas;

Direct mortality of listed fish is anticipated, as well as sub-lethal physiological responses that affect survival (harass). The fire retardants are likely to kill macroinvertebrate food items in the above areas, resulting in significant habitat degradation that affects foraging and breeding (harm). Extirpation of populations in areas of highest mortality may reduce species range in upstream areas that have natural or manmade dams, falls, or other knick points that prevent species recolonization.

Fig. 1. The shaded 12-digit HUCs in the Conasauga River and Holly Creek watersheds were considered vulnerable to fire retardant application on the National Forests (cross-hatched). The Conasauga mainstem basins are shaded light brown, and Holly Creek is shaded green. Other shaded basins are tributaries that contribute to flows in the Conasauga mainstem in the vulnerable reach.

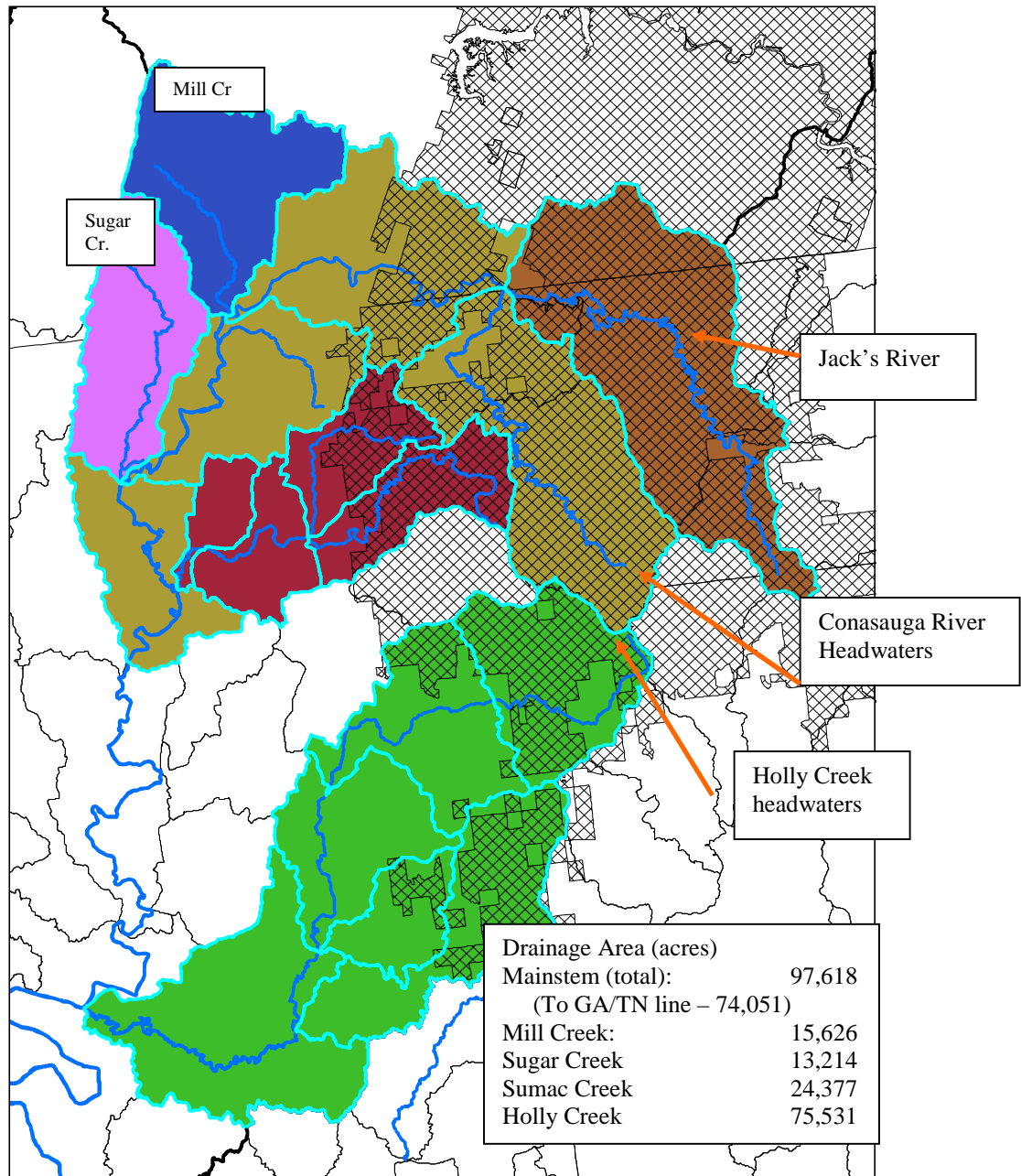


Fig. 2. The shaded 12-digit HUCS in the Etowah River (shaded red) and Amicalola River (shaded green) were considered vulnerable to fire retardant application on the National Forests (cross-hatched).

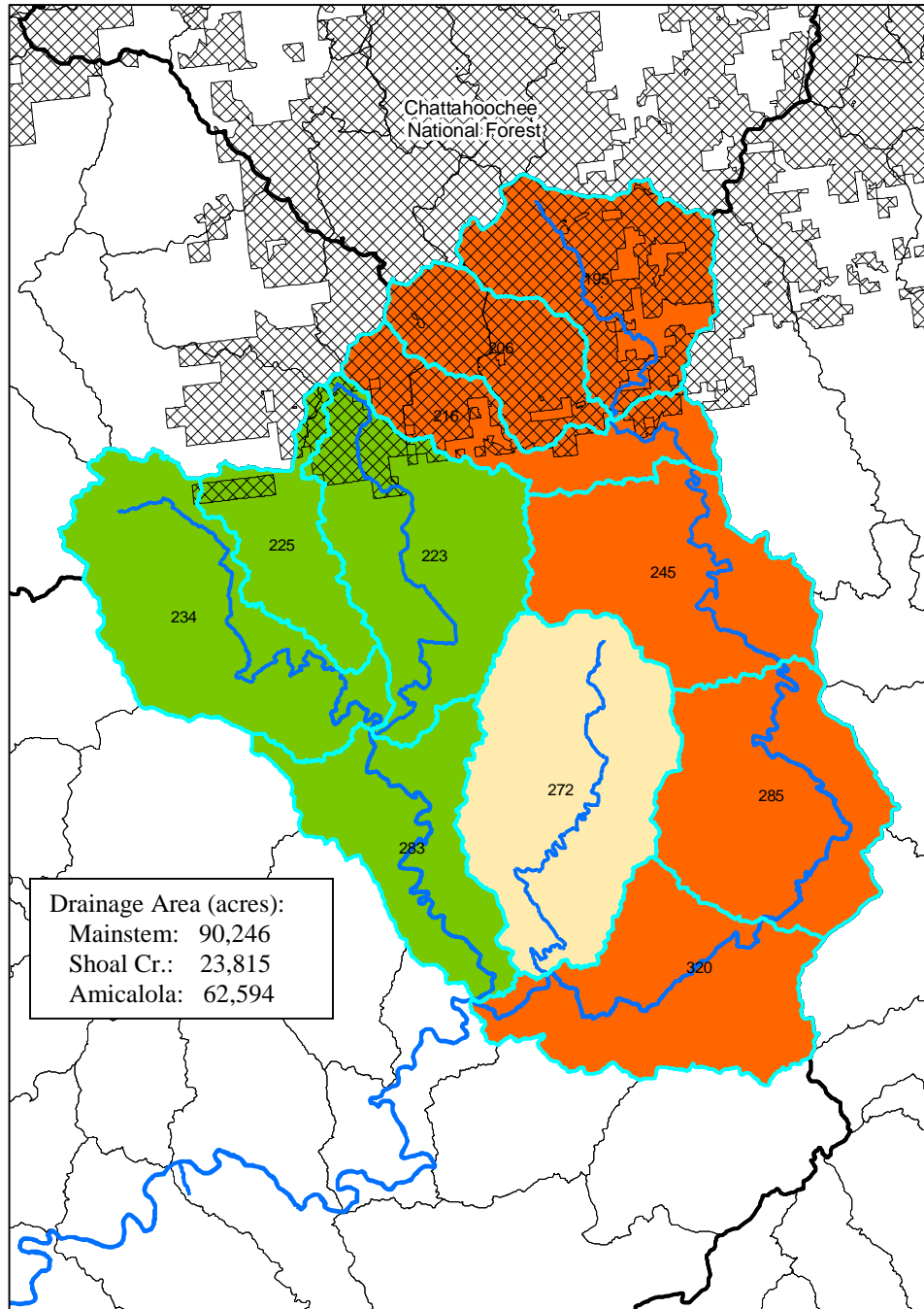
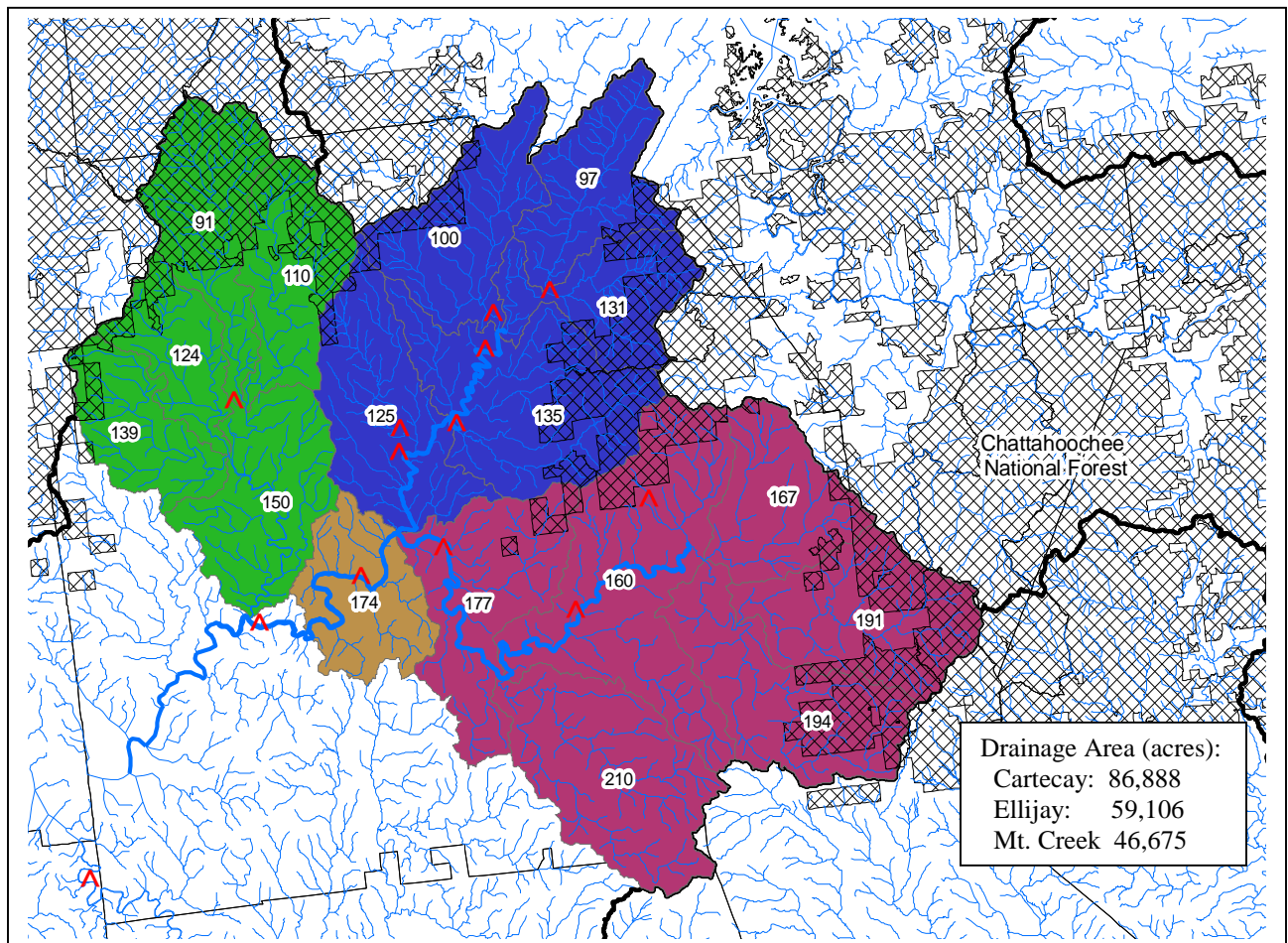


Fig. 3. The shaded 12-digit HUICS in the Cartecay River (red shading), Ellijay River (blue shading), and Mountaintown Creek (shaded green) watersheds were considered vulnerable to fire retardant application on the National Forests (cross-hatched). The brown area is the most upstream 12-digit HUC of the Coosawattee River, formed by the confluence of the Cartecay and Ellijay Rivers.



Several of the above listed species are also present in Alabama, and are included in the discussions below. Fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future. In addition, National Forests in Alabama lack air tanker facilities in the region, making it is very unlikely that fire retardants will ever be used in the vicinity of federally-listed species or any designated critical habitat (Dagmar Thurmond, USFS biologist, pers. comm. 2008).

Conclusion

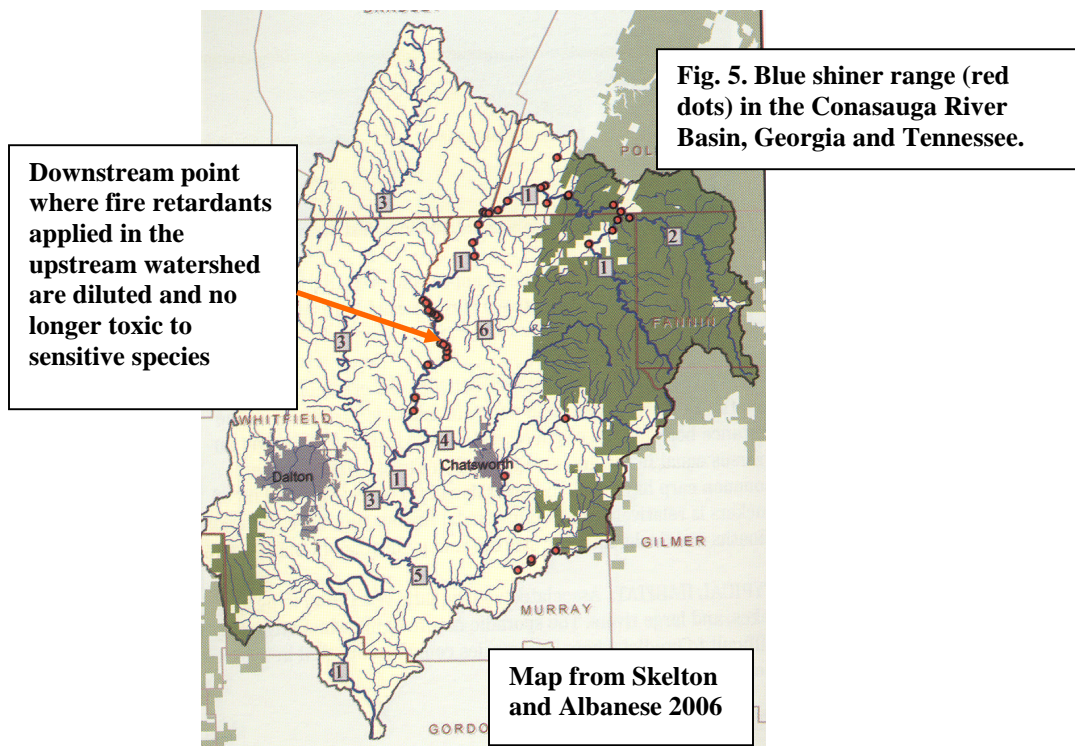
Jeopardy Determinations

After reviewing the current status of these species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is likely to jeopardize the continued existence of the blue shiner, Etowah darter, amber darter, Conasauga logperch, Coosa moccasinshell, and southern pigtoe.

Blue Shiner: The blue shiner is endemic to the Mobile River basin above the fall line in Alabama, Georgia and Tennessee. The species has been extirpated from the Cahaba River system, and currently

is found only in the Conasauga River and its tributary, Holly Creek, in Georgia and Tennessee (Skelton and Albanese 2006), and the lower reaches of the Little River, Weogufka Creek, and Choccolocco Creeks, Alabama (Boschung and Mayden 2004) (Fig. 5). The blue shiner is found in the Conasauga River basin within the boundaries of both the Chattahoochee and Cherokee National Forests (Conservation Fisheries, Inc. 2004; Shute and Rakes 2005).

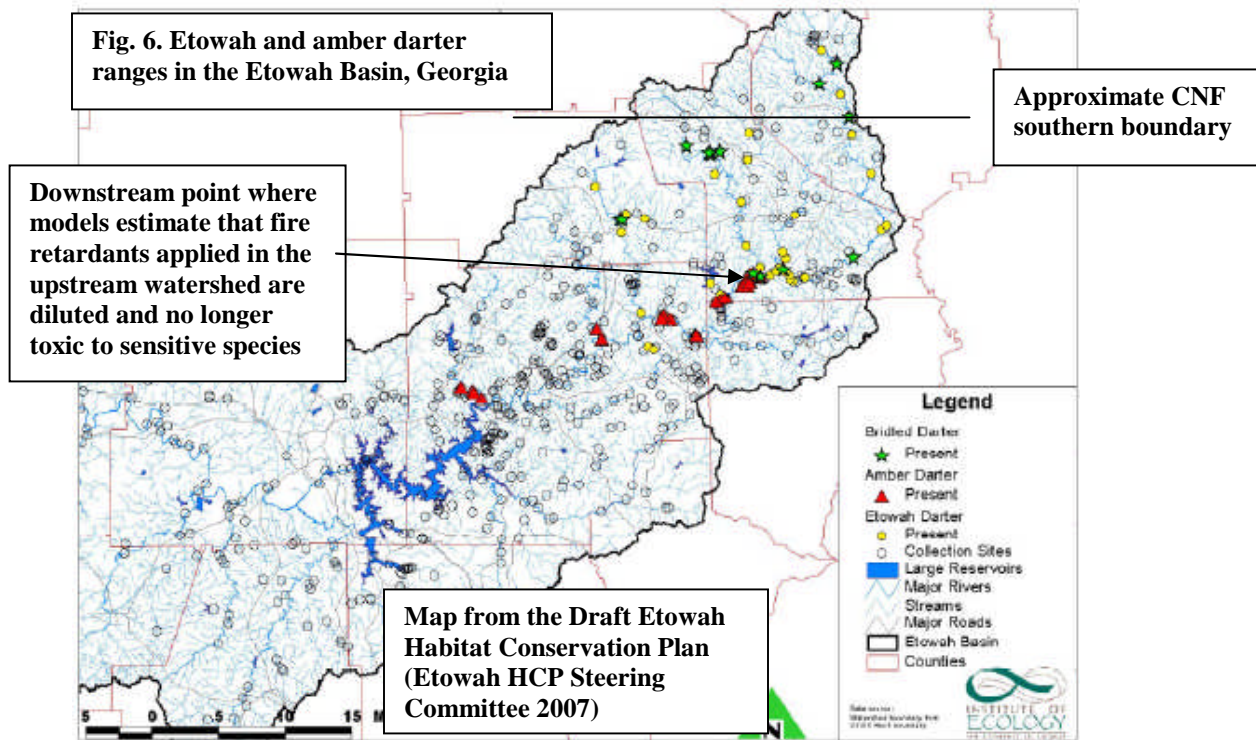
Application of fire retardant on the Chattahoochee or Cherokee National Forests in the headwaters of the Conasauga River could take all blue shiners, their eggs, and their larvae in a reach that extends over almost the entire species' range in the mainstem. Release of these chemicals into tributaries of the Conasauga could have varying impact on blue shiner populations, depending on where the tributary flows into the Conasauga. Application of retardant in Holly Creek or its tributaries could take all blue shiners in the stream below the entry point, but would not affect mainstem populations.



We have determined jeopardy due to potential for retardant application on the Chattahoochee and/or Cherokee National Forests, in the headwaters of the Conasauga River, to (1) take the majority of one of only four known blue shiner metapopulations and (2) reduce the species' genetic diversity due to likely loss of rare alleles in the metapopulation. Recolonization of habitat in the mainstem Conasauga River, if populations are extirpated due to retardant application may occur, but this likely will be a lengthy process due to the limited dispersal ability of this fish. Johnston (2000) found that the average distance moved by blue shiners over a two-year study was less than 430 feet. Dispersal may be limited by fish passage barriers in the Conasauga that we have not identified or that develop in the future.

Etowah Darter: The Etowah darter is endemic to the Etowah River basin, Georgia. Substantial numbers have been found only in the mainstem Etowah above Lake Allatoona, in the Amicalola River, and in Shoal (Dawson County), Long Swamp, and Raccoon Creeks (Fig. 6) (Etowah HCP Steering Committee 2007). Recent genetic studies indicate that individuals in Raccoon Creek, which

previously were thought to be greenbreast darters (*Etheostoma jordani*), genetically are Etowah darters; in some reaches, the two species are sympatric (B.J. Freeman, UGA, pers. comm., 2005).



Application of fire retardant on the Chattahoochee National Forest in the headwaters of the Etowah or Amicalola Rivers could take all Etowah darters, their eggs, and their larvae in a large portion of the species' range. Release of these chemicals into other tributaries of the Etowah could have varying impact on Etowah darter populations, depending on where the tributary flows into the Etowah.

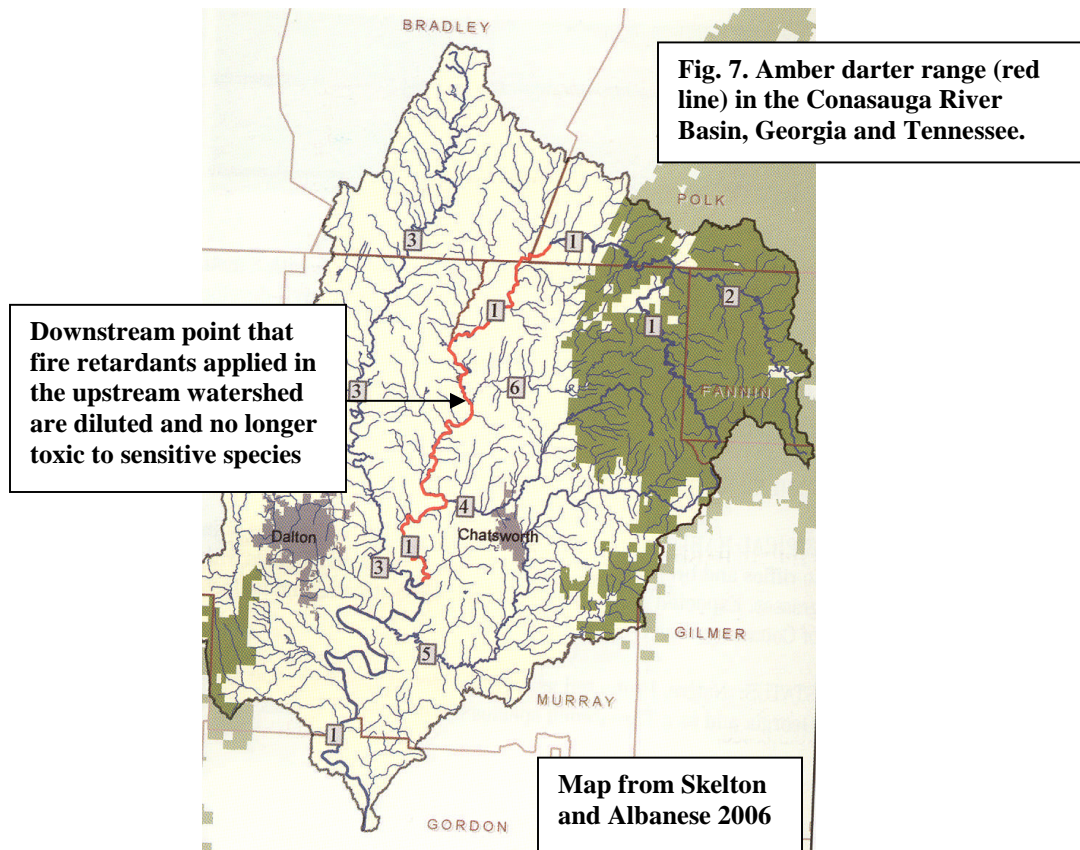
We have determined jeopardy due to potential for retardant application on the Chattahoochee National Forest, in the headwaters of the Etowah and/or Amicalola Rivers, to (1) take all Etowah darters in a large portion of the species' range and (2) reduce the species' genetic diversity due to likely loss of rare alleles. Recolonization of habitat in the Etowah and/or Amicalola Rivers, if populations are extirpated due to retardant application may occur, but this likely will be a lengthy process due to the limited dispersal ability of this fish. Roberts (2003) found that mean dispersal distance of three darter species in the Roanoke River, Virginia, was 417 feet during the sample year (range 131-1952 feet). Dispersal into upstream reaches of these rivers may be limited by Etowah Falls on the Etowah River in Lumpkin County and other fish passage barriers that we have not identified or that develop in the future.

Amber Darter: The amber darter is endemic to the Coosa River basin. This fish is found only in a 33-mile reach of the Conasauga River from TN Rt. 74 near the Tennessee-Georgia line downstream to Tibbs Bridge (Etnier and Starnes 1993) (Fig. 7); a 26-mile reach of the Etowah River upstream of Lake Allatoona; and the lower portions of two Etowah River tributaries, Shoal and Sharp Mountain Creeks in Cherokee County (Fig. 6) (Etowah HCP Steering Committee 2007).

Application of fire retardant on the Chattahoochee or Cherokee National Forests in the headwaters of the Conasauga River could take all amber darters, their eggs, and their larvae in a reach that extends over more than half of the species' range in the mainstem. Release of these chemicals into tributaries

of the Conasauga could have varying impact on amber darter populations, depending on where the tributary flows into the Conasauga.

Application of fire retardant on the Chattahoochee National Forest in the headwaters of the Etowah River or its tributaries may take a limited number of amber darters, but the majority of the shoals occupied by this species are downstream of the Etowah's confluence with the Amicalola River (Fig. 6).



We have determined jeopardy due to potential for retardant application on the Chattahoochee and/or Cherokee National Forests, in the headwaters of the Conasauga River, to (1) take the majority of one of only two known amber darter metapopulations and (2) reduce the species' genetic diversity due to likely loss of rare alleles in the metapopulation. Recolonization of habitat in the Conasauga River, if upstream populations are extirpated due to retardant application may occur, but this likely will be a lengthy process due to the limited dispersal ability of this fish. We have no data on dispersal ability of amber darters; however, Roberts (2003) found that mean dispersal distance of three darter species in the Roanoke River, Virginia, was 417 feet (range 131-1952 feet). Dispersal may be limited by fish passage barriers in the Conasauga that we have not identified or that develop in the future.

Conasauga Logperch: The Conasauga logperch was known only from an 18.5-km reach of the Conasauga River when the species was listed in 1985. Surveys conducted during the past two decades have extended the known range downstream to the Mitchell Bridge area, Murray County, Georgia and upstream, through the Cherokee National Forest, to the Alaculsky Valley, Murray

County, Georgia (Freeman 1989, 1990a, 1990b, Johnston and Damon 1996; Rakes and Shute 2005, 2006; B. Albanese, GADNR, pers. comm., May 2006) (Fig. 8).

Application of fire retardant on the Chattahoochee or Cherokee National Forests in the headwaters of the Conasauga River could take all Conasauga logperch, their eggs, and their larvae in a reach that extends over almost all of the species' known range. Release of these chemicals into tributaries of the Conasauga could have varying impact on Conasauga logperch populations, depending on where the tributary flows into the Conasauga.

We have determined jeopardy due to potential for retardant application on the Chattahoochee and/or Cherokee National Forests, in the headwaters of the Conasauga River, to (1) take the majority of the only known Conasauga logperch populations and (2) reduce the species' genetic diversity due to likely loss of rare alleles. Recolonization of habitat in the Conasauga River, if upstream populations are extirpated due to retardant application may occur, but this likely will be a lengthy process due to the limited dispersal ability of this fish. We have no data on dispersal ability of Conasauga logperch; however, Roberts (2003) found that mean dispersal distance of three darter species in the Roanoke River, Virginia, was 417 feet (range 131-1952 feet). Dispersal may be limited by fish passage barriers in the Conasauga that we have not identified or that develop in the future.

Impacts to Critical Habitat:

Please refer to the critical habitat designations for the amber darter (50 FR 31597), Conasauga logperch (50 FR 31597), and six listed mussel species (69 FR 40083) for detailed information about the status of critical habitat. Critical habitat has been designated for the

- amber darter in the Conasauga River from the US Route 411 bridge in Tennessee downstream 33.5 miles to the Tibbs Bridge Road (CR 109/100) in Georgia.
- Conasauga logperch from the confluence of the Conasauga River with Halfway Branch in Tennessee downstream 11 miles to GA Highway 2.

The primary constituent elements essential for the conservation of the species include those habitat components that support feeding, sheltering, reproduction, and physical features for maintaining the natural processes that support these habitat components. The primary constituent elements for the amber darter include high quality water, riffle areas (free of silt) composed of sand, gravel, and cobble, which becomes vegetated primarily with *Podostemum* during the summer. For the Conasauga logperch, primary constituent elements include high quality water, pool areas with flowing water and silt free riffles with gravel and rubble substrate, and fast riffle areas and deeper chutes with gravel and small rubble.

The fire retardants proposed for use would degrade water quality such that it is toxic to macroinvertebrates and other forage species for the amber darter and Conasauga logperch. The fire retardants proposed for use are also toxic to *Podostemum* that covers the amber darter's cobble habitat in summer. Application of these chemicals to vulnerable areas in Fig. 1, 2, or 3 will degrade the water quality necessary to support normal behavior, growth, and the viability of all life stages; and will kill fish hosts and temporarily eliminate living, foraging, and spawning areas supporting fish hosts. Effects to water quality, cobble habitat covered by *Podostemum*, and forage species could result in the extirpation of populations in areas of highest mortality and could diminish or eliminate the function and conservation role of the affected critical habitat.

After reviewing the current status of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological

opinion that the action, as proposed, is likely to destroy or adversely modify critical habitat for the amber darter and Conasauga logperch.

Kendall Warm Springs Dace Effects Analysis

The use of fire retardant by the USFS may adversely affect the Kendall Warm Springs dace (*Rhinichthys osculus thermalis*). Given the information provided by USFS, the likelihood of occurrence of such adverse effects to the species from this action remains uncertain. USFS guidance states that aerial fire retardant drops shall stay 300 feet from waterways unless exceptions are made by the incident commander or misapplications occur.

Rangewide, the Kendall Warm Springs dace is confined to one small stream approximately 328 yards (300 meters) in length that originates at a series of thermal springs near the base of a bluff in Sublette County, Wyoming. The habitat ends with a waterfall approximately 3 meters in height which plunges downward to the non-thermal Green River below. Kendall Warm Springs dace are believed to occupy their entire historic range (Hubbs and Kuhne 1937; Kaya et al. 1992). The habitat remains in relatively good condition and is located entirely on land managed by the Bridger-Teton National Forest. To date, the Bridger-Teton National Forest has done a commendable job of managing the Kendall Warm Springs dace habitat and implementing numerous recovery actions for this species.

The area immediately surrounding the Kendall Warm Springs is a mosaic of sagebrush and grass (Figure 2) and is located in a greater than 1 mile wide predominantly treeless valley (Figure 3). The edge of the coniferous forest lies approximately 0.5 mile to the east and greater than 0.5 mile and across the Green River to the west. The Green River Lakes Road, a forest service road heavily used by the public, bisects the area. Kendall Warm Springs is bordered on three sides by the Green River: immediately adjacent to the west, approximately 0.4 miles to the north and 1 mile to the south. Westward intrusion by wildfires could be contained by fire fighting crews by using existing firebreaks such as the Green River to the west, north and south or the Roaring Forks Road to the west or the Green River Lakes Road which crosses the Kendall Warm Springs dace habitat.

It is possible that wildfire suppression efforts would not result in the application of fire retardants to the Kendall Warm Springs area. Over the past six years, the Bridger-Teton National Forest has had very limited use of fire retardants, averaging 1.8 aerial applications of fire retardant per year (USFS unpublished data). No buildings occur in the vicinity of Kendall Warm Springs and there are no private in-holdings to protect (Neil and Hutta 2008). Additionally, the grass and sagebrush habitat surrounding Kendall Warm Springs is likely to be sufficiently dry to allow a fire to burn through it during a window of approximately 6 weeks (September-early October) (Neil and Hutta 2008). Kendall Warm Springs is highly accessible to firefighting crews given the well-maintained forest service roads in the area (Neil and Hutta 2008). If a fire did threaten the area, it is typical for the Bridger-Teton National Forest fire fighting personnel use ground crews with water to control the fire rather than fire retardant in such a highly accessible area (Neil and Hutta 2008).

The USFS is also committed to protect and maintain Kendall Warm Springs dace and its habitat as part of the Bridger-Teton National Forest Land and Resource Management Plan (USFS 1990). Furthermore, the chance of an accidental application of fire retardant to the Kendall Warm Springs dace habitat might be minimized because the aquatic habitat. Furthermore, fire retardant may not be applied accidentally to the Kendall Warm Springs dace area because the aquatic habitat for this

species is highly visible from the ground (Figure 4) and the air. Also according to the Forest Service's project description, the fire retardants currently in use by the Forest service bind quickly to soil and do not travel through the soil. Therefore, they would not be expected to impact the water quality of the Kendall Warm Springs unless directly applied to, or within a narrow buffer of approximately 3 feet of, the water surface.



Figure 2. Kendall Warm Springs dace habitat looking north with the heavily traveled Green River Lakes Road and the Green River in the background.



Figure 3. Aerial view of Kendall Warm Springs area. Habitat for the Kendall Warm Springs dace starts approximately 900 feet northwest of the confluence with the Green River (marked by a blue

dot). An abandoned road (here marked by a short white line) extends the entire length of the habitat. The Kendall Warm Springs dace's habitat terminates at the confluence (a waterfall)



Figure 4. The springs where the Kendall Warm Springs dace habitat starts (looking west from atop a bluff).

Although misapplication or deliberate use of fire retardant in the Kendall Warm Springs area may be of low likelihood, the potential effects of such activity if it did occur could be disastrous for this species given that it is only found in one location in the world. Misapplications of fire retardants have occurred in past USFS firefighting activities (NMFS 2007). Some of these misapplications have occurred at such a scale that could encompass the entire range of the Kendall Warm Springs dace. To our knowledge, USFS does not have non-discretionary standards that would completely remove the risk of fire retardant use near the Kendall Warm Springs dace habitat.

The use of fire retardants during fire fighting efforts appears to be increasing. In 1956, 23,000 gallons of retardants were applied on or around fires nationwide. By 1977, the volume of retardant increased to more than 14.55 million gallons. From 2000 through 2006 across all federally owned lands, an average of 25.7 million gallons were used each year. Each load of fire retardant is on average 1,500 gallons, which means the number of loads increased to 20,867 in 2006 on all Federal and state lands. The general linear trend between 1977 and 2006, indicates there has been an increase of 16.75 million gallons over 29 years. Based on this trend, we anticipate that retardant use on USFS lands will increase in the future.

Direct Effects

Kendall Warm Springs dace may be exposed to fire retardants via two primary ways: 1) through the intentional application of retardants (i.e., a planned release across or immediately adjacent to its habitat; or 2) through the accidental drop or spill during aerial application or on-the-ground activities. Even when following the 2000 Guidelines, the USFS may still drop fire retardants into bodies of water, both visible and out of sight. When fighting wildfires, the USFS conducts a Wildland Fire Situation Analysis (WFSA), which is a decision making structure that considers the objectives and

constraints of fighting the fire, compares multiple management alternatives, evaluates the expected effects of the alternatives, selects the preferred alternative, and documents the decision. This process takes into consideration such resource considerations including federally listed species and their critical habitats. If the Incident Commander, after reviewing the WFSA alternatives, determines aerial application of fire retardant adjacent to a waterway is necessary, the USFS could drop fire retardant into and adjacent to streams.

If a retardant drop occurred into Kendall Warm Springs dace habitat, Kendall Warm Springs dace could be killed or injured by increases in the ammonia concentration of the spring. When fire retardants initially enter a stream, the ammonia concentration in the receiving stream immediately spikes. For instance, when Phos Chek 259-F hits the surface of the water, it is 22.9 percent ammonia (Buhl and Hamilton 2000). The peak of the spike and area affected depends on many factors, such as volume of retardant to hit the water, volume of water to dilute the retardant, and turbulence of the stream. In simulations of only 267 gallons (a normal load being approximately 1,500 gallons) of fire retardants hitting the surface of a stream, peak ammonia concentrations reached 5,026 mg/l (Buhl and Hamilton 1998). When the volume of retardant hitting the stream is doubled, the zone of mortality is extended 10 times farther downstream (Norris *et al.* 1991). These studies looked at only the ammonia concentration caused directly by the fire retardant, but in a natural situation during a fire, ammonia levels will also be elevated due to smoke adsorption (Gresswell 1999). Furthermore, the application of fire retardants increases the amount of smoke produced by a fire (Kalabokidis 2000), which ultimately leads to more ammonia in the system.

Discernable levels of ammonia were detected as much as 2,730 meters downstream when only a fraction of an actual retardant load was placed in the stream (Norris *et al.* 1978). Ammonia concentrations could remain at lethal levels between 0 and 6.2 miles downstream, depending on stream characteristics and the size of the retardant load (Norris and Webb 1989). Van Meter and Hardy (1975) found that concentrations of retardant high enough to kill 10 percent of the fish population were measurable over 4 miles downstream. This information creates cause for concern for the Kendall Warm Springs dace given its limited distribution in a 300 meter stretch of habitat.

The response of fish to fire retardants could be more significant than their response to fire (Backer *et al.* 2004). Fish response depends not only on the amount of retardant to hit the water and variables within the stream, but also on interactive effects between the various ingredients in the retardant or on the interaction of retardant effects coupled with the effects of the nearby fire to the stream. We know of no information regarding the Kendall Warm Springs dace's response to fire retardants and no information on how Kendall Warm Springs dace would respond to elevated levels of ammonia. However, we assume that increased ammonia concentrations could kill individual Kendall Warm Springs dace, as they have been shown to be lethal to other species of fish (Buhl and Hamilton 1998; Fisher 2001; Walch 2004; Little and Calfee 2002; Riehle 2002). Additionally, if Kendall Warm Springs dace swim downstream to avoid any retardants entering the spring, they could swim over the waterfall at the terminus of their habitat and enter the Green River, where we assume that they would die due to the 20 degree temperature change and the presence of predatory fish. Even if they were not to die, they would be lost to the population because they would be unable to return up the waterfall to the warm spring.

Fire retardants, and the ammonia plume that develops when retardants enter a stream, do not persist above the lethal concentrations for long periods of time. Even when relatively small amounts of fire retardant enter a stream, the ammonia concentration reaches levels that could cause immediate mortality. The plume is diluted downstream, but longer exposure could also prove lethal (Buhl and

Hamilton 1998). While there has been a fair amount of research conducted in laboratory environments, the response of fish to an accidental fire retardant drop in the natural environment with additional stressors, such as low dissolved oxygen, ash, hot water, and other conditions expected as the result of the nearby fire, has not been studied.

Indirect Effects

Fire retardants have been shown to have negative direct impacts to many resources on which fish depend. When nitrogen-based fire retardants enter water, they break down and eventually become nitrogenous nutrients. The application of nutrients could degrade water quality and also lead to eutrophication. Eutrophication can be a significant problem in many slack water areas such as the backwater nursery areas for Kendall Warm Springs dace fry. Eutrophication can impair light penetration, submerged vegetation growth, and nursery habitat permanence. The application of nutrients into waters can lead to shifts in phytoplankton composition or provide a competitive advantage to organisms that are not naturally suited for those waters. Increased nutrients can also impact food resources, such as macroinvertebrate abundance and macroinvertebrate species composition, both in the area the retardant hits and downstream. Thus, the biotic community upon which the Kendall Warm Springs dace depends could be impaired if fire retardant were to enter its habitat.

When fire retardant hits the water and ammonia concentrations increase quickly, macroinvertebrates, the main food source for many fish species, exhibit highly variable responses from no response to high mortality (Adams and Simmons 1999; McDonald *et al.* 1997). Almost all macroinvertebrates will drift in the presence of elevated ammonia, but even then, many die (NMFS 2007). As long as there is depressed individual and species abundance, fish that depend on those macroinvertebrates as a food source could be adversely affected. Kendall Warm Springs dace feed on benthic invertebrates and epiphytic organisms (Gryska and Hubert 1997); thus, their food supply could be reduced by retardant entering the stream.

Integration and Synthesis of Effects

The USFS has proposed to continue aerial application of long-term fire retardants on National Forest Service and adjacent lands using the 2000 Guidelines to minimize the number of introductions of long-term fire retardants to streams. The 2000 Guidelines establish a 300 foot buffer on either side of rivers on USFS land, beyond which the USFS assumes long-term retardant application has no effect on listed aquatic species. While the USFS will fight fires with long-term retardants on all National Forests, there are no specific non-discretionary standards which would completely preclude the use of such fire retardant near the habitat of the Kendall Warm Springs dace. We have determined that the 2000 Guidelines would not prevent the Kendall Warm Springs dace from being exposed to long-term fire retardant. Incident commanders can choose not to implement the 300 foot buffer if need be and accidents where retardants enter waterways have been known to occur. Given the small area where Kendall Warm Springs dace occurs, any retardant drop in its habitat could be catastrophic.

While the 300 buffer contained in the Guidelines is not known to have ever been intentionally abandoned, at least 15 misapplications of fire retardant (11 reported by the USFS and four identified in NMFS 2007) have been documented between August 2001 and December 2005. Therefore even with the 2000 Guidelines in place, it is possible that the Kendall Warm Springs dace will be exposed to the USFS' continued use of long-term fire retardants.

Based on the general linear trend between 1977 and 2006, retardants use has increased by 16.75 million gallons over 29 years (NMFS 2007). The USFS recently stated that in the coming years they anticipate more fires and larger fires across much of the western landscape. Because the USFS expects more and larger fires and based on past trends of increasing aerial fire retardant use, we expect a continual increase in the use of retardant and as a result more potential exposure of the Kendall Warm Springs dace to fire retardants in future years.

We are not aware of any information concerning the sub-lethal response of Kendall Warm Springs dace to long-term fire retardant compounds. Guar gum is a known respiratory inhibitor, while the sub-lethal impacts of ammonia range from skin, eye, and gill damage to reduced hatching success; reduced growth rate; impaired morphological development; injury to liver and kidneys; and the development of hyperplasia. Sub-lethal levels can persist for more than 6.2 miles downstream and for more than 15 months. All of these effects can have an adverse, long-term impact to listed fish, which is very difficult to measure without extensive long-term monitoring.

Kendall Warm Springs dace depend on the health of the aquatic ecosystem they occupy for their survival and recovery. The USFS' fire retardant program is meant to protect National Forest Service and other lands from the devastating effects of wildfires. Consequently, while the 2000 Guidelines may help prevent exposure in some cases, we know that the 2000 Guidelines cannot prevent endangered species, threatened species, and designated critical habitat from being exposed in all instances, and as the number of fires increases across the landscape we would expect that the number of times listed species are likely to be exposed to fire retardants will likely increase in the future. We believe it is reasonable to expect that the exposure is likely to increase commensurate with the USFS use of fire retardants. Therefore, we do not believe the USFS can insure that the 2000 Guidelines and their continued use of fire retardants is not likely to jeopardize the continued existence of the Kendall Warm Springs dace.

Conclusion

After reviewing the proposed action and its likely effects to the Kendall Warm Springs dace, it is the Service's biological opinion that the proposed action is likely to jeopardize the continued existence of the Kendall Warm Springs dace. Our conclusion is based upon the following: 1) the use of fire retardant on National Forest lands according to the 2000 Guidelines can not ensure that no fire retardant would enter the limited habit of this species; 2) the species is known from such a limited area (300 m) that any retardant entering the stream could be catastrophic; 3) misapplications of retardant have been documented to occur at such a scale that the entire distribution of the Kendall Warm Springs dace could be affected; and 4) the documented lethal and sublethal affects of increased ammonia concentrations following small amounts of retardants entering aquatic systems. No critical habitat has been designated for this species; therefore, none will be affected.

Greenback Cutthroat Trout Effects Analysis

Greenback cutthroat trout (GBCT) populations have been reduced from an estimated 6,500 miles of pure native habitat in Colorado and a small portion of Wyoming. The remaining populations of GBCT are all in Colorado and contain an estimated 141 miles of stream and 413 acres of lakes; these populations are highly fragmented and no longer function as metapopulations. Approximately 79

miles (56 percent) of all GBCT occupied waters occur on USFS lands within the South Platte and Arkansas drainage.

The GBCT occupied habitat has been drastically reduced since the late 1800's for a variety of reasons including introduction of non-native salmonids, loss of habitat from water exploitation, mining, agriculture, logging, and un-regulated fishing. The introduction of non-native salmonids has had the greatest impact on GBCT population declines through hybridization and competition for limited resources on their remaining habitat. As a result of the hybridization issue, our recovery program for the species places a higher value on pure native populations of GBCT. Due to low numbers of remaining GBCT populations throughout its range, the loss of any pure native GBCT population is of concern for the survival and recovery of this species.

The best available information indicates that four GBCT populations are genetically important populations that likely represent pure native GBCT populations (Metcalf *et al.* 2007). All four of these populations (Severy Creek, Bear Creek, South Prong of Hayden Creek in the Arkansas River drainage and Como Creek in the South Platte River drainage) occur on USFS lands. Other important GBCT populations are present within the South Platte and Arkansas drainages on USFS. Some GBCT populations may occur on the western slope of Colorado, which is outside the pure native range of the species but may provide important genetic material in the future (Metcalf *et al.* 2007).

Streams that contain GBCT populations are particularly vulnerable to fire retardant because they are small headwater streams (typically 1, 2, and 3 order) with low flows and little opportunity for dilution of contaminants. Many of these populations occupy only short sections of stream, often less than 5 miles in length, with little opportunity to escape to tributaries in the event of contamination by fire retardant or to escape downstream due to presence of barriers that protect GBCT from downstream threats of non-native fish and diseases. Likewise, the presence of barriers prohibits the recolonization of populations. Pure native populations are already at risk due to low population numbers and low annual recruitment. Despite our emphasis on the four pure native GBCT populations identified above, we are also concerned with introduction of fire retardant to the other GBCT populations present on USFS lands.

According to the 2000 Guidelines, the USFS is directed to avoid the aerial use of fire retardant within 300 feet of a waterway. However, these guidelines serve to only minimize, rather than prevent, the chance of fire retardant entering waterways by the following mechanisms: Fire retardant can enter waterways if: 1) an Incident Commander chooses to deviate from the guidelines and specify the application of fire retardant directly to the waterway in situations where alternative fire line construction tactics are not available due to terrain constraints, life and property, and other reasons; 2) accidentally during aerial application (e.g., during strong winds); 3) waterways may not be visible in some instances (e.g., smoky conditions with limited visibility, thick forest canopy) so applicators are unable to avoid to avoid them. Accidental drops and misapplications with fire retardant entering waters on USFS lands have been documented (NMFS 2007).

Runoff from fire retardant applied in terrestrial uplands adjacent to waterways or dry streams may pose problems to GBCT in: 1) areas of recently disturbed riparian vegetation; 2) areas without riparian vegetation; and 3) areas where retardant was unburned. Direct application of long-term fire retardants onto the stream surface was the primary source of retardant contamination in streams (Norris *et al.* 1991). Only minor amounts of retardant have entered streams from riparian areas, and as small as a 3-meter buffer virtually eliminated retardant runoff from entering stream waters (Norris *et al.* 1991). Retardants that have been applied to terrestrial areas and have not been consumed by a

fire can remain toxic for 21 days (Little and Calfee 2002). Therefore, rain events that occur within three weeks after application in riparian area or across dry stream beds pose a risk of introducing lethal levels of ammonia to a stream, potentially occurring after any sort of monitoring had been conducted and after the effects to GBCT from the fire had been analyzed by USFS personnel.

Direct Effects

Fire retardants are known to kill many aquatic species, including salmonids, due to the presence of ammonium compounds that represent approximately 10 percent of fire retardant slurry. Other ingredients in fire retardant include gum thickener, coloring agent, and corrosion inhibitors, and water (Norris and Webb 1989; Gaikowski *et al.* 1996a; Gaikowski *et al.* 1996b; McDonald *et al.* 1996; McDonald *et al.* 1997; Buhl and Hamilton 1998; Adams and Simmons 1999; Buhl and Hamilton 2000; Calfee and Little 2003a; Wells *et al.* 2004).

When fire retardant enters a stream, an initial spike in ammonia occurs. For example, when the long-term fire retardant Phos Chek 259-F first enters the surface of the water, it is 22.9 percent ammonia (Buhl and Hamilton 2000). Following entry into the stream, a chemical equilibrium is formed between un-ionized ammonia, which is the more toxic form, and ionized ammonia (Norris *et al.* 1991). The chemical balance between these two forms of ammonia is determined by pH, temperature, and total ammonia concentration. In most streams, pH is sufficiently low that ionized ammonia predominates. However, in highly alkaline waters, un-ionized ammonia concentrations increase and could reach toxic levels (Norris *et al.* 1991). Almost all GBCT streams and lakes have low pH (less than 7.5)(Rosenlund 2008). Most research analyzes the lethal levels of ionized ammonia, the least toxic form that would be present in the river.

The peak of the spike of ammonia and area affected depends on many factors, such as volume of retardant to enter the water, volume of water to dilute the retardant, and turbulence of the stream. In simulations of only 267 gallons (a normal load being approximately 1,500 gallons) of fire retardants entering the surface of a stream, peak ammonia concentrations reached 5,026 mg/l (Buhl and Hamilton 1998). When the volume of retardant entering the stream is doubled, the zone of mortality is extended 10 times farther downstream (Norris *et al.* 1991). This ammonia concentration was caused by fire retardant alone, whereas in a natural situation during a fire, ammonia levels would also be elevated due to smoke adsorption (Gresswell 1999).

The responses of rainbow trout to fire retardant have been studied by various researchers. We were not able to identify any research that evaluated the effects of fire retardant on GBCT. Because the rainbow trout is closely-related to the GBCT, we are using the results of the studies on rainbow trout to approximate the potential impacts if fire retardant were applied to a GBCT stream or lake. For rainbow trout, most mortality occurs in the first 24 hours (Johnson and Sanders 1977). As a result, the 24 hour and 96 hour LC50s (the concentration at which half of the effected population will die in an established time period) were not significantly different, meaning that the values given below represent both the 24 hour and 96 hour LC50s.

The LC50 for rainbow trout varies depending on the type of retardant used. When exposed to Phos Chek 259, their LC50 was between 94 and 250 mg/l (Johnson and Sanders 1977). Buhl and Hamilton (2000) found the LC50 of rainbow trout to Phos Chek 259-F was 168 mg/l. In research on Phos Chek D75-R, the rainbow trout 96 hour LC50 was 168 mg/l (between 142 and 194 mg/l) (Calfee and Little 2003). Phos Chek D75-F has a 96 hour LC50 of 228 mg/l (between 184 and 271 mg/l) (Calfee and Little 2003) The rainbow trout LC50s in response to Phos Chek 259-R, G75-F, G75-W, LV-R,

and LC-95A-R have not been researched. Phos Chek LC-95A-R was the main fire retardant used in 2006 by the USFS and accounted for 13.5 million gallons spread applied over 11,383 loads.

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

Phos Chek D75-F was twice as toxic to rainbow trout in hard water compared to soft water (Poulton *et al.* 1993). Another study found that in hard water, all early stages were affected the same, and in soft water, there were minor differences in tolerance but they were not significantly different (Gaikowski *et al.* 1996).

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

GBCT are spring spawners, which for Colorado mountain streams typically takes place following spring runoff in mid-to-late June through early July. Therefore, GBCT swim-up fry could be present during the later part of the fire season and juveniles would also be present on USFS lands during the entire fire season. Introductions of long-term fire retardants into an aquatic habitat occupied by GBCT could cause significant mortality and be catastrophic to local populations (Finger *et al.* 1997).

Rainbow trout have been observed avoiding concentrations of ammonia as low as 1.3 mg/l (1 percent of LC50), indicating fish are likely to swim away from areas of high ammonia concentrations (Wells *et al.* 2004; Little *et al.* 2006). Rainbow trout and coho salmon have higher mortality rates after swimming in or through waters with elevated ammonia levels (Wicks *et al.* 2002). Fire retardants may also affect salmonids by inhibiting the upstream movement of spawning salmonids (Wells *et al.* 2004).

The Federal regulatory agencies use 5 percent of the LC50 value to represent the "no effect" concentration (NOEC) for threatened and endangered species. Therefore, the NOEC for GBCT (established by the surrogate rainbow trout) in response to Phos Chek 259, D75-R, and D75-F would be between 4.7 and 12.5 mg/l, between 7.1 and 9.7 mg/l, and between 9.2 and 13.5 mg/l, respectively.

A study performed following an accidental drop of only 267 gallons of Phos Chek D75- F found that ammonia levels would have needed to be diluted 660 times to reach the LC50 concentration and 13,200 times before it reached a NOEC (Buhl and Hamilton 1998). The average USFS retardant drop is approximately 1,500 gallons. Therefore, a drop of retardant into an occupied GBCT stream would far exceed both the LC50 and NOEC for ammonia concentrations and likely have disastrous effects on that GBCT population and its habitat.

Currently, pure native GBCT populations inhabit small headwater streams that have little opportunity for dilution of retardants and would be most susceptible to the wildfire effects mentioned above. In larger streams, the impacts of fire are likely less (Gresswell 1999). Small isolated populations of fish have been extirpated by fires, and similar responses would be expected if fire retardant was dropped in a GBCT headwater system (Dunham et al. 2003, Bisson et al. 2003). Larger, better connected populations are more resilient so individuals from downstream that are not harmed by the retardant may migrate back into the headwater system to spawn, helping fish re-establish in that area . (Rieman et al. 1995, Dunham et al. 2003). A retardant drop could result in an additive adverse effect to GBCT that are already stressed by the fire itself.

GBCT occur on the Arapahoe/Roosevelt National Forest and Pawnee Nation Grasslands (ARNF) and the Pike and San Isabel National Forests and Comanche National Grasslands (PSINF). The ARNF has averaged 6.7 large tanker drops per year since 2000 with a six year total of 40 tanker drops. The most drops in one year occurred in 2005 with 11 tanker drops with 2006 a close second with 10 more tanker drops. The PSNIF had very similar numbers averaging 6.8 tanker drops per year with since 2000 with a six year total of 41 tanker drops. In 2002, the year of the large Hayman Fire, the PSNIF had a total of 13 tanker drops. Due to the pine bark beetle epidemic that is currently plaguing most of Colorado, we expect that the average number of tanker drops for both Forests may increase in the near future. As the number of dead and dying pine trees continues to rise, the potential for large catastrophic fires requiring increased tanker drops adjacent to GBCT waters also increases.

Concomitant with the increase of fires in Colorado, the use of fire retardants during fire fighting efforts appears to be increasing. In 1956, 23,000 gallons of retardants were applied on or around fires nationwide. By 1977, the volume of retardant increased to more than 14.55 million gallons. From 2000 through 2006 across all federally owned lands, an average of 25.7 million gallons were used each year. Each load of fire retardant is on average 1,500 gallons, which means the number of loads increased to 20,867 in 2006 on all Federal and state lands. The general linear trend between 1977 and 2006, indicates there has been an increase of 16.75 million gallons over 29 years. Based on this trend, we anticipate that retardant use on USFS lands will increase in the future.

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

In other work on rainbow trout response to many toxins in a low DO environment, the greatest response was to ammonia, surpassing other toxins such as lead, zinc, and copper (Lloyd 1961).

Although ammonia is a major toxic component in fire retardants, other components in the formulation may have significant influence on the toxicity of the retardant to salmonids (Buhl and Hamilton 1998). Ash and guar gum have both been identified as respiratory inhibitors in the water. Ash has been identified as one of the causes for fish kills during wildfires and volcanic eruptions. Guar gum is a common ingredient found in fire retardants and would further exacerbate the effects of increased ammonia concentrations (Newcombe and Jensen 1996). Spikes in the salinity as a result of the ammonia salts contained in the aerially-applied fire retardants would negatively impact all fish living in freshwater environments, including adults (Little *et al.* 2006).

The hardest to measure and potentially most significant effects of fire retardant could be long-term, sub-lethal impacts to fish. The distance and the extent of sub-lethal effects from elevated ammonia levels is not known, but may extend further downstream than has been previously recognized and is an area of research that should be analyzed in the future. Laboratory studies show that rainbow trout exposed to ammonia levels over 0.1 mg/l developed skin, eye, and gill damage (Norris *et al.* 1978). Other reactions to sub-lethal levels of ammonia include reduced hatching success, reduced growth rate; impaired morphological development; injury to gill tissue, liver, and kidneys; and the development of hyperplasia. Hyperplasia in fingerling salmonids can result from exposure of ammonia levels as low as 0.002 mg/l for six weeks (Norris *et al.* 1978). Hyperplasia can also be caused by silt, bacteria, and parasites (B. Rosenlund, FWS, pers. com.). Considering the research in California (Norris *et al.* 1978) that showed detectable levels of ammonia for an entire year following retardant introduction, it is possible that hyperplasia could be a concern for listed salmonids. The presence of ammonia in the water can also lead to suppression of normal ammonia excretion and a buildup of ammonia on the gills.

Apparently, monitoring for long-term retardant in runoff has not been studied by the USFS in the past because runoff typically only enters streams in sub-lethal levels. Current studies analyzing the risk of runoff only used mortality as the endpoint measurement. The results did not evaluate persistent or sub-lethal effects, but stated that because retardant drops are likely to be intermittent one-time events, a chronic analysis for the products was not conducted (Labat 2007). The study does mention that the USFS is engaged in evaluating the possible sub-lethal effects from the ingredients in approved products, including those from longer-term exposures, but the information is not yet available for the purposes of this consultation (Labat 2007).

Indirect Effects

When fire retardant enters the water and ammonia concentrations increase quickly, macroinvertebrates, the main food source for juvenile salmonids, exhibit highly variable responses. Macroinvertebrate drift increased during a 30 minute dose period and was elevated for some taxa for 30 minutes after the chemical application (Finger *et al.* 1997). It can take years for macroinvertebrates to recolonize a stretch of stream that is negatively impacted during a wildfire (Minshall *et al.* 1997). Macroinvertebrates that react similarly to small amounts of ammonia have up to a four fold difference in their resistance to acute toxicity (Williams *et al.* 1986). Mayflies and stoneflies in Australia were not affected by Phos Chek D75-F (Adams and Simmons 1999). A study on the retardant D75-F evaluated *Hyalella azteca*, typically a very chemically tolerant species of macroinvertebrate, found that the 96 hr LC50 was between 53 and 394 mg/l depending on pH, which is not only lethal, but more lethal than for many species of fish. The loss of a macroinvertebrate

community in a GBCT stream would adversely affect the entire GBCT population inhabiting that stream. All life stages of GBCT use macroinvertebrates as their primary food source and any loss of their food source would adversely affect growth and survival in that population.

Other indirect effects from application of fire retardant include the eutrophication of waterbodies, primarily reservoirs, estuaries, and bays. Eutrophication can result from increased nitrogen in the water from the breakdown of fire retardant compounds. The application of nutrients into these waters could lead to shifts in phytoplankton composition or provide a competitive advantage to organisms that are not naturally suited for the oligotrophic waters. Eutrophication can impair light penetration, submerged vegetation, and nursery habitat and can alter macroinvertebrate abundance and species composition. Eutrophication could be a concern if fire retardant entered a lake containing GBCT in sufficient quantities to cause a decrease in water quality or food availability.

Likelihood of Observing Accidental Exposures

According to the USFS, instances of accidental spills or misapplied retardants are rare. It is unclear, however, whether the misapplication of fire retardants would be detected and recorded while all other aspects of fighting a fire are also happening. Unobserved accidents may be found after the fact during the Burned Area Emergency Rehab (BAER) analysis by observing the coloring agent of a fire retardant around a stream, at which point an evaluation for any impacts would be conducted, but this could be long after the actual fire and misapplication.

Not all observed accidental applications to water must be reported to the Wildland Fires Chemicals System. Prior to reporting the accident to the National Interagency Fire Center, the 2007 Redbook instructs the USFS to first determine if there have been adverse effects. It is unclear how quickly (and likely variable based on the conditions of the site) personnel would monitor the stream for dying or distressed fish, or adverse changes in water quality. If the USFS determines that there were no adverse effects, even when in some cases they do not monitor immediately after the accident due to safety constraints, there is no requirement to report the misapplication or to conduct an emergency consultation (Redbook 2007). We recognize there are human safety issues with monitoring water quality and surveying for fish kills immediately after a misapplication. However, the lack of dead fish, even if monitored immediately after a drop, is a poor indication that the drop had no effect on fish in the area. It is possible, that under current monitoring guidelines, that a number of retardant drops into waterbodies may never be observed, and when they are observed by personnel there is a low likelihood that USFS employees would find a dead or distressed fish. Based on discussions with USFS, it would appear that water quality monitoring is only included in BAER reports if there is evidence that long term retardants entered the streams. Consequently, the number of misapplications reported to the National Interagency Fire Center and potential effects those misapplications caused may be underestimated by the USFS.

Conclusion

After reviewing the current status of GBCT, the environmental baseline for the action area, the effects of the proposed action, it is the Service's biological opinion that the project, as proposed, is likely to jeopardize the continued existence of the GBCT. Our conclusion is based upon the following: 1) the use of fire retardant on USFS lands according to the 2000 Guidelines can not ensure that no fire retardant would enter the limited habit of this species; 2) all four of the known populations of pure native GBCT essential for survival and recovery of the species occur on USFS lands in low-order streams most vulnerable to impacts from retardant drops; 3) misapplications of

retardant have been documented to occur at such a scale that could extirpate an entire native GBCT population, of which all are essential for the survival and recovery of the species; and 4) the documented lethal and sublethal affects of increased ammonia concentrations following small amounts of retardants entering aquatic systems. Because of these reasons, we do not believe the USFS has insured that the 2000 Guidelines and their continued use of fire retardants would not be likely to jeopardize the continued existence of GBCT. No critical habitat has been designated for this species; therefore, none will be affected.

Little Kern Golden Trout (*Oncorhynchus aguabonita whitei*)

The Little Kern golden trout is only found in the Little Kern River and its tributaries, and portions of Coyote Creek, a tributary of the Kern River, in the Sierra Nevada range. During the early part of the twentieth century they were eliminated from most of their habitat through hybridization with introduced rainbow trout (*Oncorhynchus mykiss*). As of 2007, the Little Kern Golden trout was known to occupy fewer than 50 miles of streams (S. Stephens, pers. comm.), approximately 40 miles of which are located within the Sequoia National Forest. Since 1983, the California Department of Fish and Game, the Sequoia National Forest and Sequoia National Park have conducted activities to restore approximately 100 miles of fish habitat (USFWS 2003). Although restoration activities has resulted in 100 miles of potential stream habitat, rainbow trout have continued to interbreed with Little Kern golden trout, effectively excluding pure Little Kern golden trout from over half of the restored watershed. (B. Beal, pers. comm.).

While the Little Kern golden trout is known to occupy approximately 50 miles of streams in California, there exist six self-sustaining, genetically pure subpopulations of Little Kern golden trout that provide the source for the genetic variation within the entire watershed (B. Beal, pers. comm.). The Sequoia National Forest contains each of these six pure subpopulations which occupy approximately 10 total miles of streams (S. Stephens, pers. comm.).

Little Kern golden trout are located in Sequoia National Forest within the designated Golden Trout Wilderness. Designated wilderness areas have different management prescriptions as compared to non-designated lands. Within wilderness areas, no active management is conducted to reduce the accumulation of fuels (P. Strand, pers. comm.) which, if ignited, may result in an intense wildfire. Within the Sequoia National Forest, the Golden Trout Wilderness contains approximately 150 miles of trails which provide public access and an increased risk of human-caused fires. In the event of a wildfire, fire retardant is expected to be used to assist in the suppression of wildfires (P. Strand, pers. comm.). Given the locations of Little Kern golden trout on Forest Service lands and the general size and scope of wildfires in California, it is likely that fire retardant would be used in areas occupied by this listed trout.

Even though the 2000 Guidelines restrict the application of long-term fire retardants to 300 feet from a waterway, the 2000 Guidelines do allow for exceptions to this restriction. One of the situations that allows for deviation from the 300-foot buffer is when alternative line construction tactics are not available due to terrain constraints. Because the areas occupied by the Little Kern golden trout are predominantly located in steep terrain, this area could be considered constrained by the terrain and thus more likely to have retardant dropped near waterways. Additionally, because the steep terrain affects the ability of a pilot to see the waterways, and the streams are not readily visible from the air, accidental drops in waterways are more likely, increasing the probability that fire retardant will come in contact with the streams.

Fire retardants and suppressant foams have been demonstrated to be highly toxic to trout species (Poulton *et al.* 1997). The toxic component of retardant chemicals in aquatic systems is ammonia (McDonald *et al.* 1996). When fire retardants initially enter a stream, there is an immediate spike in ammonia concentration in the receiving stream. For instance, when the fire retardant Phos Chek 259-F hits the surface of the water, it is 22.9% ammonia (Buhl and Hamilton 2000), resulting in mortality to fish species (Poulton *et al.* 1997).

Norris and Webb (1989) suggested that the toxic effects to fish can extend up to 10,000 meters (6.21 miles) downstream from where retardant enters the water, and depends on the volume of water to dilute the retardant, and turbulence of the stream.

Given that the streams inhabited by Little Kern golden trout are of limited size and flow, it is likely that the toxic effects of the retardant on fish will extend a large distance downstream. Because fire retardant has been demonstrated to be extremely toxic to trout species (Poulton *et al.* 1997), and no research has been conducted on the specific effects of fire retardant in the Little Kern River drainage, the Service anticipates the mortality of all Little Kern golden trout adults and juveniles for a distance of 6.21 miles downstream of the point of application of fire retardant.

There are only six genetically pure subpopulations of Little Kern golden trout, five of which are located entirely on Forest Service lands, while the sixth is located in Soda Spring creek and extends into Sequoia National Park (S. Stephens, pers. comm.). Since none of these subpopulations occupy a section of stream greater than 3 miles in length (Christenson 1984), we anticipate that if fire retardant were to be applied to any one of the locations, it is likely to lead to the loss of the entire subpopulation. While the likelihood of a retardant drop eliminating all fish in a given subpopulation is low, we anticipate that the reduction in numbers would be so great as to lead to the extirpation of the subpopulation.

The recovery of Little Kern Golden Trout is dependant on the removal of all rainbow trout and hybridized Little Kern Golden Trout within the Little Kern River drainage, and the recolonization of historically occupied habitat by self-sustaining, genetically pure Little Kern Golden Trout (Christenson 1984). Since 1983 the California Department of Fish and Game has taken part in the restoration and restocking of the historical Little Kern golden trout habitat within the Little Kern River drainage. As of 1996, 100 miles of stream had been restored as habitat for Little Kern golden trout (USFWS 2003). Although stocking efforts by the California Department of Fish and Game appeared to be successful in restoring trout, recent genetic testing determined that the fish used in the stocking program were not genetically pure leading to hybridized trout occupying over 50 miles of habitat (B. Beal pers. comm.).

Of the remaining habitat, approximately 35 miles are known to contain Little Kern golden trout with some rainbow trout ingression (Stephens 2007) and the six subpopulations occupy the additional 15 miles of streams. The genetic study conducted by Stephens (2007) showed that the majority of the extant Little Kern golden trout population contains a restricted genetic structure and low diversity that is likely a signature of restocking. Therefore the remaining genetically pure subpopulations provide the basis for genetically pure fish stock as well as genetic variation (B. Beal pers. comm.). As such, the Service considers that the loss of one subpopulation will appreciably reduce the genetic variability within the population.

Loss of genetic variation can ultimately impact population persistence by lowering the survival and fecundity of individuals and depressing population growth rates (Lacey 1997). A decrease in genetic

variability within a species has been observed to reduce a species' ability to respond to changes in its environment, thereby reducing the viability of the species as a whole (Primack 2006), which can increase the probability of extinction (Lacey 1997). Therefore the loss of one genetically pure subpopulation is likely to reduce the overall fitness of the species, by eliminating genetic diversity within the population, which in turn may reduce the ability of the Little Kern golden trout to maintain a self-sustaining population, or to expand in range.

Critical habitat encompasses the following segments of the Little Kern River, Tulare County, California: the main channel and all streams tributary to the Little Kern River above a barrier falls located on the Little Kern River one mile below the mouth of Trout Meadows creek. The streams included in the Little Kern River watershed determined to be Critical Habitat include sufficient area for individual and population growth and dispersal of the Little Kern golden trout. The pools in stream areas within the designated area are proper habitat for aquatic insects, which provide food for the trout. The cobbles and larger rocks provide cover for both juvenile and adult fish. The gravel bottom in pool areas of the Critical Habitat streams provides proper substrate for the excavation of nest. The Little Kern River is the only known habitat of the Little Kern golden trout.

The fire retardants proposed for use would degrade water quality such that it is toxic to macroinvertebrates and other forage species for the Little Kern golden trout. Application of these chemicals to vulnerable areas in Fig. 1, 2, or 3 would degrade the water quality necessary to support normal behavior, growth, and the viability of all life stages; and would temporarily eliminate living, foraging, and spawning areas supporting fish hosts. Given that the streams designated as critical habitat are of limited size and flow, it is likely that the toxic effects of the retardant on primary constituent elements will extend a large distance downstream. Because fire retardant has been demonstrated to be extremely toxic (Poulton *et al.* 1997), and no research has been conducted on the specific effects of fire retardant in the Little Kern River drainage, the Service anticipates the significant adverse effects to critical habitat would extend a distance of 6.21 miles downstream of the point of application of fire retardant. These impacts would diminish or eliminate the function and conservation role of the affected critical habitat for the Little Kern golden trout.

Conclusion

After reviewing the current status of the Little Kern golden trout, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is likely to jeopardize the continued existence of the Little Kern golden trout, and is likely to destroy or adversely modify designated critical habitat. The proposed action would lead to a substantial decline in number of the Little Kern golden trout, it would reduce the likelihood of the recovery of the Little Kern golden trout, and it would, for a critical period of time, impact the critical habitat's ability to function and serve the intended conservation role for the species. This conclusion is based on the following reasons: (1) the spatial extent of the anticipated effects is large in comparison to the species' current distribution in the action area; and (2) the loss of one genetically pure subpopulation would reduce genetic variability within the species as a whole which would appreciably reduce to ability of the species to recover.

Unarmored Threespine Stickleback (*Gasterosteus aculeatus williamsoni*) (UTS)

Populations of UTS on NFS land are found in Shay Creek in the San Bernardino National Forest, and Soledad and Bouquet Canyons in the Angeles NF. All three of these areas are highly susceptible to fire and fire retardant drops are likely due to the number of residences in the surrounding

communities. Although the drops are supposed to avoid aquatic systems by at least 300 feet, it is conceivable that a drop over any of these populations would be necessary to protect the scattered homes in the vicinity. If fire retardant reaches any of these watercourses, the UTS populations there could be severely affected due to the aquatic toxicity of the chemical. Each of these three UTS populations is distinguished by being both native occurrences and free of hybridization with armored species of *Gasterosteus aculeatus*. The loss of any of these native occurrences of genetic purity would interfere substantially with the species' recovery in the wild. Also, because the UTS populations are isolated and widely scattered, the loss any of these three populations could severely restrict the range of the UTS. In addition, the population of UTS in Shay Creek is known to be genetically distinct from the other UTS populations, so the loss of the UTS in Shay Creek alone could represent a loss of genetic diversity in the species and thus reduce appreciably the likelihood of the species' survival and recovery in the wild.

Conclusion

Due to the likelihood of these effects to occur as a result of fire retardant drop(s), we conclude that this activity would reduce appreciably the likelihood of the species' survival and recovery in the wild, and therefore is likely to jeopardize continued existence of UTS. Critical habitat has not been designated for this species, therefore none will be destroyed or adversely modified.

Owens Tui Chub (*Gila bicolor snyderi*) (OTC)

Three locations of OTC are present on NFS lands: Sotcher Lake, Owens River Gorge, and Little Hot Creek. The population in Sotcher Lake was likely introduced from the Hot Creek Fish Hatchery during trout planting, and is not considered necessary for the species' recovery (according to the Recovery Plan for the OTC). The populations in Little Hot Creek and Owens River Gorge should be protected by the 2000 Guidelines restriction on fire retardant drops remaining at least 300 feet from aquatic systems; however, a drop in either area is conceivable if certain conditions are met (e.g. threat to life and property). For this analysis, we assume that a fire retardant drop could occur.

Little Hot Creek Population: If a fire retardant drop does occur over Little Hot Creek, the OTC there could be extirpated. This is especially true because the water in Little Hot Creek is alkaline (pH of approximately 9, per Steve Parmenter, CDFG biologist, pers. comm. Jan. 24., 2008), as is much of the water in the upper Owens Basin. While the species is found in several other areas, most other populations are affected by hybridization with other species of tui chub; only five pure populations are known, including the Little Hot Creek population. This population is unique from in that is the largest, most robust, and genetically-diverse population of OTC in existence, and it is not currently threatened by hybridization as it is the most isolated population from other tui chub species. Lastly, the Little Hot Creek OTC population inhabits an area approximately 250 feet by 300 feet in size and it is highly susceptible to water problems both within its pond and from upstream. We would expect that a retardant drop on or upstream of the Little Hot Creek population of OTC would result in extirpation of this population, and thus would reduce appreciably the likelihood of the species' survival and recovery in the wild. The Little Hot Creek population is identified in the Recovery Plan as the population with the highest priority for protection to achieve downlisting and delisting.

Owens Gorge: The significance of the Owens Gorge population of OTC lies in the fact that it is one of two "relictual" populations of OTC in existence (i.e., a remnant of the original distribution). This population has not been subjected to hybridization and is one of the populations identified as needing protection to achieve downlisting and delisting of the OTC (per the Recovery Plan). The potential for impacts to this population are the same as those discussed above for the little Hot Creek population

(e.g. alkaline water, potential extirpation). Loss of this population due to a fire retardant drop would similarly reduce appreciably the likelihood of the species' survival and recovery in the wild.

Critical Habitat

Critical habitat was designated for the Owens tui chub (50 FR 31592) to include the following two areas of Mono County, California: (1) Owens River and 50 feet on each side of the river from Long Valley Dam downstream for a distance of 8 stream miles; and (2) a portion of Hot Creek and outflows, and those areas of land within 50 feet of all sides of the springs, their outflows, and the portion of Hot Creek. This area includes about 0.25 miles of stream and springs and about 5 acres of fronting land. The primary constituent elements essential for the conservation of the species include those habitat components that support feeding, sheltering, reproduction, and physical features for maintaining the natural processes that support these habitat components. Known constituent elements include high quality, cool water with adequate cover in the form of rocks, undercut banks, or aquatic vegetation, and a sufficient insect food base.

As described above, the Owens River and Hot Creek critical habitat units are located on Forest Service land. If a fire retardant drop does occur onto critical habitat, the primary constituent elements would be significantly impacted along a reach 6.25 miles or more in length. This is especially true because the water in the Owens River and Hot Creek is alkaline (pH of approximately 9, per Steve Parmenter, CDFG biologist, pers. comm. Jan. 24., 2008), as is much of the water in the upper Owens Basin. A fire retardant drop in combination with the alkalinity of the water would degrade water quality, impact aquatic vegetation and the insect food base such that the effected critical habitat would not support feeding, sheltering, and reproduction, and thereby disabling the critical habitat from fulfilling its role and function in the conservation of the Owens tui chub. The Hot Creek unit covers only about 0.25 miles (400 meters) of stream and it is highly susceptible to water problems both within the unit and from upstream. We would expect that a fire retardant drop on or upstream of the Hot Creek unit would temporarily eliminate adequate water quality, aquatic vegetation, and the insect food base throughout the critical habitat unit. Similarly, such a drop could temporarily eliminate adequate water quality, aquatic vegetation, and the insect food base throughout about 80% of the Owens River unit.

Conclusion

After reviewing the current status of the Owens tui chub, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is likely to jeopardize the continued existence of the Owens tui chub, and is likely to destroy or adversely modify Owens tui chub critical habitat.

Paiute cutthroat trout (*Oncorhynchus clarkii seleniris*)

Effects

The Silver King Creek drainage is located in the Carson-Iceberg Wilderness on the Humboldt-Toiyabe National Forest and is the only known historical habitat for the threatened Paiute cutthroat trout (*Oncorhynchus clarkii seleniris*). It contains the best habitat and largest, most genetically diverse population (U.S. Fish and Wildlife Service 2004). Paiute cutthroat trout currently occupy a combined total of approximately 11.5 miles of stream habitat in Silver King Creek (6.3 miles) above Llewellyn Falls (impassible) and in two isolated tributaries, Corral and Coyote Creeks (5.2 miles). However, the majority of the population occurs in only approximately 3 miles of Silver King Creek.

There are also four self-sustaining, genetically pure, introduced populations of Paiute cutthroat trout in the North Fork of Cottonwood Creek (3.4 miles) and Cabin Creek (1.5 miles) on the Inyo National Forest and Stairway (2 miles) and Sharktooth Creeks (2 miles) on the Sierra National Forest. However, the long-term survival of these out-of-basin populations is uncertain due to their small size, limited genetic diversity (Cordes *et al.* 2004), and no hydrologic connections to other Paiute cutthroat trout populations. The Recovery Plan (U.S. Fish and Wildlife Service 2004) provides that these out-of-basin populations will serve an important role in the recovery of Paiute cutthroat trout, mainly to protect against a catastrophic event within the Silver King Creek drainage, but also for restocking purposes within the subspecies' historical range once other threats have been addressed.

Fire retardants and suppressant foams are known to be toxic to aquatic species (Norris and Webb 1989; Gaikowski *et al.* 1996a, b; McDonald *et al.* 1996, 1997; Buhl and Hamilton 1998, 2000; Adams and Simmons 1999; Calfee and Little 2003; Wells *et al.* 2004). The toxic component of retardant chemicals in aquatic systems is ammonia (McDonald *et al.* 1996). When fire retardants initially enter a stream, there is an immediate spike in ammonia concentration. The peak of the spike and area affected depends on many factors, such as volume of retardant to hit the water, volume of water to dilute the retardant, and turbulence of the stream. Studies on the toxicity of fire fighting chemicals can be summarized by: 1) long-term fire retardants are considerably less toxic than most foaming and water-enhancing agents; 2) toxicity is likely to persist on the ground and may be released in rainwater runoff; 3) high organic soils rapidly decrease chemical persistence; 4) combustion appears to remove the toxicity of the chemicals; and 5) fish are capable of avoiding exposure if an avenue of escape is available (Little and Calfee 2002).

The 2000 Guidelines only restrict the application of long-term fire retardants to areas where water is visible, which means that many first, second and third order streams, such as Silver King Creek and its tributaries, would not be seen through the trees from the air and therefore would likely be exposed to long-term fire retardants without ever being monitored or the misapplications observed and reported. No fire personnel are charged with monitoring the application of fire retardant. Fire personnel only report a misapplication if they see it. Furthermore, it does not appear that the Forest Service monitors the cumulative use of retardants across the nation or the cumulative use over multiple Forests that overlap with individual listed species distributions. On fires over 300 acres, a Burned Area Emergency Rehabilitation (BAER) team conducts an analysis of the effects of fire, and at this point it would be expected that any misapplication that went unnoticed while fighting the fire would be discovered. The Forest Service provided the National Marine Fisheries Service (NMFS) a Misapplication List that notes there have been 11 observed misapplications of long-term fire retardant between 2001 and 2005 (NMFS 2007). NMFS revised this list and documented three additional incidents where retardant was applied to waterbodies (NMFS 2007). Based on the evaluation of the Forest Service's Misapplication List, even when an accidental application of long-term fire retardant is introduced to water, it appears that the Forest Service only monitors obvious physical effects of fires and fire retardant misapplication for fires greater than 300 acres.

Given the nature of the fire retardant program, the Forest Service does not know how frequently fire retardant enters water bodies containing endangered species, threatened species, or designated critical habitat, much less the precise fire retardant to which listed resources are exposed when a drop is observed entering waters containing listed species. Moreover, the Forest Service has no established procedures for post emergency monitoring of field conditions when fire retardants knowingly enter a waterway that would provide meaningful information on the direct and indirect effects of the retardant on water quality and listed species within the area, nor does the Forest Service necessarily conduct post emergency (follow-up) consultations.

Endangered and threatened species are among the many things the Forest Service must consider when making decisions under their fire suppression program. Consequently, while the 2000 Guidelines may help prevent exposure in some cases, they cannot prevent Paiute cutthroat trout from being exposed in all instances. As the number of fires increases along the eastern front of the Sierra Nevada Mountain Range, we expect that the number of times Paiute cutthroat trout are likely to be exposed to fire retardants will likely increase in the future. We believe it is also reasonable to expect that the exposure risk is likely to increase commensurate with the Forest Service's increasing use of fire retardants.

Conclusion

After reviewing the current status of the Paiute cutthroat trout, the environmental baseline for the action area, and the effects of the proposed action, we conclude that the proposed action would reduce appreciably the likelihood of the species' survival and recovery in the wild, and therefore is likely to jeopardize the continued existence of Paiute cutthroat trout. The Service bases this conclusion on the following: 1) The limited distribution of Paiute cutthroat trout within the Silver King Creek watershed and the four out-of-basin waters; 2) the small populations that currently exist; 3) the lack of connectivity among isolated headwater drainages which limits their ability to recolonize currently occupied areas if they become extirpated or are forced downstream of barriers to escape exposure to retardant; 4) the genetic material found in all current populations is needed for recovery; 5) the demonstrated inability of the Forest Service to fully implement the 2000 Guidelines, 6) the inaccuracy associated with dropping fire retardant chemicals from aircraft; and 7) the expected increase in wildfires and likely increase in use of fire retardants to fight those wildfires.

Santa Ana Sucker

Based on the studies described above regarding the effects of fire retardants on aquatic species, extensive mortality of the Santa Ana sucker could occur due to a fire retardant drop. Populations of Santa Ana suckers in the East, West, and North Forks of the San Gabriel River are likely to survive a retardant drop due to the multiple stretches of stream that are unlikely to be affected at once and the streamflow, which should help flush retardant. In addition, the Santa Ana sucker has a high reproductive rate; females can produce 4,000-16,000 eggs (65 FR 19686). Thus, this species has the potential to repopulate streams temporarily affected by a retardant drop.

However, the population of Santa Ana suckers in Big Tujunga Canyon in the Angeles National Forest could be particularly susceptible to negative effects due to a retardant drop into its habitat. Big Tujunga Canyon can dry in the late summer to early fall to the point that the Santa Ana sucker is restricted to about one mile of stream length (65 FR 19686). This restricted habitat makes this population especially susceptible to the negative effects of fire retardants and would allow for extended effects of fire retardants due to the limited streamflow. Since Big Tujunga Canyon is one of only three populations of the federally listed entity of the Santa Ana sucker, extensive mortality of this population would represent an appreciable reduction in the numbers and distribution of this species.

Based on the best available information, the primary constituent elements essential for the conservation of the Santa Ana sucker are the following:

- (1) A functioning hydrological system that experiences peaks and ebbs in the water volume reflecting seasonal variation in precipitation throughout the year;
- (2) A mosaic of loose sand, gravel, cobble, and boulder substrates in a series of riffles, runs, pools, and shallow sandy stream margins;
- (3) Water depths greater than 3 cm (1.2 in) and bottom water velocities greater than 0.03 m per second (0.01 ft per second);
- (4) Non-turbid water or only seasonally turbid water;
- (5) Water temperatures less than 30[deg]C (86[deg]F); and
- (6) Stream habitat that includes algae, aquatic emergent vegetation, macroinvertebrates, and riparian vegetation.

Based on the studies described above regarding the effects of fire retardants on aquatic species, extensive mortality of algae, aquatic emergent vegetation, and macroinvertebrates could occur due to a fire retardant drop, which would temporarily diminish or eliminate the suitability of stream habitat until sufficient dilution takes place and the aquatic species that comprise the stream habitat recover. The magnitude and extent of the potential impacts to stream habitat could significantly impact the function and role of critical habitat for the conservation of the species. Because the multiple stretches of stream habitat available in the San Gabriel River Unit are not likely to be impacted simultaneously, a fire retardant drop is unlikely to significantly impact the function and role of that unit for the conservation of the Santa Ana sucker. However, Big Tujunga Canyon can dry in the late summer to early fall to the point that the available stream habitat is restricted to about one mile of the Big Tujunga Creek unit. A fire retardant drop in this unit in late summer could impact the stream habitat so completely as to compromise its function and role in the conservation of the Santa Ana sucker.

Conclusion

Due to the likelihood of these effects to occur as a result of fire retardant drop(s), we conclude: that this activity would reduce appreciably the likelihood of the species' survival and recovery in the wild, and therefore is likely to jeopardize continued existence of Santa Ana suckers; and would reduce appreciably the function and role of the Big Tujunga Unit in the conservation of the Santa Ana sucker, and therefore is likely to destroy or adversely modify its critical habitat.

Amphibians

Mountain Yellow-Legged Frog (So Cal. DPS) *(Rana muscosa)*

Numerous fires have burned in or near mountain yellow-legged frog habitat in recent years. There is a strong possibility of additional fires and retardant drops near habitat in the future. City Creek within the San Bernardino National Forest burned over in 2003, and fire burned near the watershed in 2007. The San Jacinto Mountain populations within the San Bernardino National Forest are identified as being under threat from future wildfires (USFS 2002).

A retardant drop in or near mountain yellow-legged frog habitat has a high likelihood of resulting in mortality of this species. Based on the studies described above regarding the potential effects of fire retardants on aquatic species and the small sizes of populations (in some cases limited to a few pools), most or all of the mountain yellow-legged frogs in a given population could be lost due to a fire retardant drop.

The mountain yellow-legged frog may be especially susceptible to the effects of fire retardants due to the amount of time spent in the tadpole stage. It may take the mountain yellow-legged frog up to 3.5 years to morph from the tadpole stage (67 FR 44382). The loss of late stage tadpoles would be

especially destructive since they have lived a number of years and consumed local resources, but will not be able to contribute to future populations. Further, since mountain yellow-legged frogs can spend an extended timeframe in the tadpole stage, this species would not be able to escape the effects of a fire retardant drop into stream habitat, regardless of the timeframe of the drop.

In addition, mountain yellow-legged frog habitat can dry to the point that this species occurs in isolated pools. Retardant dropped in these pools could remain for an extended time due to the lack of streamflow. If a retardant drop occurred in these pools, the habitat could be contaminated for an extended timeframe with no flushing of the retardant downstream. Not only may the reproductive effort be destroyed, but the mountain yellow-legged frogs could lose access to food resources and cover from predators due to lack of access to the contaminated pools.

Finally, the mountain yellow-legged frog in southern California occurs in only eight small populations all within the San Bernardino and Angeles National Forests. The loss of even one population due to a fire retardant drop would be a significant effect to this species. Further, given the small population sizes, the loss of even one or a few frogs from a population could be a significant effect to this species.

Conclusion

In summary, the mountain yellow-legged frog is highly susceptible to the effects of fire retardants due to the toxicity of fire retardants to aquatic species, the potential for fires within habitat, the amount of time spent in the tadpole stage, the small numbers of remaining occurrences and the small numbers of frogs in each occurrence. Thus, a fire retardant drop in occupied mountain yellow-legged frog habitat is likely to result in an appreciable reduction in the distribution and reproduction of the southern California distinct population segment of this species. Therefore, we conclude that this activity would reduce appreciably the likelihood of the species' survival and recovery in the wild, and is likely to jeopardize its continued existence.

Critical Habitat.

Critical habitat for the mountain yellow-legged frog includes about 8,283 acres in three units including the San Gabriel Mountains Unit, the San Bernardino Mountains Unit, and the San Jacinto Mountains Unit. The San Gabriel Mountains Unit is within the Angeles National Forest and the San Bernardino Mountains and San Jacinto Mountains Units are within the San Bernardino National Forest. These units contains the essential features for the conservation of the species including space for individual and population growth and normal behavior; food, water, air, light, minerals or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species.

Primary Constituent Elements (PCEs): 1) Water source(s) found between 1,214 to 7,546 feet in elevation that are permanent. Water sources include, but are not limited to, streams, rivers, perennial creeks (or permanent plunge pools within intermittent creeks), pools (*i.e.*, a body of impounded water that is contained above a natural dam) and other forms of aquatic habitat. The water source should maintain a natural flow pattern including periodic natural flooding. Aquatic habitats that are used by mountain yellow-legged frog for breeding purposes must maintain water during the entire tadpole growth phase, which can last for up to 2 years. During periods of drought, or less than average rainfall, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but they would still be considered essential breeding habitat in wetter years. Further, the aquatic includes: a) bank and pool substrates consisting of varying percentages of soil or silt,

sand, gravel, cobble, rock, and boulders; b) open gravel banks and rocks projecting above or beneath the surface of the water for sunning posts; c) aquatic refugia, including pools with bank overhangs, downfall logs or branches, and/or rocks to provide cover from predators; and d) streams or stream reaches between known occupied sites that can function as corridors for movement between aquatic habitats used as breeding and/or foraging sites. 2) Riparian habitat and upland vegetation (*e.g.*, ponderosa pine, montane hardwood-conifer, montane riparian woodlands, and chaparral) extending 262 feet (80 meters) from each side of the centerline of each identified stream and its tributaries, that provides areas for feeding and movement of mountain yellow-legged frog, with a canopy overstory not exceeding 85 percent that allows sunlight to reach the stream and thereby providing basking areas for the species.

Fire retardant dropped into mountain yellow-legged frog designated critical habitat may stay for an extended timeframe. Mountain yellow-legged frog habitat frequently dries to the point that occurrences are in isolated pools with no flushing of retardant downstream. Further, based on the general effects of the action described above, it is unclear how long fire retardant may stay in a stream system.

A fire retardant application into mountain yellow-legged frog designated critical habitat would adversely affect water sources (PCE 1). Water sources and aquatic refugia may become unusable to the mountain yellow-legged frog until the fire retardant is flushed from the system. Not only may the frog lose reproductive opportunities, but they could lose access to food resources and cover from predators due to degradation of their habitat. Since mountain yellow-legged frogs are highly restricted in their distribution, highly aquatic, occur in very small numbers, and habitat can dry to isolated pools, contamination of their designated critical habitat by fire retardant could appreciably diminish the value of critical habitat for both the conservation and recovery of the mountain yellow-legged frog. Riparian habitat and upland vegetation (PCE 2) are not likely to be substantially affected by the use of fire retardant.

Conclusion

Due to the potential for these effects to arise from a fire retardant drop in designated critical habitat and appreciably diminish the function of designated critical habitat in providing for the conservation and recovery of the mountain yellow-legged frog, we conclude that this activity is likely to destroy or adversely modify designated critical habitat for this species.

REASONABLE AND PRUDENT ALTERNATIVE

The regulations (50 CFR 402.02) implementing section 7 of the Act define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) would, the Service believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

The USFS shall implement the following which, when added to the action as proposed, constitutes the Service's reasonable and prudent alternative to avoid jeopardizing the continued existence or destroying or adversely modifying the critical habitat of those species/critical habitats identified in

Table 3. If the USFS incorporates this reasonable and prudent alternative into their final decision, the alternative action would avoid the likelihood of jeopardizing the continued existence of listed species or destroying or adversely modifying critical habitat.

The USFS shall develop Service-approved species-specific measures prior to the fire season to be carried out before, during, and/or after fire emergency response for each National Forest in which the proposed action was found likely to jeopardized listed species or destroy or adversely modify critical habitat found in Table 3. The measures shall be developed in consultation between the Service and USFS supporting species listed in Table 3 and the appropriate local Service office. The measures shall include the following considerations:

1. USFS will coordinate with local Service offices each year prior to the onset of the fire season to ensure that 1) the most up-to-date detailed maps or descriptions of areas on USFS lands that are designated critical habitat or occupied by species found in Table 3, 2) this information is incorporated in local fire planning and distributed to appropriate resources by the local Fire Management Officer, 3) maps and information are made available to incident commanders and fire teams for the purposes of avoiding application of retardants to areas designated critical habitat or occupied by species found in Table 3, whenever possible, including use of best available technologies to avoid areas designated critical habitat or occupied by species found in Table 3, and 4) any other appropriate conservation measures are included to avoid the likelihood of jeopardizing species or adversely modifying or destroying critical habitat, such measures may include enhancement of populations or other appropriate contingency measures.
2. Wherever practical, the USFS shall prioritize fuels reduction projects for lands in the National Forest System that are in close vicinity to areas designated critical habitat or occupied by species listed in Table 3, so as to reduce the need to use aerially applied fire retardants.
3. Whenever practical, USFS will use water or other less toxic fire retardants than those described in the proposed action within areas designated critical habitat or occupied by species in Table 3.
4. If areas designated critical habitat or occupied by species found in Table 3 are exposed to fire retardant, then the USFS will initiate Emergency Consultation pursuant to regulations at 50 CFR 402.05 implementing section 7 of the Endangered Species Act of 1973, as amended (see “Incidental Take” section below). As part of the Emergency Consultation, the following measures may apply:
 - a. Conduct monitoring in coordination with the local Service office of the direct, indirect, and cumulative impacts of the fire retardant application on listed species. Service-approved monitoring protocols and reporting frequency shall be developed. Monitoring for aquatic species may include water quality.
 - b. If appropriate and in consultation with Service, include measures to prevent or compensate for population declines due to application of fire retardant.
 - c. During monitoring, all non-native plant species will be removed from areas of concern as appropriate for the area and listed species affected, as determined in consultation with the appropriate Service office. Appropriate weed control methods will be developed in coordination with the local Service office.

Because this biological opinion has found jeopardy and adverse modification of critical habitat, the USFS is required to notify the Service of its final decision on implementation of the reasonable and prudent alternative.

INCIDENTAL TAKE

The use of fire retardant depends on the size, scope, and location of future fire emergency responses. This biological opinion considered this uncertainty in the analyses determining whether the action is likely to jeopardize listed species or result in the adverse modification or destruction of critical habitat. However, as this is a programmatic biological opinion and due to the nature of this action, we are unable to estimate the amount or extent of incidental take that may occur as a result of the use of fire retardant on the National Forest System at this time. As the USFS implements their action in each National Forest, the USFS must work with local FWS offices to conduct local level stepped-down consultations to determine the amount or extent of incidental take and to obtain incidental take statements from the FWS. This biological opinion in no way limits the actions that an incident commander deems necessary to undertake during a fire emergency response. Therefore, at minimum, if fire retardant is used in the vicinity of listed species or critical habitat, the USFS must conduct consultation under the emergency procedures as stated in the regulations at 50 CFR 402.05. In addition, the USFS may conduct local level consultations on local-level practices and protocols for considering listed species before, during, and/or after fire emergency response.

REINITIATION STATEMENT

This concludes formal consultation on the proposed *Guidelines for Aerial Application of Fire Retardant and Foams in Aquatic Environments*. 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 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.

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Appendix A. 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways

Definition:

WATERWAY – Any body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life.

Guidelines:

Avoid aerial application of retardant or foam within 300 feet of waterways.

These guidelines do not require the helicopter or airtanker pilot-in-command to fly in such a way as to endanger his or her aircraft, other aircraft, or structures or compromise ground personnel safety.

Guidance for pilots: To meet the 300-foot buffer zone guideline, implement the following:

Medium/Heavy Airtankers: When approaching a waterway visible to the pilot, the pilot shall terminate the application of retardant approximately 300 feet before reaching the waterway. When flying over a waterway, pilots shall wait one second after crossing the far bank or shore of a waterway before applying retardant. Pilots shall make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant within the 300-foot buffer zone.

Single Engine Airtankers: When approaching a waterway visible to the pilot, the pilot shall terminate application of retardant or foam approximately 300 feet before reaching the waterway. When flying over a waterway, the pilot shall not begin application of foam or retardant until 300 feet after crossing the far bank or shore. The pilot shall make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant within the 300-foot buffer zone.

Helicopters: When approaching a waterway visible to the pilot, the pilot shall terminate the application of retardant or foams 300 feet before reaching the waterway. When flying over a waterway, pilots shall wait five seconds after crossing the far bank or shore before applying the retardant or foam. Pilots shall make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant or foam within the 300-foot buffer zone.

Exceptions:

1. When alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel, it is acceptable to anchor the foam or retardant application to the waterway. When anchoring a retardant or foam line to a waterway, use the most accurate method of delivery in order to minimize placement of retardant or foam in the waterway (e.g., a helicopter rather than a heavy airtanker).
2. Deviations from these guidelines are acceptable when life or property is threatened and the use of retardant or foam can be reasonably expected to alleviate the threat.
3. When potential damage to natural resources outweighs possible loss of aquatic life, the unit administrator may approve a deviation from these guidelines.

Threatened and Endangered (T&E) Species:

The following provisions are guidance for complying with the emergency section 7 consultation procedures of the ESA with respect to aquatic species. These provisions do not alter or diminish an action agency's responsibilities under the ESA.

Where aquatic T&E species or their habitats are potentially affected by aerial application of retardant or foam, the following additional procedures apply:

1. As soon as practicable after the aerial application of retardant or foam near waterways, determine whether the aerial application has caused any adverse effects to a T&E species or their habitat. This can be accomplished by the following:
 - a. Aerial application of retardant or foam outside 300 ft of a waterway is presumed to avoid adverse effects to aquatic species and no further consultation for aquatic species is necessary.
 - b. Aerial application of retardant or foam within 300 ft of a waterway requires that the unit administrator determine whether there have been any adverse effects to T&E species within the waterway.

These procedures shall be documented in the initial or subsequent fire reports.

2. If there were no adverse effects to aquatic T&E species or their habitats, there is no additional requirement to consult on aquatic species with Fish and Wildlife Service (FWS) or National Marine Fisheries Service (NMFS).
3. If the action agency determines that there were adverse effects on T&E species or their habitats then the action agency must consult with FWS and NMFS, as required by 50 CFR 402.05 (Emergencies). Procedures for emergency consultation are described in the Interagency Consultation Handbook, Chapter 8 (March, 1998). In the case of a long duration incident, emergency consultation should be initiated as soon as practical during the event. Otherwise, post-event consultation is appropriate. The initiation of the consultation is the responsibility of the unit administrator.

Appendix B (provided by the FS):

WILDLAND FIRE SITUATION ANALYSIS

Wildland Fire Situation Analysis (WFSA) is a decision-making process in which the Agency Administrator or representative describes the situation, establishes objectives and constraints for the management of the fire, compares multiple strategic wildland fire management alternatives, evaluates the expected effects of the alternatives, selects the preferred alternative, and documents the decision. The format and level of detail required is dependent on the specific incident and it's complexity. The key is to document the decision.

WFSA INITIATION

FIRE NAME

--

JURISDICTION(S)

--

DATE AND TIME INITIATED

--

VI. DECISION

The selected alternative is:

RATIONALE:

AGENCY ADMINISTRATOR SIGNATURE _____

DATE/TIME _____

I. WILDLAND FIRE SITUATION ANALYSIS	
--	--

A. JURISDICTION(S):	B. GEOGRAPHIC AREA:
----------------------------	----------------------------

C. UNIT(S):	D. WFSA #:
E. FIRE NAME:	F. INCIDENT #:
G. ACCOUNTING CODE:	
H. DATE/TIME PREPARED:	
I. ATTACHMENTS: <ul style="list-style-type: none"> <input type="checkbox"/> COMPLEXITY MATRIX/ANALYSIS¹ <input type="checkbox"/> RISK ASSESSMENT¹ <input type="checkbox"/> <i>PROBABILITY OF SUCCESS</i>¹ <input type="checkbox"/> CONSEQUENCES OF FAILURE¹ <input type="checkbox"/> MAPS¹ <input type="checkbox"/> DECISION TREE² <input type="checkbox"/> FIRE BEHAVIOR PROJECTIONS¹ <input type="checkbox"/> CALCULATIONS OF RESOURCE REQUIREMENTS¹ <input type="checkbox"/> OTHER (SPECIFY) <p>¹ Required ² Required by the USFS</p>	

Section II. Objectives and Constraints

The Agency Administrator completes this page.

- II.A. Objectives: Specify criteria that should be considered in the development of alternatives.

Safety objectives for firefighters, aviation, and public must receive the highest priority, Suppression objectives must relate to resource management objectives in the unit resource management plan.

Economic objectives could include closure of all portions of an area, thus impacting the public, or impacts to transportation, communication and resource values.

Environmental objectives could include management objectives for airshed, water quality, wildlife, etc.

Social objectives could include any local attitudes toward fire or smoke that might affect decisions on the fire, safety, etc.

Other objectives might include legal or administrative constraints which would have to be considered in the analysis of the fire situation, such as the need to keep the fire off other agency lands, etc.

- II.B. Constraints: List constraints on wildland fire action. These could include constraints to designated wilderness, wilderness study areas, environmentally or culturally sensitive areas, irreparable damage to resources or smoke management/air quality concerns. Economic constraints such as public and Agency cost could be considered here.

II. OBJECTIVES AND CONSTRAINTS

A. OBJECTIVES (must be specific and measurable):

1. *SAFETY:*

Public

Firefighter

2. *ECONOMIC:*

3. *ENVIRONMENTAL:*

4. *SOCIAL:*

5. *OTHER:*

B. CONSTRAINTS:

Section III. Alternatives

The FIRE MANAGER/and or INCIDENT COMMANDER complete(s) this page.

- III.A. Wildland Fire Management Strategy: Briefly describe the general wildland fire strategies for each alternative. Alternatives must meet resource management plan objectives.
- III.B. Narrative: Briefly describe each alternative with geographic names, locations, etc., that would be used when implementing a wildland fire strategy. For example, “Contain within the Starvation Meadows’ watershed by the first burning period”.
- III.C. Resources Needed: Resources listed must be reasonable to accomplish the tasks described in Section III.B. It is critical to also look at the reality of the availability of these needed resources.
- III.D. Estimated Final Fire Size: Estimated final size for each alternative at time of containment.
- III.E. Estimated Contain/Control Date: Estimates for each alternative shall be made based on predicted weather, fire behavior, resource availability and the effects of wildland fire management efforts.
- III.F. Cost: Estimate all fire costs for each alternative. Consider mopup, rehabilitation, and other costs as necessary.
- III.G. Risk Assessment: Probability of success/Consequences of failure: Describe probability as a % and associated consequences for success and failure. Develop this information from models, practical experience or other acceptable means. Consequences described will include fire size, days to contain, days to control, costs and other information such as park closures and effect on critical habitat. Include fire behavior and long-term fire weather forecasts to derive this information.
- III.H. Complexity: Assign the complexity rating calculated in the Guide for Assessing Fire Complexity.
- III.I. Maps: A map for each alternative must be prepared. The map shall be based on the “Probability of success/Consequences of Failure” and include other relative information.

III. ALTERNATIVES

	A	B	C
A. WILDLAND FIRE STRATEGY:			
B. NARRATIVE:			
C. RESOURCES NEEDED: HANDCREWS ENGINES DOZERS AIRTANKERS HELICOPTERS			
D. ESTIMATED FINAL FIRE SIZE:			
E. ESTIMATED CONTAIN/ CONTROL DATE			
F. COSTS:			
G. RISK ASSESSMENT: PROBABILITY OF SUCCESS/ CONSEQUENCES OF FAILURE			
H. COMPLEXITY:			

I. ATTACH MAPS FOR EACH ALTERNATIVE			

Section IV. Evaluation of Alternatives

The Agency Administrator(s), FMO and/or Incident Commander(s) completes this page.

IV.A. Evaluation Process: Conduct an analysis for each element of each objective and each alternative. Objective shall match those identified in section II.A. Use the best estimates available and quantify whenever possible. Provide ratings for each alternative and corresponding objective element. Fire effects may be negative, cause no change or may be positive. Examples are: 1) a system which employs a "-" for negative effect, a "0" for no change, and a "+" for positive effect; 2) a system which uses a numeric factor for importance of the consideration (soils, watershed, political, etc.) and assigns values (such as -1 to +1, -100 to +100, etc.) to each consideration, then arrives at a weighted average. If you have the ability to estimate dollar amounts for natural resource and cultural values this data is preferred. Use those methods which are most useful to managers and most appropriate for the situation and agency. To be able to evaluate positive fire effects, the area must be included in the resource management plan and be consistent with prescriptions and objectives of the Fire Management Plan.

Sum Of Economic Values: Calculate for each element the net effect of the rating system used for each alternative. This could include the balance of: pluses (+) and minuses (-), numerical rating (-3 and +3), or natural and cultural resource values in dollar amounts. (Again resource benefits may be used as part of the analysis process when the wildland fire is within a prescription consistent with approved Fire Management Plans and in support of the unit's Resource Management Plan.)

IV. EVALUATION OF ALTERNATIVES

A. EVALUATION PROCESS	A	B	C
<i>SAFETY</i>			
Firefighter			
Aviation			
Public			
Sum of Safety Values			
<i>ECONOMIC</i>			
Forage			
Improvements			
Recreation			
Timber			
Water			
Wilderness			
Wildlife			
Other (specify)			
Sum of Economic Values			
<i>ENVIRONMENTAL</i>			
Air			
Visual			
Fuels			
T & E Species			
Other (specify)			
Sum of Environmental Values			
<i>SOCIAL</i>			
Employment			
Public Concern			
Cultural			
Other (Specify)			
Sum of Social Values			

Section V. Analysis Summary

The Agency Administrator(s), FMO and/or Incident Commander(s) complete this page.

- V.A. Compliance with Objectives: Prepare narratives that summarize each alternative's effectiveness in meeting each objective. Alternatives that do not comply with objectives are not acceptable. Narratives could be based on effectiveness and efficiency. For example: "most effective and least efficient", "least effective and most efficient", "or "effective and efficient". Or answers could be based on a two-tiered rating system such as "complies with objective" and "fully complies with or exceeds objective". Use a system that best fits the manager's needs.
- V.B. Pertinent Data: Data for this section has already been presented and is duplicated here to help the Agency Administrator(s) confirm their selection of an alternative. Final Fire Size is displayed on page three, section III.D. Complexity is calculated in the attachments and displayed on page three, section III.H. Costs are displayed on page three, section III.F. Economic Values have been calculated and displayed on page four. Probability of Success/Consequences of Failure are calculated in the attachments and displayed on page three, section III.G.
- V.C. External and Internal Influences: Assign information and data occurring at the time the WFSA is signed. Identify the Preparedness Index (1 through 5) for the National and Geographic levels. If available, indicate the Incident Priority assigned by the MAC group. Designate the Resource Availability status. This information is available at the Geographic Coordination Center and needed to select a viable alternative. Designate "yes" indicating an up-to-date weather forecast has been provided to, and used by, the Agency Administrator(s) to evaluate each alternative. Assign information to the "other" category as needed by the Agency Administrator(s).

Section VI. Decision

Identify the alternative selected. Must have clear and concise rationale for the decision, and a signature with date and time. Agency Administrator(s) signature is mandatory.

V. ANALYSIS SUMMARY

ALTERNATIVES	A	B	C
<p>A. COMPLIANCE WITH OBJECTIVES:</p> <p>SAFETY</p> <p><i>ECONOMIC</i></p> <p><i>ENVIRONMENTAL</i></p> <p><i>SOCIAL</i></p> <p><i>OTHER</i></p>			
<p>B. PERTINENT DATA:</p> <p><i>FINAL FIRE SIZE</i></p> <p><i>COMPLEXITY</i></p> <p><i>COST</i></p> <p><i>RESOURCE VALUES</i></p> <p><i>PROBABILITY of SUCCESS</i></p> <p><i>CONSEQUENCES of FAILURE</i></p>			
<p>C. EXTERNAL/INTERNAL INFLUENCES:</p> <p><i>NATIONAL AND GEOGRAPHIC PREPAREDNESS LEVEL</i></p> <p><i>INCIDENT PRIORITY</i></p> <p><i>RESOURCE AVAILABILITY</i></p> <p><i>WEATHER FORECAST (LONG-RANGE)</i></p> <p><i>FIRE BEHAVIOR PROJECTIONS</i></p>			

Section VII. Daily Review

The Agency Administrator(s), or designate complete(s) this page.

The date, time and signature of reviewing officials are reported in each column for each day of the Incident. The status of Preparedness Level, Incident Priority, Resource Availability, Weather Forecast, and WFSA Validity is completed for each day reviewed. Ratings for the Preparedness Level, Incident Priority, Resource Availability, Fire Behavior, and Weather Forecast are addressed on page five, section V.C. Assign a “yes” under “WFSA Valid” to continue use of this WFSA. A “no” indicates this WFSA is no longer valid and another WFSA must be prepared or the original revised.

WFSA COMPLETION/FINAL REVIEW

THE SELECTED ALTERNATIVE ACHIEVED
DESIRED OBJECTIVES ON (DATE/TIME):

THE SELECTED ALTERNATIVE DID NOT
ACHIEVE THE DESIRED OBJECTIVES AND A
NEW WFSA WAS PREPARED ON (DATE/TIME):

AGENCY ADMINISTRATOR OR
REPRESENTATIVE SIGNATURE:

A GUIDE FOR ASSESSING FIRE COMPLEXITY

The following questions are presented as a guide to assist the Agency Administrator and staff in analyzing the complexity or predicted complexity of a fire situation. Because of the time required to assemble or move an Incident Management Team to a fire, this checklist should be completed when a fire escapes initial attack and be kept as part of the fire records. This document is prepared concurrently with the preparation of and attached to a new or revised Wildland Fire Situation Analysis. It must be emphasized that this analysis should, where possible, be based on predications to allow adequate time for assembling and transporting the ordered resources.

Use of the Guide:

- 1.** Analyze each element and check the response yes or no.
- 2.** If positive responses exceed, or are equal to, negative responses within any primary factor (A through G), the primary factor should be considered as a positive response.
- 3.** If any three of the primary factors (A through G) are positive response, this indicates the fire situation is or is predicted to be Type I.
- 4.** Factor H should be considered after all above steps. If more than two of these items are answered yes, and three or more of the other primary factors are positive responses, a Type I team should be considered. If the composites of H are negative, and there are fewer than three positive responses in the primary factors (A-G) a Type II team should be considered. If the answers to all questions in H are negative, it may be advisable to allow the existing overhead to continue action on the Fire.

GLOSSARY OF TERMS

Potential for blow-up conditions - Any combination of fuels, weather and topography excessively endangering personnel.

Threatened and endangered species - Threat to habitat of such species, or in the case of flora, threat to the species itself.

Smoke Management - Any situation which creates a significant public response, such as smoke in a metropolitan area or visual pollution in high-use scenic areas.

Extended exposure to unusually hazardous line conditions - Extended burnout or backfire situations, rock slides, cliffs extremely steep terrain, abnormal fuel situations such as frost killed foliage, etc.

Disputed Fire Management responsibility - Any wildland fire where responsibility for management if not agreed upon due to lack of agreements or different interpretations, etc.

Disputed fire policy - Differing fire policies between suppression agencies when the fire involves multiple ownership is an example.

Pre-existing controversies - These may or may not be fire management related. Any controversy drawing public attention to an area may present unusual problems to the fire overhead and local management.

Have overhead overextended themselves mentally or physically -
This is a critical item that requires judgment by the responsible agency. It is difficult to write guidelines for this judgment because of the wide differences between individuals. If, however, the Agency Administrator feels the existing overhead cannot continue to function efficiently and take safe and aggressive action due to mental or physical reasons, assistance is mandatory.

FIRE COMPLEXITY ANALYSIS

	Yes/No
A. FIRE BEHAVIOR: Observed or Predicted	
<ol style="list-style-type: none"> 1. Burning Index (from on-site measurement of weather conditions). Predicted to be above the 90% level using the major fuel model in which the fire is burning. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 2. Potential exists for “blowup” conditions (fuel moisture, winds, etc). 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 3. Crowning, profuse or long-range spotting. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 4. Weather forecast indicating no significant relief or worsening conditions. 	<input type="checkbox"/> <input type="checkbox"/>
Total	<input type="checkbox"/> <input type="checkbox"/>
 B. RESOURCES COMMITTED:	
<ol style="list-style-type: none"> 1. 200 or more personnel assigned. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 2. Three or more divisions. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 3. Wide variety of special support personnel. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 4. Substantial air operation which is not properly staffed. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 5. Majority of initial attack resources committed. 	<input type="checkbox"/> <input type="checkbox"/>
Total	<input type="checkbox"/> <input type="checkbox"/>
 C. RESOURCES THREATENED:	
<ol style="list-style-type: none"> 1. Urban interface. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 2. Developments and facilities. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 3. Restricted, threatened or endangered species habitat. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 4. Cultural sites. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 5. Unique natural resources, special designation zones or wilderness. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 6. Other special resources. 	<input type="checkbox"/> <input type="checkbox"/>
Total	<input type="checkbox"/> <input type="checkbox"/>
 D. SAFETY:	
<ol style="list-style-type: none"> 1. Unusually hazardous fire line conditions. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 2. Serious accidents or fatalities. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 3. Threat to safety of visitors from fire and related operations. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 4. Restrictions and/or closures in effect or being considered. 	<input type="checkbox"/> <input type="checkbox"/>
<ol style="list-style-type: none"> 5. No night operations in place for safety reasons. 	<input type="checkbox"/> <input type="checkbox"/>
Total	<input type="checkbox"/> <input type="checkbox"/>

- E. OWNERSHIP:** Yes/No
1. Fire burning or threatening more than one jurisdiction. ___ ___
 2. Potential for claims (damages). ___ ___
 3. Different or conflicting management objectives. ___ ___
 4. Dispute over fire management responsibility. ___ ___
 5. Potential for unified command. ___ ___
- Total ___ ___

- F. EXTERNAL INFLUENCES:**
1. Controversial wildland fire management policy. ___ ___
 2. Pre-existing controversies/relationships. ___ ___
 3. Sensitive media relationships. ___ ___
 4. Smoke management problems. ___ ___
 5. Sensitive political interests. ___ ___
 6. Other external influences. ___ ___
- Total ___ ___

- G. CHANGE IN STRATEGY**
1. Change in strategy (from lower to higher intensity management). ___ ___
 2. Large amounts of unburned fuel within planned perimeter. ___ ___
 3. WFSAs invalid or requires updating. ___ ___
- Total ___ ___

- H. EXISTING OVERHEAD:**
1. Worked two operational periods without achieving initial objectives. ___ ___
 2. Existing management organization ineffective. ___ ___
 3. Overhead/IMT overextended mentally and/or physically. ___ ___
 4. Incident actions plans, briefings, etc., missing or poorly prepared. ___ ___
- Total ___ ___

Signature	
Date	Time

WFSA INSTRUCTIONS

Section I. WFSA Information Page

The Agency Administrator completes this page.

- I.A. Jurisdiction(s): Assign the agency that have or could have fire protection responsibility, e.g., USFWS, Forest Service, BLM, etc.
- I.B. Geographic Area: Assign the recognized “Geographic Coordination Area” in which the fire is located, e.g., Northwest, Northern Rockies, etc.

Unit: Designate the local administrative unit, e.g., Hart Mountain Refuge Area, Flathead Indian Reservation, etc.
- I.C. WFSA #: Identify the number assigned to the most recent WFSA for this fire.
- I.D. Fire Name: Self-explanatory.
- I.E. Incident Number: Identify the agency number assigned to the fire, e.g., BOD 296, BNF 001.
- I.F. Accounting Code: Insert the local unit’s accounting code.

Date/Time Prepared: Self-explanatory.
- I.G. Attachments: Check here to designate attachments used in the completion of the WFSA.
- I.H. “Other” could include data or models used in the development of the WFSA. Briefly describe the “other” items used.
- I.I.

Appendix C. “Effects of the Action” analyses supporting our biological opinion that the proposed action is not likely to jeopardize the continued existence of the following listed species or destroy or adversely modify their critical habitat.

PLANTS

McDonald's rockcress (*Arabis mcdonaldiana*)

This wide-ranging species occurs in Oregon and California. Four to five populations are known to occur in Oregon on Forest Service-administered land in Curry County. In Oregon, the populations are at least three miles apart. Within California, this plant occurs in 27 populations in Del Norte County and several in Mendocino County.

National Forests: Six Rivers, Klamath, Siskiyou

Effects

Literature specific to the effects of retardant on *Arabis macdonaldiana* is not available. A literature review on the effects of fire retardant on plants in general was completed in October 2007 (Kirschbaum 2007). Based on a review of the best available scientific literature, most plants are not directly affected by this action. However, two studies (Larson and Duncan 1982, Bradstock et al 1987) have shown high mortality in leguminous shrubs and forbs after retardant application. *Arabis macdonaldiana* is not a member of the legume family so these studies have little relevance here.

Other studies have indicated that, indirectly, retardant can affect plant communities and rare plants by facilitating the invasion of non-native species (Bell 2003, Larson and Newton 1996). Literature specific to serpentine environments note that few weeds occupy undisturbed ultramafic outcrops even when ample bare ground is available (Kruckeberg 1992). As noted above soils associated with *Arabis macdonaldiana* habitat are relatively enriched in various toxic metals, including nickel, magnesium, barium, and chromium; they are also lacking in important nutrients. This infertility discourages invasive non-native species. Of 211 invasive non-native weed sites on Six Rivers National Forest recorded in Del Norte County, none are located within occupied sites of *Arabis macdonaldiana*. The closest known invasive non-native weed site occurs on an existing road 200 meters from occupied *Arabis macdonaldiana* habitat.

Retardant application can also affect plant communities and rare plants indirectly by attracting more herbivore and browsers to an application site (Larson and Duncan 1982), presumably because of the increased quality of the forage or an increase of biomass. Increases in biomass (Bell 2003, Larson and Newton 1996, Larson and Duncan 1982), and decreased plant diversity (Larson and Newton 1996, Bradstock et al 1987) have also been noted in the literature but these effects may only last for one year (Bell 2003, Larson and Newton 1996). As noted above, *Arabis macdonaldiana* habitat is often discontinuous, rocky islands surrounded by shrub dominated forest types. Nutrient poor ultramafic soils underlying the Jeffrey pine stands are not productive and thus growth of woody material is slow. The short term effects of fire retardant are unlikely to increase forage within serpentine barrens to a level that would attract herbivores.

The geographic range of *Arabis macdonaldiana* is approximately 1,151,000 acres containing 45 to 55 E.O.s. The total count of ramets across this geographic range is approximately 9600 to 13700. The occurrences are isolated due to the species' preference for a naturally fragmented habitat type (ultramafic barrens). Although the potential for take of individuals exists, within this broad geographic range it is unlikely that retardant use from a specific fire event would be

extensive enough to affect populations to the extent that the continued existence of the species would be in jeopardy. Under a hypothetical worst case scenario a drop could occur on an E.O. with fewer than 12 individuals when plants are actively growing that could lead to the extirpation of the site.

It is unknown whether some aspect of the species biology or the critical nature of a specific population would be compromised by exposure to fire retardant. However, there are aspects of its biology and habitat characteristics that would lessen any potential effects of fire retardant on *Arabis macdonaldiana*. Due to relatively early dormancy, it is likely that *Arabis macdonaldiana* would be dormant when it comes into contact with fire retardant. *Arabis macdonaldiana* flowers in May through June (Munz and Keck 1959). Fruiting occurs June through July (USDA 2001). After fruiting, above ground portion of plants shrivel and die back in late July - early August and the plants persist in a dormant state underground until revived by ground soaking rains the following spring. Fire history records collected between 1910 and 1996 show that 60% of the fires occur after August 1st when the plants are dormant. This data indicates that there is an increased likelihood that fires and the resultant use of retardant will occur when *Arabis macdonaldiana* is dormant and in a state that affords protection from both fire and potential retardant toxicity.

Additionally, some protection of *Arabis macdonaldiana* is afforded by habitat elements, particularly permeable soils and high rainfall. The species occurs on serpentine soils that are well-drained, shallow loams, gravelly loams and very gravelly sandy loams, with very low water holding capacity (Jimerson 1995). Rainfall in the heart of the species range in Del Norte County, where 29 of the 45 to 55 E.O.s are found, exceeds 90 inches per year. This increases the likelihood that water soluble compounds in fire retardant would be flushed from serpentine topsoils by this substantial rainfall and not persist into the following growing season resulting in only short term affects.

Monitoring results performed by Six Rivers N.F. across Del Norte County, California indicate that the species is stable throughout this portion of its range which includes 29 E.O.s. Monitoring was performed in 2003, one year after the Biscuit Fire burned 29,000 acres in the heart of the species range. Eight E.O.s were visited when the species was in bloom and most easily recognizable. Five of the E.O.s visited were within the range of the Biscuit Fire. In general, fire severity was high throughout areas visited resulting in the death of all trees and the charring of shrubs to their bases, although a high percentage of shrubs were vigorously re-sprouting by May of 2003. Effects of the fire on ARMA occurrences varied, but in all areas sampled within the fire, mortality of *Arabis macdonaldiana* was low and few individuals appeared to have burned. Fire affects were likely benign due to the scarcity of fuels within the barren habitat and the late season timing of the fire when *Arabis macdonaldiana* was dormant. It is possible that fire suppression efforts also contributed to low mortality. Aside from the fire, habitat appeared undisturbed in all but Diamond Creek. In this area shrub cover had apparently increased substantially since former 1983 inventories, perhaps due to fire suppression. Although retardant was used numerous times (number of drops unknown) it is unknown if any *Arabis macdonaldiana* came into contact with retardant.

The likelihood of a retardant dump occurring where *Arabis macdonaldiana* occurs, within suitable habitat, or within its geographic range.

Fire tends to burn in a mosaic, more so where high variability of vegetation types and low continuity of cover exists across the landscape as is found within the range of *Arabis macdonaldiana*. The Biscuit Fire burned over 28,000 acres on the Smith River National Recreation Area on Six Rivers National Forest in 2002. Severity mapping of the Biscuit Fire showed that 80% of the area burned with low to moderate severity as is characteristic of fires burning in outcrops and bouldery serpentine barrens, Jeffrey pine woodlands and shrub dominated areas of low vegetative cover and high bare soil and surface rock cover. *Arabis macdonaldiana* is an early successional species that is a poor competitor and as such it is likely that they would respond favorably to low to moderate severity fires that reduce competition.

As noted above habitat for *Arabis macdonaldiana* is primarily associated with ultramafic (i.e. serpentinized peridotite) barren or scree slopes and to a lesser extent in the Jeffrey pine/Idaho Fescue plant association where it can be found growing in bare to gravelly patches. Nutrient poor ultramafic soils underlying the Jeffrey pine stands are not productive and thus growth of woody material is slow. In the dry Jeffrey pine savannah, where many serpentine endemics are found, fuel accumulation is minimal and thus fire intervals may be naturally long (Atzet and Martin 1991).

It is important to note the difference between the Jeffrey pine/Idaho Fescue type noted above where fuel can accumulate and contribute to a fire intense enough to kill live trees and the tops of shrubs and the gravelly serpentine barren type where there is little to no fuel to create hotspots or result in fast moving fires. Since retardant is applied to reduce the intensity and slow the spread of fire, serpentine barrens would be unlikely targets and drops made therein are more adapt to be inadvertent and less frequent. However, unintended drops could occur on occupied sites resulting in the take of some individuals due to chemical toxicity. Under a worse case scenario a site with very few individuals, as noted above, could be extirpated. It should be noted that extirpation of an E.O. with very few individuals (two sites in Del Norte County have less than 13 individuals) is highly speculative as no data exists to support this outcome.

Indirect Effects: Fire Suppression - Frequent low-to-moderate severity fire is one of the more important ecological processes in the Klamath Province. In the dry Jeffrey pine savannah, where many serpentine endemics are found, fuel accumulation is minimal and thus fire intervals may be naturally long (Atzet and Martin 1991). The influence of fire suppression on rare early successional species in both dry upland serpentine habitats and serpentine wetland habitats, which have evolved under long fire return intervals, is not as clear cut as it is in communities where biomass production and litter accumulation is higher. Instances have been noted where encroaching shrubs and trees have resulted in downward population trends in some E.O.s in *Arabis macdonaldiana* habitats where fuel accumulation is not minimal as in the Diamond Creek site noted above and within a knobcone pine stand at Red Mountain, Mendocino County population (USDI 2002). In general, fire suppression has the potential to both adversely affect *Arabis macdonaldiana* as a result of its effect in maintaining the existing overstory or shrub canopies, as well as benefit *Arabis macdonaldiana* by reducing fire intensity in cases where the burn severity is adequate to cause death of the plant.

Cumulative Effects: Cumulative effects of fire suppression, mining, and human uses on State and private lands may include take of individuals but because a significant portion (over 90%) of the *Arabis macdonaldiana* population is found on Federal lands, take of those on State or private lands would not threaten the continued existence of the species.

Conclusion

It is our biological opinion that the aerial application of fire retardant, as proposed, is likely to adversely affect McDonad's rockcress. It is our biological opinion that the aerial application of fire retardant, as proposed, is not likely to jeopardize the continued existence of McDonald's rockcress.

Fire suppression in general could indirectly affect *Arabis macdonaldiana*, both beneficially, through a reduction in fire severity, or detrimentally, by preventing the removal of competing vegetation. The likelihood of direct application of retardant on top of *Arabis macdonaldiana* cannot be predicted. Partial or complete burial of the plant could have negative effects depending on the degree of burial.

Sacramento prickly poppy (*Argemone pleiacantha ssp. pinnatisecta*)

Effects Analysis

Sacramento prickly poppy grows in steep rocky canyons in habitats that may include arid canyon bottoms, dry terraces above riparian areas, and along streams, springs, and seep areas. Plants also occur in areas of human disturbance such as roadsides, pipeline rights-of-way, and old fields. Sites that collect surface water are considered favorable for seedling establishment. The surrounding plant communities vary from desertscrub up to ponderosa pine forest; the elevation range is 1,280-2,150 m (4,200-7,100 ft).

Sacramento prickly poppy historically occurred in 10 canyons on the western slope of the Sacramento Mountains. The entire range is estimated to be about 230 square km (90 square mi). The plant has declined in recent years due to drought. There were 425 plants in 6 canyons in 2004 with 90 percent of the plants in the connecting Alamo/Caballero canyon system.

No non-native invasive plants have been identified as a problem in the Sacramento prickly poppy's habitat.

Most of the habitat of Sacramento prickly poppy is in an area with low probability for use of fire retardants. The vegetation is desertscrub, grassland, and sparse pinyon-juniper woodland. However, plants at the upper end of Alamo Canyon are in Ponderosa pine forest and due to the risk to the Town of Cloudcroft and other private-land developments, any fire in this area will be fought aggressively with retardants. Most retardant use would be in forests at the upper end of the Alamo Canyon watershed above the area occupied by Sacramento prickly poppy.

Conclusion

After reviewing the current status of the Sacramento prickly poppy and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Sacramento prickly poppy. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based on the following: 1) most of the habitat of Sacramento prickly poppy is in plant communities where fire retardants are unlikely to be used, and; 2) plants in Alamo Canyon are likely to have fire retardants applied just above occupied habitat and retardants are likely to wash into occupied habitat, but there are no non-native invasive plants that are likely to increase in Sacramento prickly poppy habitat as a result of this retardant. Due to the low potential for fire retardant use in much of the Sacramento prickly poppy's habitat, and the general absence of non-native invasive plants in the habitat, we determine that the use of fire retardant is not likely to jeopardize the existence of Sacramento prickly poppy.

Applegate's milk-vetch (*Astragalus applegatei*)

No known populations of Applegate's milk-vetch occur on or near National Forest System land. All known populations of the species occur more than 10 miles away from National Forest System lands.

Braunton's milk-vetch (*Astragalus brauntonii*)

This species does not occur on or near any National Forest System lands.

Deseret Milkvetch (*Astragalus desereticus*)

Effects Analysis

The proposed action is expected to have no impacts to the Deseret milkvetch. Only one population of the species is known to exist. This population is located on Utah State lands on the outskirts of the town of Birds Eye, Utah County, Utah (Franklin 2008). Deseret milkvetch grows in a sparsely vegetated pinyon-juniper habitat type on sandy-gravelly soils. Discussions with state, forest and regional USFS resource specialists indicate that despite extensive surveys of suitable habitat on Forest Service lands, no Deseret milkvetch populations or individuals have been found (Hubbard 2008, Player 2008, Prendusi 2008).

Conclusion

After reviewing the current status of the Deseret milkvetch and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Deseret milkvetch. No critical habitat has been designated for this species; therefore, none will be affected. We base our conclusion on the fact that the Deseret milkvetch is not known to occur on Forest Service lands, and therefore will not be exposed to fire retardant drops.

Coachella Milk-vetch (*Astragalus lentiginosus var. coachella*)

The Coachella milk-vetch is not on and is not near any National Forest System lands where we would anticipate a fire retardant drop.

Heliotrope Milkvetch (*Astragalus montii*)

Effects Analysis

The proposed action is expected to have no impacts to the Heliotrope milkvetch. This species occurs in shale barrens surrounded by alpine/sub alpine Cushion plant and Krumholz communities, between 10,004 ft and 10,988 ft in elevation (Cronquist et al. 1989). The entire distribution consists of three populations totaling approximately 200,000 plants within an eight mile range managed by the Manti LaSal NF in Utah county (CPC 2008).

The closest retardant drop previously occurred approximately 1 mile away from known Heliotrope milkvetch populations (Player and Hubbard 2008). Habitat for the Heliotrope milkvetch (sparsely vegetated shale barrens) does not support fuel loading that would carry a fire. Discussions with state, forest resource specialists and fire personnel indicate the potential for retardant drop, even near the population, is extremely low.

Conclusion

After reviewing the current status of the Heliotrope milkvetch and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Heliotrope milkvetch. We base our conclusion on the fact that the habitat within which the species occurs does not support a fuel load that would carry a fire and be subject to a retardant drop. No critical habitat has been designated for this species; therefore, none will be affected.

Osterhout milkvetch (*Astragalus osterhoutii*)

Effects Analysis

The proposed action is not expected to adversely affect the Osterhout milkvetch. The species occurs in scattered populations across a 15-mile range in Grand County, Colorado. An estimated 25,000 to 50,000 Osterhout milk-vetch plants occur in two general areas: 90 percent occur in the vicinity of Muddy Creek, and the remaining 10 percent occur on the eastern and western extremities of the range at Troublesome and Red Dirt Creek (a tributary to Muddy Creek)(54 Federal Register 29658; Service 1992). The majority of the two populations occur on land owned by the Bureau of Land Management, but significant colonies also occur on private and State lands. We are not aware of any populations on USFS lands, which are a considerable distance from any known population. Because it is unlikely that the species is present on USFS lands, retardant use on USFS lands is not expected to adversely affect the Osterhout milkvetch.

Conclusion

After reviewing the current status of the Osterhout's milkvetch and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Osterhout's milkvetch. Our

conclusion is based the fact the species is not known to occur on USFS lands. No critical habitat has been designated for the species; therefore, none will be affected by the proposed action.

Encinitas Baccharis (*Baccharis vanessae*)

A single population of this plant is known from the Cleveland National Forest in the Santa Margarita. This population represents less than 10 percent of the known populations of this species. The other populations are covered under San Diego Multi-Species Conservation Plan, quite distant from USFS lands. Given the fire-following habit of the plant, i.e. may benefit from the mineral stimulation of fire-generated ash, and the fertilization effect of the retardant, we conclude that this plant may be affected, but is not likely to be adversely affected by aerial retardant application on National Forest System lands.

California Jewelflower (*Caulanthus californicus*)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) indicated 46 occupied occurrences for this species in Fresno, Kern and Tulare Counties (CNDDDB 2007). Two of these occurrences are on National Forest System lands (Los Padres National Forest) and two are adjacent to Forest System lands.

Direct, Indirect, and Cumulative Effects

California jewelflower is an annual herb that blooms from February to late May, thus the plant reproductive period is complete before typical fire season begins (mid June through October). There are no specific data on potential effects of fire retardants to this species.

A primary threat to California jewelflower is loss of habitat, but competition from non-native plants is listed as a secondary threat (USFWS 2008). Given that fire retardant is in essence a fertilizer, if a retardant drop were to occur on a jewelflower population, non-native plants in the area could increase in size and number, thus increasing the competition pressure. The California jewelflower seems to occur in soils with low nitrogen levels in situations where few other plants can do well, because of the lack of nitrogen (B. Delgado, botanist, Bureau of Land Management, pers. comm.). Fire retardant is expected to increase levels of nitrogen which can enhance environmental conditions for invasive non-native species (Hopmans and Bickford 2003) that may out-complete jewelflower for water, nutrients, or other resources. Prevalent non-native grasses in the genera *Bromus*, *Avena*, and *Schismus* are known to have invaded jewelflower habitat (USFWS 1998; Lewis 2003). Therefore, if retardant were dropped on California jewelflower, we would expect increase competition from non-native plants that would likely reduce population numbers and reproductive efforts of jewelflowers in that area.

Conclusion

After reviewing the current status of the California jewelflower, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of California jewelflower. The proposed action would not lead to a substantial decline in number of

jewelflower, a substantial reduction in range of jewelflower, and it would not preclude the recovery of jewelflower. This conclusion is based on the following reasons: (1) the spatial extent of the species outside the proposed action area is large; and (2) the likelihood of any single population on Forest Service lands being hit by a retardant drop is extremely low.

Sacramento Mountains thistle (*Cirsium vinaceum*)

Effects Analysis

Sacramento Mountains thistle is an obligate riparian species that is restricted to travertine springs and their outflow creeks at elevations of 2,300-2,900 m (7,500-9,500 ft) in the Sacramento Mountains. The springs are in meadows or at the edges of mixed conifer forests. Plants occur at about 90 sites, but these are small with perhaps not more than 40 ha (100 ac) of total occupied habitat. The total number of plants is about 350,000-400,000 with many of these plants in small dense colonies. The range of Sacramento Mountains thistle is about 37 km (23 mi) north-south and about 10.5 km (6.5 mi) east-west for a total area of about 390 sq km (150 sq mi).

Non-native invasive plants are a threat to Sacramento Mountains thistle. Teasel (*Dipsacus sylvestris*) and musk thistle (*Carduus nutans*) have invaded some Sacramento Mountains thistle sites. These weeds occupy slightly drier sites than Sacramento Mountains thistle, so they have not invaded Sacramento Mountains thistle's core wetland habitat at spring sources.

The likelihood of fire retardant use in or near Sacramento Mountains thistle habitat is very high. The Sacramento Mountains are a matrix of private and public lands with numerous developments.

Conclusion

After reviewing the current status of the Sacramento Mountains thistle and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Sacramento Mountains thistle. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based on the following: 1) the 90 sites for Sacramento Mountains thistle are separated widely enough that only a few of them are likely to be affected by retardant applications during any one fire; 2) most of the 90 sites are in mountain meadows or in clearings at the edge of forests so retardants are unlikely to be applied directly on the sites, and; 3) Sacramento Mountains thistles grow in spring fed wetlands in dense colonies that exclude most other plants; non-native invasive plants that already occur in the area have not invaded this core habitat so it appears unlikely they will do so even if retardants are applied. Due to low likelihood of fire retardants affecting more than a few Sacramento Mountains thistle sites during any one fire, the likelihood that retardants will not be applied directly on the sites, and the dense growth of the Sacramento Mountains thistle colonies that exclude other vegetation, including non-native invasive species, we determine that the use of fire retardant is not likely to jeopardize the existence of Sacramento Mountains thistle.

Springville Clarkia (aka Springville Fairy Fan) (*Clarkia springvillensis*)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) showed 18 occurrences for this species in Tulare County: 17 in the Tule Watershed and one in the Kaweah River Watershed (CNDDDB 2007). Ten of these occurrences are on Forest Service lands (Giant Sequoia National Monument).

Direct, Indirect, and Cumulative Effects

Springville clarkia flowers from May to late June, thus the plant is active during times when fire retardant may be used (mid June to October). There is no specific data on potential effects of fire retardants to this species.

Springville clarkia tends to grow in open, relatively unvegetated areas. Several of these populations cover long, linear areas (approximately 0.25 to 1 mile in length and 300 feet wide), parallel and adjacent to streams. Being adjacent to a stream, these locations have a reduced probability of a retardant drop hitting a population due to the 300-foot buffer zone guidelines. However, if a retardant drop was keyed into a water course adjacent to a Springville Clarkia population, it is highly unlikely that the entire population would be hit by the retardant because of the long, linear nature of these populations; rather a small portion of a population may be affected.

The primary threat to Springville clarkia is competition and thatch build-up from non-native plants (USFWS 2008). Fire retardant is expected to increase levels of nutrients (Hopmans and Bickford 2003) which can enhance environmental conditions for invasive non-native species that may out-complete clarkia for water, nutrients, or other resources. Therefore, if retardant were dropped on clarkia, we would expect increase competition from non-native plants that may reduce population numbers and reproductive efforts of clarkia in that area.

Conclusion

After reviewing the current status of the Springville clarkia, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of Springville clarkia. The proposed action would not lead to a substantial decline in number of clarkia, a substantial reduction in range of clarkia and it would not preclude the recovery of clarkia. This conclusion is based on the following reasons: (1) the spatial extent of the species outside the proposed action area is large; (2) the likelihood of an entire population being affected by retardant is extremely low; and (3) the potential effects to the species would be minor.

Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*)

Effects Analysis

The range of Pima pineapple cactus is from Tucson, Arizona, southward to northern Sonora, Mexico. The range extends about 70 km (45 miles) east to west and 80 km (50 miles) north to south. Plants are unevenly distributed within this range, but exist in at least 21 somewhat poorly defined populations. Plants on National Forest System lands occur on the Nogales and Sierra

Vista ranger districts of the Coronado National Forest. These populations are somewhat disjunct from the main distribution to the north and they represent only a very minor part of the species' distribution and abundance.

Pima pineapple cactus grows in desert grasslands and Sonoran desertscrub. The introduction of non-native grasses, principally Lehmann lovegrass (*Eragrostis lehmanniana*) and buffelgrass (*Pennisetum ciliaris*), into these habitats for rangeland improvement has drastically altered fire regimes. These grasses both produce abundant fine fuels that have greatly increased the frequency and intensity of fire to the detriment of many non-fire adapted desert plants, including Pima pineapple cactus. Lehmann lovegrass and buffelgrass both regenerate vigorously under the fire regime they promote. It is estimated these grasses affect up to 75 percent of Pima pineapple cactus habitat.

The use of fire retardants may promote more vigorous growth of Lehmann lovegrass and buffelgrass, but it is unlikely to promote its encroachment into more Pima pineapple cactus habitat because that habitat is largely already occupied by these grasses. Further, these two grasses will likely regenerate just as vigorously when burned as when treated with fire retardants.

Fire retardants are seldom used to control fires in southern Arizona desert grasslands or desertscrub unless needed to protect resources such as urban interface, developments, or facilities. No such resources exist in the general vicinity of the Pima pineapple cactus populations on National Forest System lands so the likelihood of fire retardant applications is low.

Conclusion

After reviewing the current status of the Pima pineapple cactus and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Pima pineapple cactus. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based on the following: 1) the species has a fairly wide distribution in southeastern Arizona; 2) the abundance of the species on National Forest System lands where it could be affected by the proposed action is only a tiny fraction of the overall abundance of the species, and; 3) fire retardants are unlikely to be used in the habitats where Pima pineapple cactus occurs on National Forest System lands. Due to the small representation of Pima pineapple cactus on Forest Service lands and the low potential for fire retardant use, we determine that the use of fire retardant is not likely to jeopardize the existence of Pima pineapple cactus.

Santa Monica Mountains Dudleya (*Dudleya cymosa* ssp. *Ovatifolia*)

One population of *D.c.* ssp. *ovatifolia* is known to occur on the Cleveland National Forest on Modjeska Peak, where up to 500 individual plants have been observed. A fire retardant drop could reach this population due to the proximity of residential development; however, the majority of the populations occur on private or other public lands outside of NF Lands and would not be subject to retardant drops by the USFS. The habitat for this species is described in the Recovery Plan (Service 1999) as “exposed, dry habitats” and “shaded slopes and canyon bottoms

on sedimentary conglomerate rock.” Because *D.c. ssp. ovatifolia* grows on rocky habitat where other vegetation is not likely to become established, increased competition from other plant species is not likely to result from chemical retardant drops. Also, because other plants are not likely to increase in density in the habitat of *D.c. ssp. ovatifolia*, we do not expect an increase in grazing or browsing animals to be a threat resulting from fire retardant drops. Lastly, *D.c. ssp. ovatifolia* is not a legume, so it would not be especially susceptible to the direct effects of contact with the fire retardant.

Kuenzler hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*)

Effects Analysis

Kuenzler hedgehog cactus grows in grasslands or pinyon-juniper woodlands at 1,600-2,210 m (5,200-7,250 ft) in elevation. The plant’s range extends about 185 km (115 mi) from the Guadalupe Mountains around the eastern side of the Sacramento Mountains to the southern side of the Capitan Mountains. There are numerous populations with three population concentration areas.

No non-native invasive plants have been identified as a problem in the Kuenzler hedgehog cactus’ habitat.

The likelihood of fire retardant use is low in Kuenzler hedgehog cactus habitat. The prevailing winds during the fire season carry fires in Kuenzler hedgehog cactus habitat away from the forest and into desert grasslands where fires die out naturally.

Conclusion

After reviewing the current status of the Kuenzler hedgehog cactus and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Kuenzler hedgehog cactus. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based on the following: 1) the species has a fairly wide distribution in southeastern New Mexico so retardant applications for fire control would affect only a small proportion of the overall habitat; 2) fire retardants are unlikely to be used in the habitats where Kuenzler hedgehog cactus occurs because prevailing winds usually carry fires into areas of lower fuels where they will burn out naturally, and 3) there are no invasive plants in the area that are likely to increase with retardant use. Due to the small proportion of Kuenzler hedgehog cactus habitat that is likely to be affected by a fire, the low potential for fire retardant use, and the general absence of invasive noxious weeds in the habitat, we determine that the use of fire retardant is not likely to jeopardize the existence of Kuenzler hedgehog cactus.

Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*)

Effects Analysis

Arizona hedgehog cactus usually grows in clumps in the cracks of granite boulders. Few other plants are able to get a foothold in these conditions so the cactus often grows with no apparent competition. The surrounding vegetation is interior chaparral consisting of various evergreen shrubs and oaks. Herbaceous vegetation is usually sparse. The species distribution is limited by the density of the overstory shrub layer and the shortage of growing sites in boulder habitat. This is a fire adapted community where most of the vegetation regenerates from sprouts after burning.

Arizona hedgehog cactus has a relatively small distribution occupying only about 7,650 ha (18,900 ac) in one main population and two small subpopulations. But, the cactus is relatively abundant within its range. Surveys give a total population estimate of about 250,000 plants.

Arizona hedgehog cactus grows in rugged habitat with few roads or other developments. Non-native invasive plants have not been identified as a threat in this area.

Conclusion

After reviewing the current status of the Arizona hedgehog cactus and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Arizona hedgehog cactus. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based on the following: 1) there are no non-native invasive plants presently in the habitat of this cactus that might increase with the application of fire retardants, and; 2) the habitat of this cactus in boulder rock cracks is so specialized that non-native invasive plants are unlikely to invade this habitat even if they should increase in surrounding areas such as roadsides, stream banks, and alluvial slopes, where fire retardant may be applied. Due to the unlikely potential that non-native invasive plants will move into the habitat of Arizona hedgehog cactus after fire retardant application, we determine that the use of fire retardant is not likely to jeopardize the existence of Arizona hedgehog cactus.

Kern mallow (*Eremalche kernensis*)

The proposed project is outside the known range of Kern mallow. Because there are no known occurrences of this listed species on or adjacent to U.S. Forest Service lands and the project is outside the range of this plant species, the Service has determined that the proposed project is not likely to adversely affect Kern mallow.

Giant Woollystar (*Eriastrum densifolium ssp. sanctorum*)

The giant woollystar is not on and is not near any National Forest System lands where we would anticipate a fire retardant drop.

Maguire Daisy (*Erigeron magirei*)

Effects Analysis

The proposed action is expected to have minor impacts to the Maguire daisy. If fire retardant were to be dropped on individuals of the species, they might be adversely affected. However, only a small proportion of the entire known populations of the species occur on Forest Service

land where they could be subjected to the proposed action. Currently, we know of 9 populations (118 sites) comprised of approximately 164,250 Maguire daisy individuals (Clark et al. 2006, p. 16) across approximately 1,010 square km (390 square mi) of southeastern Utah. Approximately 99 percent of known Maguire daisy plants occur on lands managed by the National Park Service (91 percent), the Bureau of Land Management (6 percent), and the School Institutional Trust Lands Association property (less than 2 percent). Approximately one percent of the plants occur on Forest Service land, on the Fishlake National Forest (1 percent)(Clark et al. 2006, p. 16).

The Maguire daisy's habitat is unlikely to be subject to fires and fire fighting activities. The species occurs mostly on rock mesa tops, exposed sandstone canyons, and occasional seed dispersal into sandy wash bottoms (Kass 1990, pp. 22, 27; Service 1995, p. 2). These areas are not likely to carry a fire which would need fire suppressant.

Conclusion

After reviewing the current status of the Maguire daisy and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Maguire daisy. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: 1) only 1 percent of Maguire daisy is on National Forest lands where it could be in a position to be affected by the proposed action; 2) the species is widely distributed across approximately 390 mi² (1,010 km²) in southeastern Utah (Clark et al. 2006, p. 16); and 3) the species' habitat on rock mesa tops, exposed sandstone canyons, and sandy wash bottoms (Kass 1990, pp. 22, 27; Service 1995, p. 2) are unlikely to carry a fire which would need fire suppressant. Due to the unlikely potential of fire and use of fire retardant in combination with small representation of Maguire daisy on Forest Service lands, we determine that the use of fire retardant is not likely to jeopardize the existence of Maguire daisy.

Zuni fleabane (*Erigeron rhizomatus*)

Effects Analysis

Zuni fleabane grows on nearly barren clay hillsides (up to 60% clay) in soils often high in selenium. These soils derived from the Chinle and Baca formations are found in limited areas in west-central New Mexico and east-central Arizona. Plants grow in open piñon-juniper woodlands at elevations of 2,200-2,400 m (7,300-8,000 ft). The geographic range is about 320 km (200 mi) and most populations are widely separated.

No non-native invasive plants have been identified as a problem in the Zuni fleabane's habitat. In fact, few other plants are adapted to grow in these harsh soil conditions.

The likelihood of fire retardant use is low in Zuni fleabane habitat. The vegetation is so sparse that the habitat will not carry a fire and most populations are in remote areas where fires in the surrounding piñon-juniper woodlands are simply allowed to burn.

Conclusion

After reviewing the current status of the Zuni fleabane and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Zuni fleabane. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based on the following: 1) the species is widely distributed in west-central New Mexico and east-central Arizona so retardant applications for fire control would affect only a small proportion of the overall habitat; 2) the species grows in a sparsely vegetated plant community that is unlikely to need fire retardant because Zuni fleabane habitat is unlikely to carry a fire, and 3) the sparsely vegetated specialized habitat is unlikely to be invaded by noxious weeds because very few plants are adapted to Zuni fleabane's harsh growing conditions. Due to the fact that retardant applications for fire control would affect only a small proportion of the overall habitat, that direct application of retardant in the habitat is unlikely because the habitat is unlikely to burn, and that noxious weeds have little potential to invade the habitat because of the harsh growing conditions, we determine that the use of fire retardant is not likely to jeopardize the existence of Zuni fleabane.

Mexican Flannelbush (*Fremontodendron mexicanum*)

The only confirmed, extant native population of this species in the U.S. is located in the chaparral and cypress woodland plant community in Cedar Canyon on Otay Mesa in San Diego County, California, where it grows in the canyon bottoms; most of this area is owned and managed by the Bureau of Land Management (BLM). Therefore Mexican flannelbush would not be affected by a fire retardant drop or drift on National Forest System lands, which are located many miles to the east.

Showy Stickseed (*Hackelia venusta*)

The showy stickseed is a narrow endemic plant known from one location in Chelan County, Washington. The only known population consists of about 600 plants that are scattered over approximately 12 acres of unstable, granitic sand and granite cliffs on the middle to lower slopes of Tumwater Canyon (U.S. Fish and Wildlife Service 2007). The steepness of the slopes on which this plant is found exceeds 100 percent (45 degrees) inclination in many places. Clusters of showy stickseed plants are concentrated in open, unstable areas of granitic sand and talus, and on ledges and cracks of vertical granite cliffs (U.S. Fish and Wildlife Service 2007). This plant is found in areas with relatively sparse cover of other vascular plants and low canopy cover. The majority of showy stickseed plants occur on Forest Service land with a small number of plants on private land.

Six major threats to this species have been identified: (1) physical disturbance to the plants and habitat by humans; (2) mass wasting (landslides); (3) encroachment by invasive plant species; (4) low seedling establishment; (5) fire suppression activities; and (6) wildfire. A single natural or human-caused environmental disturbance could destroy a significant percentage of the population or the entire population, leading to the extinction of the species (U.S. Fish and Wildlife Service 2007).

Direct Effects

A retardant drop on these plants could cause surface erosion, with a risk of uprooting and/or burying a portion of the population. Although the plants have fully senesced before the fire season, remaining seeds of the showy stickseed would be consumed if fire were allowed to burn over the site.

Indirect Effects

Similar to the effects of fertilizers, fire retardants may encourage growth of non-native invasive plants as evidenced in a North Dakota grassland community (Larson 1997). Conversely, allowing fire within the population may kill vegetation providing root strength to the loose soils, thereby increasing the risk of landslides. Fire also removes competition for invasive plants, increasing the potential for invasion of the site. Two invasive plant species, diffuse knapweed (*Centaurea diffusa*) and Dalmatian toadflax (*Linaria genistifolia* ssp. *Dalmatica*) are known to be proximal to the showy stickseed population (U.S. Fish and Wildlife Service 2007).

It remains unclear if a fire burning through the area occupied by the showy stickseed would result in more negative effects than an aerial application of fire retardant. In 1994, this area was burned by a wildfire. Most of the effects of the fire on the showy stickseed were considered beneficial due to the removal of overstory plants, which were competing with showy stickseed plants for light. Invasive plants were not observed to markedly increase in distribution or abundance within the burned area post-fire.

From the perspective of fire management and strategic uses of fire retardant, an aerial retardant drop at this particular location is extremely unlikely given its location on the lower to middle slopes of a steep river canyon. In addition, the area containing the showy stickseed population is not currently at risk of supporting a high intensity wildfire or of being the point of origin for a fire. (R. Harrod, pers. comm., 2008). Where and when to use an aerial application of fire retardant is a decision left to the discretion of the Incident Commander and resource specialists (FS 5100 Manual). Other forms of fire suppression may be undertaken, however, Forest Service resource specialists would most likely advise against applying retardant in the Tumwater Botanical Area containing the showy stickseed population (R. Harrod, pers. comm., 2008).

Conclusion

Although showy stickseed occurs in a single population with low seedling establishment and is proximal to invasive plants, it remains unknown whether the application of fire retardant will produce more negative effects than a fire burning through the area. Furthermore, the terrain where showy stickseed is found is very unlikely to receive aerial applications of retardant if a fire were to occur in this area. Based on these two major factors, it is the opinion of the Service that the proposed action is not likely to jeopardize the continued existence of the showy stickseed. No critical habitat has been designated for this species, therefore, none will be affected.

Todsens' pennyroyal (*Hedeoma todsenii*)

Effects Analysis

Todsen's pennyroyal grows in loose, gypseous-limestone soils associated with or positioned immediately below the Permian Yeso Formation; usually on steep north or east-facing slopes. It grows in pinyon-juniper woodlands at 1,900-2,300 m (6,200-7,400 ft). Populations occur in two mountain ranges separated by about 75 km (45 mi). There are five populations, with three on White Sands Missile Range and two on the Lincoln National Forest. The national forest populations encompass about 390 ha (960 ac) each.

Todsen's pennyroyal populations have hundreds to thousands of separate clumps of plants with slender unbranched rhizomes connecting many of these clumps. This plant appears to be secure within its suitable habitat, but sexual reproduction is very low so it has little potential to disperse to other suitable habitats. As a result, catastrophic fire that destroys a population is considered to be a serious threat to this species because once a population is extirpated it has little potential for recolonization.

No non-native invasive plants have been identified as a problem in the Todsen's pennyroyal's habitat.

Conclusion

After reviewing the current status of the Todsen's pennyroyal and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Todsen's pennyroyal. No critical habitat has been designated for this species; therefore, none will be affected. A wildfire in Todsen's pennyroyal habitat could have serious adverse consequences to the species due to the low likelihood that plants can naturally recolonize extirpated sites. Independent of this potential damage, we must evaluate the potential damage from the application of fire retardants and we conclude this potential damage is minimal based on the following: 1) the distribution of the five populations of Todsen's pennyroyal in two mountain ranges makes it unlikely that a fire would affect more than one of the populations, and 2) there are no non-native invasive plants in the area that are likely to increase with retardant use. Due to the fact that no non-native invasive plants have been identified as a problem in the Todsen's pennyroyal's habitat and that fire retardants are unlikely to be applied on or near more than one population during any one fire, we determine that the use of fire retardant is not likely to jeopardize the existence of Zuni fleabane.

Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*)

Effects Analysis (Species)

The Huachuca water umbel grows in cienegas (marshy wetlands) and along streams and rivers. It can grow in saturated soils or as an emergent in water depths up to about 25 cm (10 in). High quality Huachuca water umbel sites have stable perennial stream flow and herbaceous vegetation that stabilizes the banks and channel. The surrounding non-wetland vegetation can be desertscrub, grassland, oak woodland, or conifer forest. The populations on National Forest System lands are in small streams with a conifer overstory in the Huachuca Mountains.

This plant has been documented from 16 extant sites in four watersheds in southeastern Arizona and adjacent Sonora, Mexico. Some of the sites are widely separated from one another, but the four sites on National Forest System lands and one site on adjacent Fort Huachuca are in relatively close proximity at the southern end of the Huachuca Mountains. The Huachuca Mountains sites have the greatest plant density of the known populations. For instance, Scotia Canyon contains one of the largest populations occupying about 57 percent of the 1,500 m (4,800 ft) perennial reach of the stream.

The occupied streams in the Huachuca Mountains are so small that they will be difficult to observe and avoid if retardant drops are needed to suppress a nearby fire.

No invasive non-native weeds have been identified as threats in the general area of the Huachuca Mountains. No non-native aquatic plants have been identified as threats to Huachuca water umbel.

Conclusion (Species)

After reviewing the current status of the Huachuca water umbel and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Huachuca water umbel. A wildfire in the southern end of the Huachuca Mountains has the potential to seriously damage the best Huachuca water umbel populations through post-fire rainfall triggered scouring floods and excess siltation from denuded upland slopes. Independent of this potential damage, we must evaluate the potential damage from the application of fire retardants and we conclude this potential damage is minor based on the following: 1) there are no invasive non-native terrestrial weeds in the southern end of the Huachuca Mountains that might be promoted with the application of fire retardants, and 2) there are no weedy competitors of Huachuca water umbel in its aquatic habitats that might be promoted with the application of fire retardants. Due to the unlikely potential that non-native invasive plants will move into the habitat of Huachuca water umbel after fire retardant application, we determine that the use of fire retardant is not likely to jeopardize the existence of Huachuca water umbel.

Effects Analysis (Critical Habitat)

Seven critical habitat units have been designated for Huachuca water umbel. Three of those units totaling 6.8 km (4.2 mi) of stream are on National Forest System lands in the Huachuca Mountains. The critical habitat units include the stream courses and adjacent areas out to the beginning of upland vegetation. Within these areas, the primary constituent elements include, but are not limited to, the habitat components which provide – 1) sufficient perennial base flows to provide a permanently wetted substrate for growth and reproduction of Huachuca water umbel; 2) a stream channel that is relatively stable, but subject to periodic flooding that provides for rejuvenation of the riparian plant community and provides open microsites for Huachuca water umbel expansion; 3) a riparian plant community that is relatively stable over time and in which nonnative species do not exist or are at a density that has little or no adverse effect on resources available for Huachuca water umbel growth and reproduction; and 4) in streams and rivers,

refugial sites in each watershed and in each reach, including but not limited to springs or backwaters of mainstem rivers, that allow each population to survive catastrophic floods and recolonize larger areas.

Conclusion (Critical Habitat)

Critical habitat has been designated for Huachuca water umbel. The proposed action is likely to affect critical habitat, but the action is not likely to appreciably diminish the value of primary constituent elements essential to the species' conservation. Our conclusion about the application of fire retardants on or near critical habitat areas on National Forest System lands is based on the following: 1) fire retardant applications in or near critical habitat areas will not change stream base flows; 2) fire retardant applications in or near critical habitat areas will not alter stream channel stability; 3) any increase in vegetation growth from fire retardants is temporary (there is no measurable increase in growth for the growing season following the retardant application), therefore, fire retardant applications in or near critical habitat areas will not change the stability of the riparian plant community over time, and 4) fire retardant applications in or near critical habitat areas will not change the presence of refugial sites. Due to the unlikely possibility that fire retardant application will appreciably diminish the value of any primary constituent elements essential to the species' conservation, we determine that the use of fire retardants will not adversely modify the critical habitat of Huachuca water umbel.

Butte County Meadowfoam (*Limnanthes floccosa ssp. californica*)

The proposed project is outside the known range of Butte County meadowfoam. Because there are no known occurrences of this listed species on or adjacent to National Forest System lands and the project is outside the range of this plant species, the Service has determined that the proposed project will not affect Butte County meadowfoam.

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

Four of 13 known populations of this species occur on Forest Service land. These populations are widely separated. Adverse effects to this species from the proposed action are likely to be avoided or minimized for the following reasons: (1) fire-fighting staff are briefed in the early stages of fire suppression about known federally listed species to protect, including the Macfarlane's four-o'clock, and are directed to avoid use of fire retardant (typically at least 300 feet from the known occurrence sites) and avoid the construction of fire lines near this species as long as doing this does not compromise the safety of firefighters; (2) the peak season of fire activity in the Pacific Northwest is July-October, which coincides with the period of dormancy for Macfarlane's four-o'clock. Therefore, there is an anticipated low risk of affecting the survival of this species, if retardant was inadvertently dropped in an area where this species occurs; and (3) to date, the Wallowa-Whitman National Forest and federal lands in Idaho where this species occurs have been successful in preventing retardant use near known populations of the Macfarlane's four-o'clock.

Bakersfield Cactus (*Opuntia treleasei*)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) showed 30 known or presumed extant occurrences for this species in central Kern County (CNDDDB 2007). Of these occurrences, one is on Forest Service lands (Sequoia National Forest) and another is adjacent to Forest Service lands.

Direct, Indirect, and Cumulative Effects

Bakersfield cactus grows in sparsely vegetated low shrub-grasslands, which due to their low density and short vegetation height make for ideal places for fire retardant drops. However, given the limited geographic distribution of the cactus occurrences on or near Forest Service lands, it is highly unlikely that more than one occurrence would be impacted by fire suppression activities in any given year.

Bakersfield cactus is a perennial, with no dormant periods. While studies have not been conducted to determine potential toxicity of fire-retardant on this species, toxicity is expected to be none to low due to the nature of the species. Cacti are adapted to low nutrient conditions, but can do well in nutrient rich environments. The increased level of nutrients, due to the application of fire retardant, could allow for the increased growth of both native and non-native plant species (Larson and Duncan 1982). Hopmans and Bickford (2003) suggest that the increased growth rates in plants due to increased nutrient loading can continue for six years, and altered species composition may persist for up to 20 years. Therefore, it is likely that the application of retardant would increase competition with non-native plants.

However, while competition with non-native plants is listed as a threat to this species, it is a tertiary, not primary, threat. Reproduction of this species is not fully understood and the primary conservation of the species at this point is preventing the loss of large plant complexes, which are minimally threatened by non-native plants. Thus, if a retardant drop were to occur on the Bakersfield cactus, the adverse affect due to competition is anticipated to be low.

Conclusion

After reviewing the current status of the Bakersfield cactus, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of Bakersfield cactus. The proposed action would not lead to a substantial decline in number of the cactus, a substantial reduction in range of the cactus and it would not preclude the recovery of the cactus. This conclusion is based on the following reasons: (1) the spatial extent of the species outside the proposed action area is large with only one population known on Forest Service lands; and (2) potential adverse effects are considered minimal.

San Rafael Cactus (*Pediocactus despainii*) and Winkler Cactus (*Pediocactus winkleri*)

Effects Analysis

The proposed action is expected to have no impacts to the San Rafael cactus and Winkler cactus. Both species occur in desert scrub or open Pinyon-Juniper woodland communities, between

4,900 ft and 6,600 ft elevation (Clark 2005, p2). San Rafael and Winkler cacti occur in Wayne and Emery counties, in south central Utah. Approximately two-thirds of the known populations of both species are located on lands administered by the BLM and the rest occur within Capitol Reef National Park or on State lands (Clark 2005, p2). No individual plants of either species were known on Forest Service lands at the time of their listing nor currently (52 FR 34914; 63 FR 44587-44587; Clark 2005, p2).

Conclusion

After reviewing the current status of the San Rafael cactus and Winkler cactus and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the San Rafael cactus or Winkler cactus. Our conclusion is based on the fact that neither the San Rafael cactus nor the Winkler cactus occurs on Forest Service lands; therefore, neither species would be affected by use of fire retardant on Forest Service land. No critical habitat has been designated for these species; therefore, none will be affected.

Blowout Penstemon (*Penstemon haydenii*)

Effects Analysis

The proposed action is expected to have minor adverse effects to the blowout penstemon. If fire retardant were to be dropped on individuals of the species, they might be adversely affected. However, only a small proportion of the entire known distribution of the species occurs on Forest Service land where they could be subjected to the proposed action. Currently, we know of 9 small populations (13 sites) comprised of approximately 3,000-5,000 individuals (Stubbendieck et al 1997, p. 1) across approximately 32,049 km² (12,374 mi²) in the Nebraska Sandhills. The Nebraska Sandhills comprises the largest contiguous tract of grassland remaining in the United States and the largest stabilized sand dune area in the Western Hemisphere (LaGrange 1997). Within this area, the Nebraska National Forest lands comprise only 971 km² (375 mi²), or roughly three percent of the total sandhills area. One blowout penstemon population occurs on Samuel R. McKelvie National Forest (Nebraska Natural Heritage Database 2007; Stubbendieck et al 1997, p 1). The Forest Service in Nebraska has been identifying and surveying for potential habitat for the species. Where the species occurs or is found on Forest Service lands, the agency will monitor, manage, and protect the site (Service and Nebraska National Forest 2001). Approximately 55-60 percent of known blowout penstemon populations are on U.S. Fish and Wildlife Service's National Wildlife Refuge land and 40-45 percent of populations are on State and private lands (Service 1992).

Blowout penstemon habitat is unlikely to be subject to fire fighting activities. This species is restricted to active sand blowouts, irregular crater-shaped depressions are naturally occurring in the Nebraska Sandhills (SERVICE 1992). The plant can be found in early successional blowout habitat where it has little competition from other plants because of scarce water and nutrients. However, as blowout habitats mature and become stabilized, other plants will become established, and the blowout penstemon disappears. Artificial propagation and discovery of additional wild populations have shown that the species is appears to be stable in Nebraska.

Stabilization of blowouts and other disturbances that result in the physical loss of these habitats can have an adverse affect on the blowout penstemon. The habitats where existing blowout populations occur in Nebraska are not likely to carry fires that would need fire retardants on Forest Lands.

Conclusion

After reviewing the current status of the blowout penstemon and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the blowout penstemon. Our conclusion is based upon the following: 1) only 1 population of blowout penstemon is on National Forest lands in Nebraska where it could be in a position to be affected by the proposed action; 2) the species is distributed across approximately 32,049 square km (12,374 square mi) in the Nebraska Sandhills); and 3) the species' habitat is not likely to carry fires that would need fire retardants. Due to the unlikely potential of fire and use of fire retardant in combination with small representation of blowout penstemon on Forest Service lands, we determine that the use of fire retardant is not likely to jeopardize the existence of the blowout penstemon. No critical habitat has been designated for this species; therefore, none will be affected.

Clay Phacelia (*Phacelia argillacea*)

Effects Analysis

Clay phacelia is found on xeric (dry) sites dominated by Green River shale detriment slopes. In 1977, only 1 population of 9 plants (bisected by a railway) was known (42 FR 44811). A 1980 survey of the site found an estimated 200 individuals across both the railroad cut and a four-lane state highway (Service 1982, p.2). In 1999, an additional population was found approximately 8 kilometers (5 miles) down stream from the prior known population (Paul West, Utah Department of Transportation, and Paige Wolken, Service Botanist, survey notes 2000). Neither of these locations is on National Forest lands.

The majority of suitable, but unoccupied habitat, is on Uinta National Forest. In 2004, the Uinta National Forest agreed to introduce the clay phacelia on suitable lands in order to advance recovery goals of establishing at least one new population of 2,000 individuals. In 2007, seeds from greenhouse grown plants were introduced to two sites on Uinta National Forest lands. It is unknown if these seeds will germinate in 2008 and lead to self-sustaining, established populations.

The proposed action may have minor impacts to the clay phacelia. If fire retardant were to be dropped on individuals of the species, they might be adversely affected. However, both introduction sites are located on sparsely vegetated, fragmented, steep shale outcroppings within approximately 1,000 feet (305 meters) of large, high voltage power transmission lines. In addition, natural (exposed rock) and man-made (railroad tracks and highway) breaks exist within ¼ to ¾ miles of the introduction sites. These areas are not likely to carry a fire initiating an aerial fire retardant drop, nor are either areas likely to receive a fire retardant drop due to the proximity of large, high voltage power transmission and risk to the aircraft.

Conclusion

After reviewing the current status of the clay phacelia and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the clay phacelia. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: 1) no viable populations currently exist on National Forest lands (Service 1982, p2); 2) the success of seeding to introduce new populations to National Forest lands is unknown; 3) sites chosen for clay phacelia introduction are unlikely to require fire suppression; and 4) the location of natural and manmade fire barriers, in addition to large, high voltage transmission lines make aerial application of fire retardant unlikely. Due to the low potential of fire and use of fire retardant in combination with the known plant's distribution, we determine that USFS' use of fire retardant is not likely to jeopardize the continued existence of the clay phacelia.

Yreka Phlox (*Phlox hirsuta*)

Environmental Baseline

The federally-listed endangered plant, *Phlox hirsuta* (Yreka phlox) is a serpentine endemic known from five locations in the vicinity of Yreka, California. Approximately 8,015 to 15,865 plants are found over a total of more than 665 acres (269 hectares), 26% of which are Federal lands managed by the Klamath National Forest (KNF) on Soap Creek Ridge. The Soap Creek Ridge occurrence is comprised of at least 14 discrete suboccurrences containing 5,000 to 10,000 plants over a 236-hectare (584-acre) area. *Phlox hirsuta* habitat is generally rocky and occurs on rounded ridge tops and steeper side slopes that are sparsely vegetated with scattered *Pinus jeffreyi* (Jeffrey pine), an assortment of drought tolerant shrubs, including *Ceanothus cuneatus* (buckbrush) and *Cercocarpus betuloides* (birch-leaf mountain mahogany), and perennial native grasses and forbs. The KNF Land and Resource Management Plan (1994) does not provide any specific direction for protection of *Phlox hirsuta* over and above its status as a Region 5 Sensitive Plant species.

Fire retardant use within KNF boundaries has averaged about 150,000 gallons (gal.) a year (equivalent to about 50-75 drops) over the last 20 years. Air tankers have the capacity to hold 3,000 gal. of fire retardant, but because of safety reasons, generally carry only about 2,000 gal. at a time. The formulation of retardant used to refill air tanker planes, once they have arrived on the KNF, uses less guar gum thickener so that the retardant can penetrate the forest canopy and ground fuels can be reached more effectively, in this region of relatively sparse vegetation cover. Coverage levels range from 3 gal./100 square feet on grassland-type fuels to 9 gal./100 square feet on shrub- and hardwood type-fuels.

By agreement with KNF, California Department of Fire and Forestry Protection (Cal Fire) conducts fire suppression activities within the range of *Phlox hirsuta*. Before 2002, 95% (142,500 gal.) of the total annual amount of fire retardant was applied on Federal lands, predominantly on heavily forested ridges and side slopes with high fuel loadings (J. Davis, KNF, pers. comm. 2008). Since 2002, as the number of dwellings in the urban/forest interface has

increased, only 60% (90,000 gal.) of the total annual amount of fire retardant has been used on Federal lands (J. Davis, pers. comm. 2008) and the remaining amount has been applied on private lands.

Effects

The likelihood that a retardant drop would occur on *Phlox hirsuta* habitat and/or areas where plants exist is low for the following reasons:

1. The habitat on which *Phlox hirsuta* occurs poses a low risk of high intensity fire (i.e., a fire for which the rate of spread would need to be controlled using fire retardant). The open, rocky ridges where *P. hirsuta* occurs are often considered natural barriers, where no fire suppression actions need to be taken (i.e., a non-pyrogenic community).
2. In the past eight years, all the fires that have occurred on Soap Creek Ridge have been caused by lightning strikes that ignited a single pine tree. In each case, helicopters were used to drop water on these fires until fire crews could be deployed at the site (J. Sweet, Cal Fire, pers. comm. 2008).
3. The acreage that could be affected by a retardant drop would vary by the coverage level specified in the air operations plan, from 1.5 acres (0.62 hectares) for a coverage level of 3 gal./100 square feet to 0.51 acre (0.21 hectares) for a coverage level of 9 gal./100 square feet, assuming 2,000 gal./tanker drop. Assuming that no more than one tanker would be used to suppress fire in areas of open, rocky ridges and considering that the total acreage of *Phlox hirsuta* habitat is 665 acres (269 hectares), only a small proportion of the total *P. hirsuta* population would be affected, in the unlikely event that fire retardant is used on habitat suitable for this species.
4. Within CalFire's State Responsibility Area, a KNF Resource Advisor is assigned to each fire to coordinate and plan protection measures for listed species at the appropriate time during the course of fire suppression activities. This type of planning and coordination has been effective for listed plants in the past.

In the event that a retardant drop was to occur on *Phlox hirsuta* habitat, there could be a range of effects.

Direct effects would most likely be in the form of chemical burning of plants, in the same way that over-application of fertilizer affects garden plants, and which may or may not cause lasting damage to individual plants. In general, *Phlox hirsuta* plants are shaped in a rounded, convex mound which may shed retardant to some degree. *Phlox hirsuta* has relatively small leaves and therefore, a low leaf surface area, which would limit direct exposure to sensitive tissues. The fire retardant is expected to stay on the plants until dissipated by rainfall or moisture.

Fire season in northern California occurs between the months of June and October. By the end of July, most seed produced by *Phlox hirsuta* will have been shed. By mid-summer, the above-ground parts of *Phlox hirsuta* plants become dry and non-photosynthetic as a result of the

extreme heat exposure on these sites. If a retardant drop occurred during this time, there would likely be no effect to seed production.

Indirect effects would most likely involve the increased growth of vegetation in general the following spring from the additional nutrients in the retardant. In particular, alien plant species have been shown to quickly adapt to nutrient availability. In this area, the predominant non-native plant is an annual grass, *Bromus tectorum* (cheat grass).

Conclusion

The use of aerially applied fire retardant on National Forest System lands, managed by the KNF, on suitable habitat for Yreka phlox is extremely low. In the event that fire retardant is used in suitable phlox habitat, it would not be expected to affect a large proportion of the species' range, therefore the effect is may affect, likely to adversely affect, but is not likely to jeopardize the continued existence of Yreka phlox.

Maguire Primrose (*Primula maguirei*)

Effects Analysis

The proposed action may adversely affect the Maguire primrose if fire retardant were to be dropped on individuals of the species. However, this species is restricted to cool, moss-covered dolomite cliffs and boulders in the lower elevations of Logan Canyon, Utah. The probability of receiving a retardant drop is highly unlikely as the plant occurs in cracks and crevices in the limestone cliffs adjacent to the Logan River or its tributaries low in the canyon. Most known plant locations occur within 300 feet of a waterway. The 2007 Uinta and Wasatch-Cache National Forest Fire Management Plan provides guidelines that would prevent retardant drops within 300 feet of waterways (USFS 2007). One known occurrence of the plant at the mouth of the canyon is growing in soil with grass/shrub (fire adapted) associated vegetation. A potential retardant drop at that site or anywhere in the canyon within the known range of the species is unlikely due to safety concerns for the pilot and plane (Rackham and Tonioli 2008). Tactically, retardant drops along the ridgeline, high above the known populations would be the more likely scenario.

Conclusion

After reviewing the current status of the Maguire primrose and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Maguire primrose. Our conclusion is based upon the following: 1) due to habitat restrictions, the majority of the populations occur within 300 feet of a waterway which has been identified in the 2007 Uinta and Wasatch-Cache NF Fire Management Plan as an avoidance area for retardant drops; and 2) the known range of the Maguire primrose occurs in topography that would be unlikely to be subject to retardant drops due to safety concerns for pilot and plane. No critical habitat has been designated for this species; therefore, none will be affected.

Arizona cliffrose (*Purshia subintegra*)

Effects Analysis

The proposed action is expected to have minor impacts to the Arizona cliffrose. This plant grows in four disjunct populations spread across 320 km (200 mi) in central Arizona. Two of the populations are wholly or partly on National Forest System lands (U.S. Fish and wildlife Service 1995). This distribution reduces the likelihood that fire would occur in more than one population at a time.

The habitat of Arizona cliffrose is unlikely to have fires or fire fighting activities. Arizona cliffrose grows in a desertscrub plant community. It is endemic to soils developed from white Tertiary limestone lakebed deposits that support only scattered vegetation (U.S. Fish and Wildlife Service 1995). In particular, the community supports few grasses or other plants that create fine fuels that carry fires.

Conclusion

After reviewing the current status of the Arizona cliffrose and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Arizona cliffrose. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based on the following: 1) the species is widely distributed across 320 km (200 mi) in central Arizona; and 2) the species grows in a sparsely vegetated desertscrub plant community that is unlikely to carry a fire which would need fire retardant. Due to the unlikely potential of fire and use of fire retardant in combination with the fact that a fire, though unlikely in the first place, would affect no more than 25 percent of the populations, we determine that the use of fire retardant is not likely to jeopardize the existence of Arizona cliffrose.

San Francisco peaks groundsel (*Senecio franciscana*)

Effects Analysis (Species)

The proposed action is expected to have minor impacts to the San Francisco Peaks groundsel. This plant is endemic to an alpine tundra area of about 490 ha (1,200 ac) on the summit of the San Francisco Peaks north of Flagstaff, Arizona (U.S. Fish and Wildlife Service 1987). The entire population is in habitat that is unlikely to have fires or fire fighting activities. In fact, the alpine tundra of San Francisco Peaks functions as a fire break against fires moving from one side of the mountain to the other.

Fire retardant is unlikely to be used in the sub-alpine forests that directly contact the tundra because any fire will burn out when the tundra is reached. Retardants may be used at lower elevations on the mountain, but the retardants would be washed down hill away from San Francisco Peaks groundsel habitat.

Invasive non-native plants are a serious problem in northern Arizona. The Leroux Fire burned about 490 ha (1,200 ac) on the southwest side of San Francisco Mountain below the tundra zone

in June 2001. The noxious weed Dalmatian toadflax (*Linaria dalmatica*) increased dramatically within the fire boundaries (B. Phillips, Coconino NF, e-mail pers. comm. with C. McDonald, U.S. Forest Service, Southwestern Region, RO, 5 September 2003). So far, however, there is no evidence that this noxious weed or other noxious weeds in the area have the potential to invade the harsh alpine tundra habitat of San Francisco Peaks groundsel.

Conclusion (Species)

After reviewing the current status of the San Francisco Peaks groundsel and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the San Francisco Peaks groundsel. Our conclusion is based on the following: 1) the habitat of this plant is unlikely to carry a fire which would need fire retardant; 2) any fire retardants applied to adjacent forests would be washed down hill away from the habitat, and; 3) no noxious weeds in the area have the potential to persist in the San Francisco Peaks groundsel's harsh tundra habitat. Due to the unlikely potential of fire and use of fire retardant in the San Francisco Peaks groundsel's habitat on Forest Service lands, we determine that the use of fire retardant is not likely to jeopardize the existence of San Francisco Peaks groundsel.

Effects Analysis (Critical Habitat)

Critical habitat for San Francisco Peaks groundsel includes about 290 ha (720 ac) of the summits of Agassiz and Humphreys peaks and the surrounding slopes and alpine areas. The primary constituent elements of critical habitat are the loose cinder talus slopes of the San Francisco Peaks alpine tundra system (U.S. fish and wildlife Service 1983). This area is unlikely to burn or have fire retardants applied.

Conclusion (Critical Habitat)

Critical habitat has been designated for San Francisco Peaks groundsel, but the action is not likely to affect that critical habitat. Therefore, there is no destruction or adverse modification of the critical habitat.

Keck's Checkermallow (*Sidalcea keckii*)

The proposed project is outside the known range of Keck's checkermallow. Because there are no known occurrences of this listed species on or adjacent to National Forest System lands and the project is outside the range of this plant species, the Service has determined that the proposed project will not affect Keck's checkermallow.

Canelo Hills ladies'-tresses (*Spiranthes delitescens*)

Effects Analysis

The proposed action is expected to have minor impacts to the Canelo Hills ladies'-tresses. Only one of the five known populations of this plant occurs on National Forest System lands and it is the smallest of the known populations (four flowering plants when discovered in 1996). The

other four populations are on private land. The populations are geographically isolated from one another (U.S. Fish and Wildlife Service 1997).

Canelo Hills ladies'-tresses grows in cienega wetlands that do not burn. The habitat surrounding the population on National Forest System land is desert grassland and oak savannah that will burn, but fire retardants are unlikely to be used in this area because there are no nearby resources such as urban interface, developments, or facilities that need protection.

Invasive noxious weeds are not a problem in the cienega habitat of Canelo Hills ladies'-tresses.

Conclusion

After reviewing the current status of the Canelo Hills ladies'-tresses and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Canelo Hills ladies'-tresses. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based upon the following: 1) only one population of Canelo Hills ladies'-tresses (the smallest of the known populations) is on National Forest lands where it could be affected by the proposed action; 2) the species' cienega habitat will not burn and the surrounding habitat that will burn is unlikely to have retardant use, and; 3) there are no invasive plants in the area that are likely to increase with retardant use. Due to the unlikely potential of fire retardant use in combination with small representation of Canelo Hills ladies'-tresses on Forest Service lands, we determine that the use of fire retardant is not likely to jeopardize the existence of Canelo Hills ladies'-tresses.

Kneeland Prairie penny-cress (*Thlaspi californicum*)

Nearest National Forest: Six Rivers

Proximity to NF: Nearest contact 8 miles due east from occupied habitat

Rationale: Both the known current, and historical distribution of Kneeland Prairie penny-cress occurs on a single exposure of serpentine rock, confined to a 0.5 square mile area within Kneeland Prairie, Humboldt County. Six Rivers National Forest is located approximately 8 miles due east of the site. Jennings (2001) inventoried all suitable habitat for the Kneeland Prairie penny-cress within Six Rivers National Forest, over an area extending 10 miles north, 10 miles south, and 5 miles east of the closest point on the Six Rivers National Forest boundary. That inventory and other past efforts failed to locate any additional populations for the species outside of Kneeland Prairie (USFWS 2003). Six Rivers National Forest is separated from Kneeland Prairie by the north trending Mad River, which effectively isolates the two locations hydrologically. Therefore, aerial retardant releases on Six Rivers National Forest should have no effect on the Kneeland Prairie penny-cress.

Last Chance Townsendia (*Townsendia aprica*)

Effects Analysis

Most populations of the Last Chance townsendia occur in a band about 5 miles (8 km) wide and

30 miles (48 km) long in central Utah. Occupied sites tend to be very small, about an acre in size (Service 1993, p.1). Currently, we know of 20 populations (2 historic, last observed in 1986) (158 sites) comprised of approximately 21,000 individuals (Fertig 2005, p. 23) in roughly 160 square mi (414.4 square km) of habitat (Fertig 2004, p. 4-8). Less than one third of all known sites occur on USFS lands, on the Fishlake and Dixie National Forests (Fertig 2004, p. 4-8).

The proposed action may adversely affect Last Chance townsendia if fire retardant were to be dropped on individuals of the species. However, only a third of the known populations of the species occur on USFS land where they could be subjected to the proposed action. In addition, the species' biology minimizes its potential exposure to fire retardants. Flowering for Last Chance townsendia occurs April to May and fruiting occurs May to June (Service 1993, p. 4). Fire starts in this area are limited, with the fire season beginning at the end of June to late September (Tait 2008). Habitat for the Last Chance townsendia occurs in pinyon-juniper woodland openings on soils derived from shale lenses (Service 1993, p. 4). USFS lands containing Last Chance townsendia habitat are not likely to carry a fire needing fire suppressant, nor are there any known resources at risk within or nearby Last Chance townsendia habitat that would require an aggressive initial attack using fire retardant (Tait 2008).

Conclusion

After reviewing the current status of the Last Chance townsendia and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Last Chance townsendia. Our conclusion is based upon the following: 1) most occupied sites are small in size and found over a wide-range across approximately 160 square mi² (414 km²) of habitat within central Utah so that the chance of fire retardant being used at a scale that could result in population-level adverse effects to the species is highly unlikely; 2) USFS lands containing Last Chance townsendia are not likely to carry a fire needing fire suppressant (small openings in pinyon-juniper woodland on shale derived soils (Service 1993, p.4)); and 3) no known resources at risk occur in or nearby Last Chance townsendia populations that would require an aggressive attack using fire retardant. No critical habitat has been designated for this species; therefore, none will be affected.

INVERTEBRATES

Cumberland elktoe mussel (*Alasmidonta atropurpurea*)

Proximity of the action: The Cumberland elktoe mussel, *Alasmidonta atropurpurea*, is known to occur in certain perennial streams on the Daniel Boone National Forest, in perennial streams that flow from the Daniel Boone NF, and/or in perennial streams off the Daniel Boone NF that receive flow from tributary streams from the Daniel Boone NF. The aerial application of retardant could be applied on or adjacent to some of these streams.

Critical habitat has been designated for this species in the following streams and counties in Kentucky: Big South Fork Cumberland River, Marsh Creek, and Rock Creek in McCreary

County; Sinking Creek in Laurel County; Laurel Fork in Whitley County. Critical habitat has also been designated for this species in selected streams of the upper Cumberland River drainage in Tennessee.

Distribution: In Kentucky, the Cumberland elktoe mussel is found on or near the Daniel Boone NF in the upper Cumberland River drainage of Eastern Kentucky.

Timing: Periods for which the Cumberland elktoe mussel may be particularly sensitive to the constituents of fire retardant include the fall and winter when spawning occurs along with the development of larvae or glochidia in the female mussel. Glochidia are released in late winter and into spring at which time they attach to a fish host for about two to three weeks and then drop off the fish host and settle in the stream bottom. Therefore the time period from late fall till late spring may be especially sensitive periods for this species. The Daniel Boone NF has two separate fire seasons that generally last around 10 weeks each. The spring season is from (approximately) February 1st through May 15th. The fall season runs from (approximately) October 1st through December 15th.

Nature of the effect: The primary effect on the Cumberland elktoe mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a mussel or result in an interruption of spawning activity or cause the abortion of larvae. Indirect effects could occur to mussels from the retardant interfering with fish host activity and/or presence, at critical times of larval mussel release and encystment on the fish host, or larval mussel excystment from the fish host.

Critical habitat has been designated for this species. The five primary constituent elements for this species are listed as follows along with the nature of the effect of this action on each.

- 1) Permanent flowing stream reaches with a flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
- 2) Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
- 3) Stable substrates, consisting of mud, sand, gravel, and/or cobble/boulder, with low amounts of fine sediments or attached filamentous algae.
- 4) Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussel and its fish host.
- 5) Fish hosts with adequate living, foraging, and spawning areas for them.

The proposed action is not expected to alter constituent elements 1-3. Constituent elements 4 (water quality) may be adversely affected by the presence of ammonia compounds in solution in

the water. Ammonia compounds may adversely affect constituent element 5 (fish host) primarily by causing mortality or altering behavior.

Duration: The effects of this proposed action on both this species and designated critical habitat would most likely be considered a short term (pulse) event; however, depending on stream conditions (i.e., rainfall, flow) the duration could extend over a greater extent of stream length.

Disturbance frequency: The Service is not able to make a precise assessment regarding disturbance frequency for this species or its designated critical habitat; however, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. Aerial application would only be used for wildfire suppression. The use of fire retardant is thought to have been used only once in the last four years on the Daniel Boone Forest.

Disturbance intensity: The Service is not able to make a precise assessment regarding disturbance intensity for this species or its designated critical habitat; however, it is likely the intensity of fire retardant application would be dependent on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

Disturbance severity: The Service is not able to make a precise assessment regarding disturbance severity for this species or its designated critical habitat; however, severity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

b. Analyses for effects of the action

Beneficial effects: The Service does not believe the effects of the action are wholly beneficial to this species.

Direct effects: A direct effect on the Cumberland elktoe mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the fire retardant is applied and/or very soon thereafter. If these effects are severe enough they could result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain Cumberland elktoe mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to

impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

Critical habitat constituent elements are previously noted in Nature of the Effect above. Of the five elements, water quality (4) and fish host (s) (5) may be adversely affected by fire retardant and its associated toxic ammonia compounds released into designated critical habitat waters. Constituent element 4 (water quality) may be adversely affected primarily by the presence of ammonia compounds in the water. Ammonia compounds may adversely affect constituent element 5 (fish host) directly by causing mortality or altering behavior. The discussion above regarding the aerial application of fire retardant applies similarly to this designated critical habitat analysis. The Service assumes that these effects would occur only rarely, and the effects would be localized and temporary.

Interrelated and interdependent actions: Based on the information provided the Service has not identified any interrelated or interdependent actions applicable to the species or designated critical habitat, regarding this proposed aerial application of fire retardant.

Indirect effects: Indirect effects could occur to Cumberland elktoe mussels from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain the Cumberland elktoe mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

Critical habitat constituent elements are previously noted in Nature of the Effect above. Of the five elements, water quality (4) and fish host (s) (5) may be adversely affected by the presence of fire retardant and its associated toxic ammonia compounds released into designated critical habitat waters. Constituent element 4 (water quality) may be adversely affected by ammonia compounds in the water. Ammonia compounds may adversely affect constituent element 5 (fish host) indirectly by altering behavior and loss of recruitment. The Service assumes that these effects would occur only rarely, and the effects would be localized and temporary. The

discussion above regarding the aerial application of fire retardant applies similarly to this designated critical habitat analysis.

c. Species' response to a proposed action

Numbers of individuals/populations in the action area affected: The exact number of individuals/populations of the Cumberland elktoe mussel in the action area is not known; however, based on recent records it persists in 12 upper Cumberland River tributaries, of which five are located in Kentucky. This species is located in several streams and therefore it is unlikely all populations would be affected from any particular fire retardant application.

Sensitivity to change: The Service does not know how sensitive to change the Cumberland elktoe mussel is. Adult mussels in general are considered less sensitive than juveniles. Mussels are known to be sensitive to low levels of ammonia compounds.

Resilience: The Service does not know how resilient the Cumberland elktoe mussel is to this particular action. Mussels are dependent on their proper fish host being present in sufficient numbers to allow successful recruitment, so the resilience of the fish host is also a factor to be considered.

Recovery rate: The recovery rate of the Cumberland elktoe mussel is unknown; however, it is generally accepted by mussel biologists that mussel recovery rates are slower than those of many other invertebrates and fish, due to presence and availability of the fish host.

CONCLUSION

After reviewing the current status of the Cumberland elktoe mussel, the environmental baseline for the action area, and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely to jeopardize the continued existence of the Cumberland elktoe mussel, and is not likely to destroy or adversely modify designated critical habitat.

This proposed action is not likely to jeopardize the continued existence of the Cumberland elktoe mussel for the following reasons: 1) The species is located in several streams and therefore it is unlikely all populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to be applied directly on perennial streams that contain this species. 3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Daniel Boone NF, it is thought to have been used once in the last four years.

The primary direct effects on this species would be from toxic ammonia compounds as the fire retardant is being applied and/or very soon thereafter. If these effects are severe enough they could possibly result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. Indirect effects could occur from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or

excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain this species. However, the accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution.

Critical habitat has been designated for this species, but the proposed action is not likely to destroy or adversely modify that critical habitat. Critical habitat constituent elements are previously noted in Nature of the Effect above. The proposed action is not expected to alter constituent elements one, two, or three. Constituent element four (water quality) and five (fish host) may be adversely affected by the presence of fire retardant and its associated ammonia compounds in designated critical habitat waters. Constituent element 4 (water quality) may be adversely affected directly and indirectly by the presence of fire retardant and its associated ammonia compounds in the water. Ammonia compounds may adversely affect constituent element 5 (fish host) directly and indirectly by mortality, loss of recruitment, and altering behavior. The Service assumes that these effects would occur only rarely, and the effects would be localized and temporary. The discussion above regarding the aerial application of fire retardant applies similarly to this designated critical habitat analysis.

Dwarf Wedgemussel (*Alasmidonta heterodon*)

The dwarf wedgemussel is a relatively small freshwater mussel with a brown or yellowish brown shell containing faint green rays. Unlike some mussel species, the male and female shells differ slightly, with the female being wider to allow greater space for egg development. A distinguishing characteristic of this mussel is the dentition pattern; the right valve possesses two lateral teeth, while the left valve has only one. This trait is opposite of all other North American species having lateral teeth (Clark 1981). Recent research has confirmed at least three potential fish host species for the dwarf-wedge mussel to be the tessellated darter, Johnny darter, and mottled sculpin (Michaelson 1995).

Habitat for the dwarf wedgemussel includes creeks and rivers with a slow to moderate current and a sand, gravel, or muddy bottom. The dwarf-wedge mussel occurs in at least 25 stream reaches along the Atlantic Coast from New Brunswick, Canada, to North Carolina. Documented populations in North Carolina are located in the upper sections of the Neuse and the Tar River Basins. The Croatan National Forest also occurs in the Neuse River basin. The easternmost population of dwarf wedgemussel in North Carolina is located in Turkey Creek, a tributary to the

Neuse River. This population is approximately 75 miles upstream and west of the Croatan National Forest. We believe that the proposed project will have no effect on the endangered dwarf wedgemussel.

Appalachian elktoe (*Alasmidonta raveneliana*)

In the Nolichucky River system, the Appalachian elktoe survives in scattered areas of suitable habitat in reaches of the upper Nolichucky River system totaling about 113 kilometers (km) (~ 70.2 river miles [rm]). About 111.1 km (~ 69.03 rm) of the species occupied range in the Nolichucky River system is designated as critical habitat (Service 2002). This includes the main stem of the North Toe River, Yancey and Mitchell Counties, North Carolina, from near the confluence of Crabtree Creek downstream to the confluence of the South Toe River; main stem of the South Toe River, Yancey County, North Carolina, from the State Route 1152 Bridge, downstream to its confluence with the North Toe River; the main stem of the Toe River, Yancey and Mitchell Counties, North Carolina, from the confluence of the North Toe River and the South Toe River, downstream to the confluence of the Cane River; the main stem of the Cane River, Yancey County, North Carolina, from the N.C. State Route 1381 Bridge, downstream to its confluence with the Toe River; and, the main stem of the Nolichucky River from the confluence of the Toe River and the Cane River in Yancey County and Mitchell County, North Carolina, downstream to the U.S. Highway 23/19W Bridge southwest of Erwin, Unicoi County, Tennessee (Service 2002). In Tennessee, the Appalachian elktoe mussel, is known to occur on the Cherokee National Forest in 3.2 miles of the Nolichucky River from the state line downstream to Chestoa. The Appalachian elktoe shares this stretch of the Nolichucky River with the wavy-rayed lampmussel, creeper, and Asian clam. Surveys conducted downstream of Chestoa have never documented any native mussels (USFS 2007). Six units of critical habitat have been designated, including that on the Nolichucky River in Unicoi County, Tennessee. Additionally, in North Carolina, critical habitat has been designated in the following streams and counties: Little Tennessee River in Macon and Swain counties; Tuckasegee River in Jackson and Swain counties; Cheoah River in Graham County; Little River in Transylvania County; West Fork Pigeon River and Pigeon River in Haywood County; South Toe River and Cane River in Yancey County; North Toe River in Yancey and Mitchell counties; Toe River in Yancey and Mitchell counties; and Nolichucky River in Yancey and Mitchell counties. Big South Fork Cumberland River, Marsh Creek, and Rock Creek in McCreary County; Sinking Creek in Laurel County; Laurel Fork in Whitley County. Critical habitat has also been designated for this species in selected streams of the upper Cumberland River drainage in Tennessee.

The seven Primary Constituent Elements for this species are listed as follows along with the nature of the effect of this action on each: 1) Permanent, flowing, cool, clean water; 2) Geomorphically stable stream channels and banks; 3) Pool, riffle, and run sequences within the channel; 4) Stable sand, gravel, cobble, and boulder or bedrock substrates with no more than low amounts of fine sediment; 5) Moderate to high stream gradient; 6) Periodic natural flooding; 7) Fish hosts with adequate living, foraging, and spawning areas for them.

About 5.0 percent of the Appalachian elktoes' total occupied range and 5.1 percent of the its designated critical habitat in the Nolichucky River system is bordered by National Forest lands (the Pisgah National Forest in North Carolina and the Cherokee National Forest in Tennessee) –

about 4.05 km (2.52 mi) of the main stem of the Nolichucky River in North Carolina is bordered by the Pisgah National Forest (3.5 percent of the species total range, and 3.7 percent of its designated critical habitat, in Nolichucky River system in North Carolina). The remainder of the species' occupied and designated critical habitat in the Nolichucky River system is bordered by private lands. The reach of the Nolichucky River within the action area (Pisgah National Forest) is a popular whitewater rafting and kayaking area. This reach of the river is primarily high gradient as it passes through the Nolichucky River Gorge and has a substrate dominated by exposed bedrock, boulders, and cobble with only scattered areas of the coarse sand and gravel substrate preferred by Appalachian elktoes. Accordingly, within the action area the species' generally occurs only in relatively small numbers at scattered sites. Critical habitat has been designated for the Appalachian elktoe in Tennessee on the Nolichucky River in Unicoi County including a portion of the Nolichucky River on the Cherokee National Forest.

b. Factors Affecting the Species Environment Within the Action Area

Because the USFS implements measures to avoid and minimize impacts to the Appalachian elktoe during their forestry, maintenance, and other activities, the primary factors affecting the species and its habitat within the action area [the Pisgah National Forest (Nolichucky River System) – the species is not found near the Nantahala National Forest] are from past and on-going activities upstream of the action area. The majority of the streams in the Nolichucky River system upstream of the action area are primarily in private ownership. Run-off of sediment from past surface mining activities, agriculture, private forestry, road construction, and urban and residential development activities within the watershed have contributed to large quantities of unstable, shifting sand and sediments throughout much of the Nolichucky River system that continue to adversely affect the Appalachian elktoe and limit the species habitat both upstream of and within portions of action area. Although there have been improvements in the species' habitat following implementation of Federal and State regulations for controlling sediment and an increased awareness and/or interest in, and voluntary implementation of, conservation measures, there are still numerous land disturbance activities on private lands within the watershed that continue to adversely affect the species' habitat downstream within the action area. Periods for which the Appalachian elktoe mussel may be particularly sensitive to the constituents of fire retardant include the fall and winter when spawning occurs along with the development of larvae or glochidia in the female mussel. Glochidia are released in late winter and into spring at which time they attach to a fish host for about two to three weeks and then drop off the fish host and settle in the stream bottom. Therefore the time period from late fall till late spring may be especially sensitive periods for this species.

a. Factors to be Considered

Proximity of the Action – If the use of fire retardant becomes necessary on the Cherokee, Pisgah or Nantahala National Forests, the location of the fire would not be predictable. However, in the southern Appalachians, lightning caused fires are more common on dry, exposed ridges and south facing slopes at higher elevations. Frost (1995) estimated presettlement fire frequency on ridges and upper slopes in the Appalachians was 7-12 years in the lower mountains and >12 years in higher mountains (>3,000 ft) (Buckner and Turrill 1999). Fires above 5000 ft. are even

less frequent (Barden and Woods 1974). The locations of human-caused fires are not as predictable.

Fortunately, the habitats occupied by the noonday snail and the spruce-fir moss spider are not typically vulnerable to wildfires. Fires are extremely infrequent in the spruce-fir forest and the north-facing slope occupied by the noonday globe is typically too moist to carry a fire. The same is generally true of the riparian areas bordering the streams occupied by the Appalachian elktoe.

Timing – In the southern Appalachians, lightning set fires occur in a bimodal distribution most often in late-spring and early summer, with a less frequent peak in early fall (Komarek 1964, 1968; Barden and Woods 1974). This pattern has held true on the Nantahala and Pisgah National Forests with about half (49 percent) of all fires occurring in March and April with a smaller peak (about 12 percent of all fires) in November. The fewest fires occur between June and September. The Cherokee National Forest has two separate fire seasons. The spring season is from (approximately) February 15th through May 1st. The fall season runs from (approximately) October 15th through December 1st. However, as indicated previously, red spruce and Fraser fir are both fire intolerant species and the fire potential at the site is low.

Disturbance Duration, Frequency, and Intensity - Annually, an average of six lightning fires per one million acres occurs in the Southern Appalachians. This frequency is greater than that recorded for the Great Plains, Mississippi Basin, or northeastern United States, but less than portions of the western and southeastern United States (Schroeder and Buck 1970; SAMAB 1996). However, 88 percent of all fires in the southern Appalachians are human-caused.

On the Cherokee, Nantahala and Pisgah National Forests, most fires are very small and of short duration. Since 2001, there has been an average of 91 fires per year that have burned an average of only about 35 acres each – a total (average) of about 3185 acres a year (0.3 percent of the Nantahala and Pisgah National Forests per year). Aerial application would only be used for wildfire suppression. Additionally, interviews with experienced US Forest Service fire fighters (Street and Myers 2008) revealed that there were only three fires on Roan Mountain in the past 35 years. All of these fires were small, low intensity, and not within spruce-fir forest. The need for a retardant drop within the spruce-fir forest on Roan Mountain is extremely limited.

B. Analyses of Effects of the Action

Potential Beneficial Effects

One of the primary factors affecting the Appalachian elktoe and its critical habitat is sediment (see Factors Affecting the Species' Environment Within the Action Area). If a fire was severe enough or expansive enough to expose a significant amount of bare soil or cause the loss of bank-stabilizing vegetation, the in-stream impacts of a fire could be considerable. The use of fire retardant could prevent such an event and, with the conservation measures in place, would be unlikely to have any negative effect on the mussel.

Direct Impacts

Given the Conservation Measures put in place on The Nantahala and Pisgah National Forest to prevent any adverse impacts to the Appalachian elktoe, no direct impacts are expected.

The primary effect on the Appalachian elktoe mussel (within the Cherokee National Forest) would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a mussel or result in an interruption of spawning activity or cause the abortion of larvae. Indirect effects could occur to mussels from the retardant interfering with fish host activity and/or presence, at critical times of larval mussel release and encystment on the fish host, or larval mussel excystment from the fish host. Many studies have concluded that ammonia is the primary toxic component in fire retardants (for example, see Buhl and Hamilton 2000 and McDonald and others 1997). Several factors determine whether an aquatic organism will be exposed to toxic levels of the ammonia compounds that make up roughly 10 percent of the retardant mixture: (1) avoidance of the contaminated area, (2) time exposed to the toxin, (3) water quality, including pH, (4) quantity of retardant spilled into freshwater, (5) type of water body, and (6) size of water body (Norris, Lorz, and Gregory 1991; Van Meter and Hardy 1975). Norris, Lorz, and Gregory (1991) reported that direct application of retardants onto the stream surface was the primary source of retardant contamination in streams. They found that only minor amounts of retardant entered streams from riparian areas and as small as a 3-meter buffer virtually eliminated retardant entering stream waters. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris, Lorz, and Gregory 1991). Additionally, the Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instruct pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to occur directly on the Nolichucky River, a perennial stream known to contain the Appalachian elktoe mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. In the time frame of 2001 through 2007, the Cherokee National Forest has had a total of 14 calls for retardant for an average of 2 calls per year (Martin 2008). This use is considered to be a rare event. Critical habitat Constituent Elements are previously noted in Nature of Effects. Of the seven elements, Constituent Element 1 (as it applies to "clean" water) and Constituent Element 7 (fish hosts) can be affected by the presence of ammonia compounds in solution in the water. Constituent Element 4 (as it applies to sediment) can be beneficially affected by fire suppression activities, in general. The direct effects to critical habitat are the same as those provided in the previous species discussion.

Indirect Impacts - Indirect effects are defined as those that are caused by the proposed action and are later in time but are still reasonably certain to occur (50 CFR 402.02). Given the Conservation Measures put in place on the Nantahala and Pisgah National Forests to prevent any adverse impacts to the Appalachian elktoe, no indirect impacts are expected.

The use of aerially applied fire retardant is considered a rare event on the Cherokee National Forest. Indirect effects could occur to Appalachian elktoe mussel from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. However, several factors limit the likelihood of exposure to ammonia (as discussed above). Additionally, the Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instruct pilots to avoid known water bodies; however, there are exceptions. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to occur directly on the Nolichucky River, a perennial stream known to contain the Appalachian elktoe mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. Aerial application would only be used for wildfire suppression. Fire retardant use on the Cherokee National Forest is considered to be a rare event. Indirect effects to Critical Habitat are the same as those provided in the species discussion above.

Cumulative effects include the combined effects of any future state, local, or private actions that are reasonably certain to occur within the action area covered in this Opinion. Because the Action Area is entirely on federal land (the Cherokee, Nantahala and Pisgah National Forests), consultation pursuant to section 7 of the Act would be required for all future actions. Therefore, no cumulative impacts are expected.

CONCLUSION

After reviewing the current status of the Appalachian elktoe; the environmental baseline for the action area (the Nantahala and Pisgah National Forests); the effects of implementation of the *Guidelines for Aerial Delivery of Retardant or Foam Near Waterways* (April 2000)]; conservation measures identified by the U.S. Forest Service for the use of fire retardant on the Nantahala and Pisgah National Forests; any potential interrelated and interdependent actions associated with the proposed action; and any potential cumulative effects, it is the Service's opinion that the use of fire retardants on the Nantahala and Pisgah National Forests is not likely to adversely affect (not likely to jeopardize the continued existence of) the Appalachian elktoe.

This proposed action is not likely to jeopardize the continued existence of the Appalachian elktoe mussel with respect to the Cherokee National Forest for the following reasons: 1) This species likely occurs in relatively small numbers at scattered sites and therefore it is unlikely all or a large percentage of individuals or populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to

occur directly on the Nolichucky River, a perennial stream that contains the Appalachian elktoe mussel. 3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Cherokee National Forest. Critical habitat has been designated for this species, but the proposed action is not likely to affect that critical habitat with respect to the Cherokee National Forest. The proposed action is not expected to alter Constituent Elements two, three, five, or six. Of the seven elements, Constituent Element 1 (as it applies to “clean” water) and Constituent Element 7 (fish hosts) can be affected by the presence of ammonia compounds in solution in the water. Constituent Element 4 (as it applies to sediment) can be beneficially affected by fire suppression activities, in general.

Fat Threeridge (*Amblema neisleri*)

Effects Analyses:

The fat threeridge is a fairly wide ranging mussel occurring in the main stems of the Flint, Apalachicola and Chipola river systems in southwest Georgia and north Florida. Critical habitat was designated for this species, as well as six other mussel species from northwest Florida and Georgia in 2007 (72 FR 64286). Critical habitat for the fat threeridge includes Units 2, 7 and 8. Unit 2 encompasses the Chipola River and is entirely outside of the boundaries of the Apalachicola River, and therefore, not effected by this proposed action. Unit 7 of designated critical habitat encompasses the lower Flint River in Georgia and also entirely outside of the boundaries of the Apalachicola River, and therefore, not effected by this proposed action. Unit 8 encompasses the Apalachicola River main stem from Jim Woodruff Dam downstream to Bloody Bluff Island in Franklin County, Florida, two of its distributaries, the Chipola Cutoff and Swift Slough, and three of its tributaries, River Styx, Kennedy Slough, and Kennedy Creek. Only the main stem of the Apalachicola River in Liberty and Franklin Counties, FL occurs adjacent to the boundary of the Apalachicola National Forest, and therefore, may be affected by the proposed action.

The Forest Service’s April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies by using a 300 foot buffer. However, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. The Service believes that accidental aerial application of retardant is unlikely to be applied directly to the Apalachicola River as it is a large waterbody easily seen and avoided during aerial application. Additionally, the location is mostly rural and unlikely to invoke the exceptions to the Forest Service guidelines. However, even in the event of an accidental application of fire retardant that hits or partially hits the Apalachicola River, application is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution, and the short toxic exposure period of the chemicals. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris et al.1991). Additionally, aerial application of fire retardant is a rare event on the Apalachicola National Forest, only used seven

times in seven years on the three National Forests in Florida, making the proposed action even less likely to occur.

Conclusion:

After reviewing the current status of the fat threeridge and the likely effects of the use of fire retardant on the Apalachicola National Forest, we conclude the following: (1) The proposed action only incorporates a small portion of the known range and designated critical habitat of the species; (2) The toxic exposure period of the fire retardants proposed for use is 24 hours or less and would not result in permanent impacts to species habitat; (3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution; (4) The Service believes that aerial application of fire retardant is unlikely to be applied to the Apalachicola River because of the Forest Service guidance to avoid water bodies, and; (5) The use of aerially applied fire retardant is considered a rare event on the Apalachicola National Forest, only used seven times in seven years on the three National Forests in Florida. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the fat threeridge or result in adverse modification or destruction of its critical habitat.

Tumbling Creek Cavesnail (*Antrobia culveri*)

Effects Analysis

The Tumbling Creek cavesnail is a narrow endemic species that only occurs in Tumbling Creek Cave in Missouri. The Mark Twain National Forest (MTNF) is the only National Forest that could implement the proposed action that would affect the species. There are no occupied sites for the cavesnail on the MTNF. However, the MTNF has approximately 23% (~1100 acres) of the total recharge area (5,854 acres) for Tumbling Creek Cave. The remaining recharge area is owned mainly by private owners or by the U.S. Army Corps of Engineers (2%). A recent dye tracing study in the recharge area concluded that dye placed at Highway 160 (in the MTNF boundary) took 53-59 hours to reach the cave (Aley 2007). Therefore, if it were to rain within 24 hours of fire retardant use, those chemicals might reach the cave quickly.

If fire retardant were used in the recharge area, it could have adverse effects on the species if it rained fairly quickly and mobilized the chemicals in the retardant. However, the likelihood that fire retardant would be used in this area is considered very small. The MTNF manages much of the acreage in the recharge area with prescribed fire (no retardant used to manage fire lines) and with livestock grazing. When wildfires occur on the MTNF initial attack methods are usually sufficient to control the spread of the fires. The MTNF uses fire retardants only in rare instances. Over the last 10 years, the MTNF had an average of 171 wildfires per year. Average acreage burned by wildfire over the same time frame was 5062 acres per year. During that timeframe an average of 24 wildfires per year were over 50 acres in size. The MTNF has used fire retardants only three times in the last 20 years. In all three instances, structures were threatened by the wildfire. The MTNF does not have an air tanker or retardant storage facilities. In order to obtain those services, the Forest must call on resources in Arkansas, if they are available (J. Eberly, MTNF, pers. comm.). The MTNF does not plan on increasing the use of fire retardant, however wants to maintain the option to use it if structures or life is threatened by wildfire. In Missouri

the period most likely to produce stand replacing fires is from approximately March 25 to April 15. The MTNF also has use of a helicopter for water only drops for fire control, also minimizing the need for use of fire retardant. There are only five structures within the MTNF boundary that are within the recharge area. Fire retardant has never been used on the District in question.

The 2005 Land and Resource Management Plan (Forest Plan) for the Mark Twain National Forest addresses wildland fire suppression on pages 2-17 to 2-19. Since the Forest rarely uses fire retardants, only one guideline for its use was written:

“Do not apply fire retardants directly over water bodies unless needed for firefighter or public safety.”

Conclusion

Since the MTNF uses fire retardant so infrequently and has never used it on the District within the recharge area for Tumbling Creek Cave, the proposed action is not reasonably certain to occur in the area that would affect the Tumbling Creek cavesnail. Therefore, the proposed action is not likely to jeopardize the continued existence of the species.

Oachita rock pocketbook (*Arkansia wheeleri*)

The Ouachita Rock Pocketbook does not occur on National Forest lands in Arkansas. Any impacts to this species from the use of fire retardants on the Ouachita National Forest would occur to populations in Oklahoma. For the National Forest lands in Arkansas, the proposed action would have no effect on this species.

The Ouachita rock pocketbook (*Arkansia wheeleri*) is a freshwater mussel that maintains populations in limited sections of three rivers within Oklahoma and Arkansas. Occurrences of the species near National Forest System (NFS) lands consist of one population inhabiting the Kiamichi River downstream from the Kiamichi Ranger District of the Ouachita National Forest, and another population inhabiting the Little River partly downstream from the Tiak Ranger District of the Ouachita National Forest.

Four significant populations of the Ouachita rock pocketbook are known, including the two downstream from NFS lands. The Kiamichi River population is estimated to be fewer than 1,800 individuals and the upper Little River population (upstream of Millwood Reservoir) is estimated to be less than 100 individuals. The other populations are poorly known but probably small, such that the entire species may consist of less than 2,500 individuals.

The Ouachita rock pocketbook was listed primarily because of its decline in association with impoundments, channelization, and water quality degradation. Although one new population of the species has been found in recent years, rangewide surveys and monitoring have indicated a continuing decline in occurrence at most historical localities. Quality of habitat at those localities continues to be threatened by historical factors and by proposals for further water resource development, land use changes, direct disturbance of river channels/riparian zones, drought, and potential invasion of these systems by exotic dreissenid mussels (USFWS 2004, Galbraith and others 2005).

Effects of the Action

The proposed action has a potential to affect two populations of the Ouachita rock pocketbook. These populations are not located within the action area, but do occur in downstream segments of streams that drain NFS lands. Consequently, they could be affected by instream transport of retardants and their degradation products off of NFS lands to downstream habitats. Because precise chemical compositions of the retardants was not provided for the consultation, it is not possible to evaluate the specific effects of each formulation on the Ouachita rock pocketbook and associated mussel species. However, because all of the approved retardants contain ammonium phosphate compounds, gum thickener, and bactericide, a potential exists for any of them to cause a variety of adverse effects ranging from direct (e.g., ammonia) toxicity to indirect effects, as might result from an algal bloom (e.g., causing dissolved oxygen depletion or a change in food particles) or a reduction in bacterial populations (another component of mussel diets).

Some factors would tend to reduce potential adverse effects whereas other factors would tend to increase them. The Ouachita rock pocketbook is adapted primarily to large creek and river habitats, and is unlikely to occur in many small streams draining NFS lands. The closest known occurrences of the species downstream of NFS lands are near Whitesboro (for the Kiamichi River population) and just upstream of the Mountain Fork River (for the upper Little River population). The former of these is approximately 2 stream miles from NFS lands while the latter is approximately 1.5 stream miles from NFS lands. Most individuals of the populations would occur at greater distances from NFS lands, the Kiamichi River population inhabiting an 88-mile river section and the upper Little River population inhabiting 69 river miles. The entire Kiamichi River population lies downstream from NFS lands whereas approximately two-thirds of the inhabited portion of the upper Little River lies downstream from NFS lands. Retardant compounds traveling these distances would undergo dilution and degradation.

Because fire responses in the area are relatively short in duration, retardant concentrations would be most elevated over short periods of time, in conjunction with applications and precipitation events. However, many decomposition products of retardants are persistent and capable of producing their own ecological effects, such as algal enrichment. In addition, the life history characteristics of mussels like the Ouachita rock pocketbook indicate that populations of these animals have limited, prolonged abilities to recover from adverse effects. As indicated above, impacts to mussels would be most intense and severe at locations close to points of retardant input to streams, and would tend to attenuate downstream.

Conclusion

After reviewing the current status of the Ouachita rock pocketbook and the likely effects of the proposed fire retardant use on NFS lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Ouachita rock pocketbook. No critical habitat has been designated for the species; therefore none will be affected. Our conclusion is based upon (1) the absence of the species from NFS lands; (2) the potential exposure of only two of four known populations of the species to retardants transported off of NFS lands, and incomplete exposure of one of the populations; (3) the substantial distance of most potentially exposed individuals from NFS lands, by which likely exposure levels would be

reduced; (4) the expected effectiveness of buffer zone guidelines in normally minimizing instream concentrations of retardants; and (5) expectations that potential exposures of the mussels to elevated retardant levels would likely be infrequent and of short duration.

We recommend that the Ouachita National Forest be directed to work with the USFWS, prior to any emergency consultation associated with an actual fire, to develop a memorandum of agreement (MOA) to better address potential adverse effects of the action on the endangered Ouachita rock pocketbook. Subjects covered by this MOA should include, at a minimum, identifying needs for better evaluating potential effects on the species from retardant applications, identifying and providing means of reducing adverse effects, and standards for implementing these means during and after retardant applications.

Uncompahgre fritillary butterfly (*Boloria improba acrocneuma*)

Effects Analysis

The proposed action is not expected to adversely affect the Uncompahgre fritillary butterfly. The species occurs in small populations in the San Juan Mountains in southwestern Colorado (55 Federal Register 41721). The Uncompahgre fritillary butterfly occurs at elevations over 12,500 feet (3,810 meters) in alpine habitats above treeline (Service 1994). This habitat is unlikely to be subject to fire fighting activities because of the relatively low amount of fuels and its remote location. Thus, we do not expect that the USFS is likely to release fire retardants within the habitat of the Uncompahgre fritillary butterfly.

Conclusion

After reviewing the current status of the Uncompahgre fritillary butterfly and the likely effects of the use of fire retardant on USFS lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Uncompahgre fritillary butterfly. Our conclusion is based on the fact that the species occurs above treeline in areas unlikely to be subject to fire fighting activities. No critical habitat has been designated for the species; therefore, none will be affected by the proposed action.

Conservancy Fairy Shrimp (*Branchinecta conservatio*) (CFS)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) contained 30 occurrences for this species throughout the Central Valley (CNDDDB 2007). None of these locations are on or near Forest Service lands. Los Padres National Forest staff is aware of a CFS population on their lands, which is not reported in CNDDDB (pers. com. Kevin Cooper of LPNF).

Direct, Indirect, and Cumulative Effects

CFS spends most of the year in the cyst stage of their life cycle, with their only active time when the vernal pool is inundated with water (late winter through late spring). Since most fire suppression activities occur in summer and fall in California, if a retardant drop happens to hit either the single known population on Forest Service lands or any other existing but unknown populations on Forest Service lands, it would mostly likely occur during the dormant life stage

when the species is at its most resilient form (the cyst). Given the conditions and timing of the retardant's environmental breakdown, it is highly unlikely that it would still be present in the subsequent year's wet season (Boulton et al. 2003).

If a retardant drop were to occur on the vernal pool while the CFS were active, the retardant is expected to be moderately to significantly toxic due to the fact that vernal pools are stable, small water bodies that cannot dilute the retardant (Adams and Simmons 1999). CFS could be injured or killed if a retardant drop were to hit an occupied vernal pool.

Conclusion

After reviewing the current status of the conservancy fairy shrimp, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of conservancy fairy shrimp. The proposed action would not lead to a substantial decline in number of CFS, a substantial reduction in range of CFS and it would not preclude the recovery of CFS. This conclusion is based on the following reasons: (1) the spatial extent of the species outside the proposed action area is large with only a single population known on Forest Service lands; (2) the likelihood of the single population being affected by retardant is extremely low (3) the species is not likely to be active during times of retardant drops; and (4) potential adverse effects are considered short-term.

Longhorn Fairy Shrimp (*Branchinecta longiantenna*)

The proposed project is outside the known range of the longhorn fairy shrimp. Because there are no known occurrences of this listed species on or adjacent to U.S. Forest Service lands and the project is outside the range of this species, the Service has determined that the proposed project is not likely to adversely affect the longhorn fairy shrimp.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) (VPFS)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) showed 519 occurrences for this species throughout the Central Valley and Central Coast Range (CNDDDB 2007). Of these 519 locations, three are on Forest Service lands (Los Padres National Forest).

Direct, Indirect, and Cumulative Effects

Given the geographic locations of the three populations of VPFS on Forest Service lands, it is highly unlikely that all three occurrences would be impacted by fire suppression activities in a given year.

VPFS spends most of the year in the cyst stage of their life cycle, with their only active time when the vernal pool is inundated with water (late winter through late spring). Since most fire suppression activities occur in summer and fall in California, if a retardant drop happens to hit this single population, it would mostly likely occur when the species is a cyst, its most resilient form. Given the conditions and timing of the retardant's environmental break down, it is highly unlikely that it would still be present in the subsequent year's wet season (Boulton et al. 2003).

If a retardant drop were to occur on the vernal pool while the VPFS were active, the retardant is expected to be moderately to significantly toxic due to the fact that vernal pools are stable, small water bodies that cannot dilute the retardant (Adams and Simmons 1999). VPFS could be injured or killed if a retardant drop were to hit an occupied vernal pool.

Conclusion

After reviewing the current status of the vernal pool fairy shrimp, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of vernal pool fairy shrimp. The proposed action would not lead to a substantial decline in number of VPFS, a substantial reduction in range of VPFS and it would not preclude the recovery of VPFS. This conclusion is based on the following reasons: (1) the spatial extent of the species outside the proposed action area is large with only three populations known on Forest Service lands; (2) the likelihood of any single Forest Service land population being affected by retardant is extremely low; (3) the species is not likely to be active during times of retardant drops; and (4) potential adverse effects are considered short-term.

Hell Creek Crayfish (*Cambarus zophonastes*) and *Cambarus aculabrum*

The Hell creek crayfish and *Cambarus aculabrum* do not occur on USFS administered lands. The current known locations for the Hell creek crayfish include two caves which lie approximately 5 miles and 8 miles off USFS lands respectively. There is a suspected site that is about 10 miles off USFS lands. Given the Hell creek crayfish is a groundwater dependent species, and their surface recharge zones are delineated, it's determined no surface hydrogeologic connection occurs with adjacent USFS lands. *Cambarus aculabrum* is located in Benton and Washington County and there is no USFS lands nearby. There is a USFS Wedington unit in Washington County about 5 mile west of the most southerly crayfish site, although this site is one we'll probably never find another crayfish as it is a spring and is not enterable. For the National Forest lands in Arkansas, the proposed action would have no effect on these species.

Fanshell (*Cyprogenia stegaria*)

The following account applies to the Daniel Boone National Forest, Kentucky. See also the fanshell analysis for the George Washington and Jefferson National Forests, Virginia, further below.

a. Factors to be considered

Proximity of the action: The fanshell, *Cyprogenia stegaria*, is known to occur in certain perennial streams on the Daniel Boone National Forest, in perennial streams that flow from the Daniel Boone NF, and/or in perennial streams off the Daniel Boone NF that receive flow from tributary streams from the Daniel Boone NF. The aerial application of retardant could be applied on or adjacent to some of these streams.

No critical habitat has been designated for this species.

Distribution: The fanshell mussel is found on or near the Daniel Boone NF in the Licking River drainage of Eastern Kentucky, and it is possible it may occur in other areas of the Daniel Boone NF.

Timing: Periods for which the fanshell mussel may be particularly sensitive to the constituents of fire retardant include the fall and winter when spawning occurs along with the development of larvae or glochidia in the female mussel. Glochidia are released in late winter and into spring at which time they attach to a fish host for about two to three weeks and then drop off the fish host and settle in the stream bottom. Therefore the time period from late fall till late spring may be especially sensitive periods for this species. The Daniel Boone NF has two separate fire seasons that generally last around 10 weeks each. The spring season is from (approximately) February 1st through May 15th. The fall season runs from (approximately) October 1st through December 15th.

Nature of the effect: The primary effect on the fanshell mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a mussel or result in an interruption of spawning activity or cause the abortion of larvae. Indirect effects could occur to mussels from the retardant interfering with fish host activity and/or presence, at critical times of larval mussel release and encystment on the fish host, or larval mussel excystment from the fish host.

No critical habitat has been designated for this species.

Duration: The effects of this proposed action would most likely be considered a short term (pulse) event; however, depending on stream conditions (i.e., rainfall, flow) the duration could extend over a greater extent of stream length.

Disturbance frequency: The Service is not able to make a precise assessment regarding disturbance frequency; however, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. Aerial application would only be used for wildfire suppression. The use of fire retardant is thought to have been used only once in the last four years on the Daniel Boone Forest.

Disturbance intensity: The Service is not able to make a precise assessment regarding disturbance intensity; however, it is likely the intensity of fire retardant application would be dependent on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

Disturbance severity: The Service is not able to make a precise assessment regarding disturbance severity; however, severity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

b. Analyses for effects of the action

Beneficial effects: The Service does not believe the effects of the action are wholly beneficial to this species.

Direct effects: A direct effect on the fanshell mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the fire retardant is applied and/or very soon thereafter. If these effects are severe enough they could result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain fanshell mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

Interrelated and interdependent actions: Based on the information provided the Service has not identified any interrelated or interdependent actions applicable to this proposed aerial application of fire retardant.

Indirect effects: Indirect effects could occur to fanshell mussels from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly

on perennial streams that could contain the fanshell mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

c. Species' response to a proposed action

Numbers of individuals/populations in the action area affected: The exact number of individuals/populations of the fanshell mussel in the action area is not known; however, it occurs in multiple locations in the Licking River drainage, and therefore it is unlikely all populations would be affected from any particular fire retardant application.

Sensitivity to change: The Service does not know how sensitive to change the fanshell mussel is. Adult mussels in general are considered less sensitive than juveniles. Mussels in general are known to be sensitive to low levels of ammonia compounds.

Resilience: The Service does not know how resilient the fanshell mussel is to this particular action. Mussels are dependent on their proper fish host being present in sufficient numbers to allow successful recruitment, so the resilience of the fish host is also a factor to be considered.

Recovery rate: The recovery rate of the fanshell mussel is unknown; however, it is generally accepted by mussel biologists that mussel recovery rates are slower than those of many other invertebrates and fish, due to presence and availability of the fish host.

CONCLUSION

After reviewing the current status of the fanshell mussel, the environmental baseline for the action area, and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely to jeopardize the continued existence of the fanshell mussel. No critical habitat has been designated for this species, therefore, none will be affected.

The primary direct effects on this species would be from toxic ammonia compounds as the fire retardant is being applied and/or very soon thereafter. If these effects are severe enough they could possibly result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. Indirect effects could occur from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial

streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain this species. However, the accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution.

Aerially applied fire retardant is not likely to jeopardize the continued existence of the fanshell mussel for the following reasons: 1) The species is located in several streams and therefore it is unlikely all populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to be applied directly on perennial streams that contain this species. 3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Daniel Boone NF, it is thought to have been used once in the last four years.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) (beetle)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) showed 196 occurrences for this species in 44 drainages throughout the Central Valley, from a location along the Sacramento River in Shasta County, southward to an area along Caliente Creek in Kern County. Populations occur from the Central Valley floor, up to 3000 feet elevation in the Sierra Nevada Foothills (CNDDDB 2007). Of the 196 occurrences, only eight occurrences are on Forest Service land (five on Sierra NF, two on Sequoia NF, one on Plumas NF). There is one known occurrence adjacent to Forest Service lands. There is also the potential for this species to occur elsewhere on Forest Service lands, as it is likely that suitable habitat exists in areas that have not yet been surveyed.

Direct, Indirect and Cumulative Effects

Given the locations of known occurrences of the beetle on Forest Service lands and the general size and scope of a fire in California, it is highly unlikely that more than one known occurrence would be impacted by fire suppression activities in a given year. If we consider the entire potential habitat that has not been surveyed, it is highly unlikely that more than 1% of the potential beetle habitat would be impacted by fire suppression activities in a given year.

Beetles spend most of their life as larvae within the stems of elderberry shrubs (*Sambucus* sp.). Beetles emerge from shrubs between mid-March through June, with adult activity spanning just a few weeks (USFWS 1984). Since most fire suppression activities occur in summer and fall in California, it is highly unlikely that a retardant drop would directly hit the beetle. Given the conditions and timing of the retardant's environmental breakdown, it is highly unlikely that it would still be present in the subsequent year's flight season.

Because it has been demonstrated that plants absorb chemicals from their environment (Barbour et al. 1999), the retardant is anticipated to be absorbed by the beetle's host plant. It is unknown whether these chemicals moving through the host plant would have any measurable effect to the beetle larvae. Without this knowledge, the conservative approach, erring on the side of the

species, would lead us to assume that there may be an adverse effect to the beetle leading to potentially killing the larvae.

If a retardant drop occurs near or on elderberry shrubs, we expect the shrub will have increased growth and vigor during the next six growing season. The new growth could lead to increased herbivore browsing on the green leaves and young shoots. However, the beetle only uses portions of the elderberry shrub that are greater than one inch in diameter which is larger than what would likely be browsed. Thus while increase growth of elderberry shrubs may lead to increase herbivory, this is not expected to adversely affect the beetle.

If fire retardant were dropped on elderberry shrubs, these shrubs would have a reduced likelihood of burning, thus protecting beetle habitat.

Conclusion

After reviewing the current status of the valley elderberry longhorn beetle, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of valley elderberry longhorn beetle. The proposed action would not lead to a substantial decline in number of the beetles, a substantial reduction in range of the beetle and it would not preclude the recovery of the beetle. This conclusion is based on the following reasons: (1) the spatial extent of the anticipated effects is small in comparison to the species' likely current distribution in the action area; (2) the spatial extent of the species outside the proposed action area is large; (3) the species is not likely to be active during times of retardant drops; and (4) potential adverse effects are considered short-term.

Elimia Snail (*Elimia crenatella*)

The proposed action is expected to have a minor impact to the lacy elimia snail. The lacy elimia is found in several streams near the boundary of the west side of the Talladega National Forest including Cheaha, Weewoka, Emauhee and Talladega Creeks, with the largest population occurring in Cheaha Creek just downstream of the Forest boundary (Mirarchi, et. al 2004a). The lacy elimia is found in several drainages near the boundary of the Forest, but fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008); therefore, it is highly unlikely that the lacy elimia will be impacted by the proposed action. Were the Forest Service to begin using fire retardants on Talladega National Forest, a fire retardant application to Cheaha Creek would create a greater concern for the continued existence of the lacy elimia.

There is no designated critical habitat for the lacy elimia; therefore, there will be no effects.

Conclusion

After reviewing the current status of the lacy elimia, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action

is not likely to jeopardize the continued existence of the lacy elimia. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the lacy elimia is found in several drainages outside of National Forest lands, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Purple Bankclimber (*Elliptoideus sloatianus*)

Effects Analyses:

The purple bankclimber is a fairly wide ranging mussel occurring in the Apalachicola, Flint, Chipola, Ochlockonee and Chattahoochee Rivers of Alabama, Georgia and Florida. Critical habitat was designated for this species, as well as six other mussel species from northwest Florida and Georgia in 2007 (72 FR 64286). Critical habitat for the purple bankclimber includes Units 5, 6, 7, 8, 9, and 10. Only Units 8 (the Apalachicola River main stem from Jim Woodruff Dam downstream to Bloody Bluff Island in Franklin County, Florida, two of its tributaries, the Chipola Cutoff and Swift Slough, and three of its tributaries, River Styx, Kennedy Slough, and Kennedy Creek) and 10 (the Lower Ochlockonee River in Leon, Liberty and Wakulla Counties, FL) occur within the boundaries or adjacent to the boundaries of the Apalachicola National Forest. The main stem of the Apalachicola River in Liberty and Franklin Counties, FL occurs adjacent to the boundary of the Apalachicola National Forest, and therefore, may be affected by the proposed action. The Ochlockonee River runs through the Apalachicola National Forest in Leon, Liberty and Wakulla Counties, FL.

The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies by using a 300 foot buffer. However, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. The Service believes that accidental aerial application of retardant is unlikely to be applied directly to the Apalachicola or Ochlockonee Rivers because they are large waterbodies easily seen and avoided during aerial application. Additionally, the locations are mostly rural and unlikely to invoke the exceptions to the Forest Service guidelines. However, even in the event of an accidental application of fire retardant that hits or partially hits the Apalachicola or Ochlockonee Rivers, application is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution, and the short toxic exposure period of the chemicals. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris et al.1991). Additionally, aerial application of fire retardant is a rare event on the Apalachicola National Forest, only used seven times in seven years on the three National Forests in Florida, making the proposed action even less likely to occur.

Conclusion:

After reviewing the current status of the purple bankclimber and the likely effects of the use of fire retardant on the Apalachicola National Forest, we conclude the following: (1) The proposed action only incorporates a small portion of the known range and designated critical habitat of the species; (2) The toxic exposure period of the fire retardants proposed for use is 24 hours or less and would not result in permanent impacts to species habitat; (3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution; (4) The Service believes that aerial application of fire retardant is unlikely to be applied to the Apalachicola or Ochlockonee Rivers because of the Forest Service guidance to avoid water bodies, and; (5) The use of aerially applied fire retardant is considered a rare event on the Apalachicola National Forest, only used seven times in seven years on the three National Forests in Florida. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the purple bankclimber or result in the adverse modification or destruction of its critical habitat.

Cumberlandian combshell (*Epioblasma brevidens*)

The following account applies to Alabama. See also the fanshell analysis for the George Washington and Jefferson National Forests, Virginia, further below.

The proposed action is expected to have little to no impact to the Cumberlandian combshell. Once found throughout the Tennessee and Cumberland Rivers and a few of their tributaries, the only known population in Alabama is now found in Bear Creek, more than 65 km downstream of Bankhead National Forest (Mirarchi, et. al 2004a). It is found in Tennessee in the Powell, Clinch and Holston drainages (Parmalee and Bogan 1998). Because the Cumberlandian combshell is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the Cumberlandian combshell will be impacted by the proposed action in Alabama.

There is no critical habitat for Cumberlandian combshell on or in proximity to National Forest lands in Alabama; occupied critical habitat does exist approximately 65 km downstream of Bankhead National Forest.

Conclusion

After reviewing the current status of the Cumberlandian combshell and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Cumberlandian combshell. Critical habitat for this species has been designated at Bear Creek approximately 65 km from Bankhead National Forest, however this action does not affect that area and no destruction or adverse modification of that critical habitat is expected.

Our conclusion is based upon the following: the Cumberlandian combshell and its critical habitat are not found on National Forest lands, US Forest Service fire managers in Alabama have

never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Oyster mussel (*Epioblasma capsaeformis*)

The following account applies to the Daniel Boone National Forest, Kentucky. See also the fanshell analysis for the George Washington and Jefferson National Forests, Virginia, further below.

a. Factors to be considered

Proximity of the action: The oyster mussel, *Epioblasma capsaeformis*, is known to occur in certain perennial streams on the Daniel Boone National Forest, in perennial streams that flow from the Daniel Boone NF, and/or in perennial streams off the Daniel Boone NF that receive flow from tributary streams from the Daniel Boone NF. The aerial application of retardant could be applied on or adjacent to some of these streams.

Critical habitat has been designated for this species in the following streams and counties in Kentucky: Big South Fork Cumberland River in McCreary County and Buck Creek in Pulaski County. Critical habitat has also been designated for this species in five other streams in Tennessee, Virginia, Mississippi, and Alabama.

Distribution: In Kentucky, the oyster mussel is found on or near the Daniel Boone NF in Buck Creek and the Big South Fork Cumberland River in the upper Cumberland River drainage of Eastern Kentucky. It may also occur in the Rockcastle River drainage, a tributary of the upper Cumberland River in Kentucky.

Timing: Periods for which the oyster mussel may be particularly sensitive to the constituents of fire retardant include the fall and winter when spawning occurs along with the development of larvae or glochidia in the female mussel. Glochidia are released in late winter and into spring at which time they attach to a fish host for about two to three weeks and then drop off the fish host and settle in the stream bottom. Therefore the time period from late fall till late spring may be especially sensitive periods for this species. The Daniel Boone NF has two separate fire seasons that generally last around 10 weeks each. The spring season is from (approximately) February 1st through May 15th. The fall season runs from (approximately) October 1st through December 15th.

Nature of the effect: The primary effect on the oyster mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a mussel or result in an interruption of spawning activity or cause the abortion of larvae. Indirect effects could occur to mussels from the retardant interfering with fish host activity and/or presence, at critical times of larval mussel release and encystment on the fish host, or larval mussel excystment from the fish host.

Critical habitat has been designated for this species. The five primary constituent elements for this species are listed as follows along with the nature of the effect of this action on each.

- 1) Permanent flowing stream reaches with a flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
- 2) Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
- 3) Stable substrates, consisting of mud, sand, gravel, and/or cobble/boulder, with low amounts of fine sediments or attached filamentous algae.
- 4) Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussel and its fish host.
- 5) Fish hosts with adequate living, foraging, and spawning areas for them.

The proposed action is not expected to alter constituent elements 1-3. Constituent elements 4 (water quality) can be affected by the presence of ammonia compounds in solution in the water. Constituent element 5 (fish host) can affect fish hosts primarily by causing mortality or altering behavior.

Duration: The effects of this proposed action on both this species and designated critical habitat would most likely be considered a short term (pulse) event; however, depending on stream conditions (i.e., rainfall, flow) the duration could extend over a greater extent of stream length.

Disturbance frequency: The Service is not able to make a precise assessment regarding disturbance frequency for this species or its designated critical habitat; however, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. Aerial application would only be used for wildfire suppression. The use of fire retardant is thought to have been used only once in the last four years on the Daniel Boone Forest.

Disturbance intensity: The Service is not able to make a precise assessment regarding disturbance intensity for this species or its designated critical habitat; however, it is likely the intensity of fire retardant application would be dependent on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

Disturbance severity: The Service is not able to make a precise assessment regarding disturbance severity for this species or its designated critical habitat; however, severity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

b. Analyses for effects of the action

Beneficial effects: The Service does not believe the effects of the action are wholly beneficial to this species.

Direct effects: A direct effect on the oyster mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the fire retardant is applied and/or very soon thereafter. If these effects are severe enough they could result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain the oyster mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

Critical habitat constituent elements are previously noted in Nature of the Effect above. Of the five elements, water quality (4) and fish host (s) (5) may be adversely affected by fire retardant and its associated toxic ammonia compounds released into designated critical habitat waters. Constituent element 4 (water quality) may be adversely affected primarily by the presence of ammonia compounds in the water. Ammonia compounds may adversely affect constituent element 5 (fish host) directly by causing mortality or altering behavior. The discussion above regarding the aerial application of fire retardant applies similarly to this designated critical habitat analysis.

Interrelated and interdependent actions: Based on the information provided the Service has not identified any interrelated or interdependent actions applicable to the species or designated critical habitat, regarding this proposed aerial application of fire retardant.

Indirect effects: Indirect effects could occur to the oyster mussel from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs

possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain the oyster mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

Critical habitat constituent elements are previously noted in Nature of the Effect above. Of the five elements, water quality (4) and fish host (s) (5) may be adversely affected by the presence of fire retardant and its associated toxic ammonia compounds released into designated critical habitat waters. Constituent element 4 (water quality) may be adversely affected by ammonia compounds in the water. Ammonia compounds may adversely affect constituent element 5 (fish host) indirectly by altering behavior and loss of recruitment. The discussion above regarding the aerial application of fire retardant applies similarly to this designated critical habitat analysis.

c. Species' response to a proposed action

Numbers of individuals/populations in the action area affected: The exact number of individuals/populations of the oyster mussel in the action area is not known; however, based on recent records it persists in two upper Cumberland River tributaries located in Kentucky. This species is located in multiple locations in these two streams and therefore it is unlikely all populations would be affected from any particular fire retardant application.

Sensitivity to change: The Service does not know how sensitive to change the oyster mussel is. Adult mussels in general are considered less sensitive than juveniles. Mussels in general are known to be sensitive to low levels of ammonia compounds.

Resilience: The Service does not know how resilient the oyster mussel is to this particular action. Mussels are dependent on their proper fish host being present in sufficient numbers to allow successful recruitment, so the resilience of the fish host is also a factor to be considered.

Recovery rate: The recovery rate of the oyster mussel is unknown; however, it is generally accepted by mussel biologists that mussel recovery rates are slower than those of many other invertebrates and fish, due to presence and availability of the fish host.

CONCLUSION

After reviewing the current status of the oyster mussel, the environmental baseline for the action area, and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely to

jeopardize the continued existence of the oyster mussel, and is not likely to destroy or adversely modify designated critical habitat.

This proposed action is not likely to jeopardize the continued existence of the oyster mussel for the following reasons: 1) The species is located in two streams in multiple locations, and therefore it is unlikely all populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to be applied directly on perennial streams that contain this species. 3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Daniel Boone NF, and it is thought to have been used once in the last four years.

The primary direct effects on this species would be from toxic ammonia compounds as the fire retardant is being applied and/or very soon thereafter. If these effects are severe enough they could possibly result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. Indirect effects could occur from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain this species. However, the accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution.

Critical habitat has been designated for this species, but the proposed action is not likely to destroy or adversely modify that critical habitat. Critical habitat constituent elements are previously noted in Nature of the Effect above. The proposed action is not expected to alter constituent elements one, two, or three. Constituent element four (water quality) and five (fish host) may be adversely affected by the presence of fire retardant and its associated ammonia compounds in designated critical habitat waters. Constituent element 4 (water quality) may be adversely affected directly and indirectly by the presence of fire retardant and its associated ammonia compounds in the water. Ammonia compounds may adversely affect constituent element 5 (fish host) directly and indirectly by mortality, loss of recruitment, and altering behavior. The Service assumes that these effects would occur only rarely, and the effects would be localized and temporary. The discussion above regarding the aerial application of fire retardant applies similarly to this designated critical habitat analysis.

YELLOW-BLOSSOM PEARLYMUSSEL (*Epioblasma florentina florentina*)

a. Factors to be considered

Proximity of the action: The yellow-blossom pearlymussel, *Epioblasma florentina florentina*, is considered extinct by The Nature Conservancy (NatureServe 2008) and the scientists who contribute to their species reports. It is purported from a single collection in Citico Creek on May 19, 1957 (TDEC 2007). The Citico Creek specimen (collected by H. D. Athearn) is accepted as valid by Parmalee and Bogan (1998). However, the location, approximately one half mile downstream of the Cherokee National Forest boundary (-84.1046 35.5394), was inundated when Tellico Dam was closed in 1976. While suitable habitat for this species is not present in Citico Creek upstream of the reservoir, searches for mussels in this area have been conducted. These surveys failed to produce any *Epioblasma florentina florentina*; five native and one non-native mussel are present in the lowest flowing portion of Citico Creek. Based on this information the yellow-blossom pearlymussel is considered to be extirpated from Citico Creek with no suitable habitat remaining on or near the Cherokee National Forest. Similarly, this mussel species is considered extirpated from the Commonwealth of Kentucky, and is not known to exist within the Daniel Boone NF.

No critical habitat has been designated for this species.

Conclusion

After reviewing the current status of the yellow-blossom pearlymussel, the environmental baseline for the action area, the effects of the proposed application of aerially applied fire retardant, it is the Service's biological opinion that the application of aerially applied fire retardant, as proposed, is not likely to jeopardize the continued existence of this species. No critical habitat has been designated for this species, therefore, none will be affected.

Aerial application of fire retardant is not likely to jeopardize the continued existence of this species, because it is not known to occur in the proposed action area on the Cherokee or the Daniel Boone National Forests.

The action is not likely to result in destruction or adverse modification of critical habitat because no critical habitat has been designated for this species.

Tan riffleshell mussel (*Epioblasma florentina walkeri*)

The following account applies to the Daniel Boone National Forest, Kentucky, and Tennessee. See also the fanshell analysis for the George Washington and Jefferson National Forests, Virginia, further below.

a. Factors to be considered

Proximity of the action: In Kentucky, the tan riffleshell mussel, *Epioblasma florentina walkeri*, is known to occur in a perennial stream on the Daniel Boone National Forest which also receives flow from several tributary streams on the Daniel Boone NF. The aerial application of retardant could be applied on or adjacent to some of these streams. In Tennessee, the tan riffleshell mussel, is known to occur in the Hiwassee River where it has been taken from the state line (at Shuler Creek confluence) downstream 11 miles to Appalachia Powerhouse (USFS 2007). The aerial application of retardant could occur on or adjacent to portions of the Hiwassee River or its tributaries.

No critical habitat has been designated for this species.

Distribution: In Kentucky, the tan riffleshell mussel occurs on the Daniel Boone NF in the mainstem of the Big South Fork Cumberland River drainage of Eastern Kentucky. It occurs in at least three sites in Kentucky throughout an approximately 25 mile reach of the BSFCR. In Tennessee, six populations may be extant but most appear to be in serious declines. The six populations are: Stones River (TN), South Fork Cumberland River (KY & TN), South Fork Holston River (TN & VA), Upper Clinch (TN & VA), Hiwassee River (TN), and Duck River (TN).

Timing: Periods for which the tan riffleshell mussel may be particularly sensitive to the constituents of fire retardant include the fall and winter when spawning occurs along with the development of larvae or glochidia in the female mussel. Glochidia are released in late winter and into spring at which time they attach to a fish host for about two to three weeks and then drop off the fish host and settle in the stream bottom. Therefore the time period from late fall till late spring may be especially sensitive periods for this species. The Daniel Boone NF has two separate fire seasons that generally last around 10 weeks each. The spring season is from (approximately) February 1st through May 15th. The fall season runs from (approximately) October 1st through December 15th. The Cherokee National Forest has two separate fire seasons. The spring season is from (approximately) February 15th through May 1st. The fall season runs from (approximately) October 15th through December 1st.

Nature of the effect: The primary effect on the tan riffleshell mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a mussel or result in an interruption of spawning activity or cause the abortion of larvae. Indirect effects could occur to mussels from the retardant interfering with fish host activity and/or presence, at critical times of larval mussel release and encystment on the fish host, or larval mussel excystment from the fish host.

Many studies have concluded that ammonia is the primary toxic component in fire retardants (for example, see Buhl and Hamilton 2000 and McDonald and others 1997). Several factors determine whether an aquatic organism will be exposed to toxic levels of the ammonia compounds that make up roughly 10 percent of the retardant mixture: (1) avoidance of the contaminated area, (2) time exposed to the toxin, (3) water quality, including pH, (4) quantity of retardant spilled into freshwater, (5) type of water body, and (6) size of water body (Norris, Lorz, and Gregory 1991; Van Meter and Hardy 1975). Norris, Lorz, and Gregory (1991) reported that

direct application of retardants onto the stream surface was the primary source of retardant contamination in streams. They found that only minor amounts of retardant entered streams from riparian areas and as small as a 3-meter buffer virtually eliminated retardant entering stream waters. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris, Lorz, and Gregory 1991).

No critical habitat has been designated for this species.

Duration: The effects of this proposed action would most likely be considered a short term (pulse) event; however, depending on stream conditions (i.e., rainfall, flow) the duration could extend over a greater extent of stream length.

Disturbance frequency: The Service is not able to make a precise assessment regarding disturbance frequency; however, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. Aerial application would only be used for wildfire suppression. The use of fire retardant is thought to have been used only once in the last four years on the Daniel Boone Forest. The Forest Service indicates that in the timeframe of 2001 through 2007, the Cherokee National Forest has had a total of 14 calls for retardant for an average of 2 calls per year (Martin, D., personal communication, 2008). This use is considered to be a rare event.

Disturbance intensity: The Service is not able to make a precise assessment regarding disturbance intensity; however, intensity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

Disturbance severity: The Service is not able to make a precise assessment regarding disturbance severity; however, severity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

b. Analyses for effects of the action

Beneficial effects: The Service does not believe the effects of the action are wholly beneficial to this species.

Direct effects: A direct effect on the tan riffleshell mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the fire retardant is applied and/or very soon thereafter. If these effects are severe enough they could result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water

bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that an accidental aerial application of retardant is less likely to be applied directly on the Big South Fork Cumberland River (in Kentucky) or the Hiwassee River (in Tennessee), large perennial streams that contain the tan riffleshell mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and in the timeframe of 2001 through 2007, the Cherokee NF has had a total of 14 calls for retardant for an average of 2 calls per year. This use is considered to be a rare event.

Interrelated and interdependent actions: Based on the information provided the Service has not identified any interrelated or interdependent actions applicable to this proposed aerial application of fire retardant.

Indirect effects: Indirect effects could occur to tan riffleshell mussels from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that an accidental aerial application of retardant is less likely to be applied directly on the Big South Fork Cumberland River or the Hiwassee River, large perennial streams that contain the tan riffleshell mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF and an application of about two times a year in the Cherokee NF. This use is considered to be a rare event.

c. Species' response to a proposed action

Numbers of individuals/populations in the action area affected: The exact number of individuals/populations of the tan riffleshell mussel in the action area is not known; however, it is known to occur in several locations (riffles) in the Big South Fork Cumberland River, and it potentially occurs in low numbers at several locations (riffles) over an 11-mile stretch of the Hiwassee River. Thousands of mussel shells representing 12 native and one non-native mussel species have been collected from muskrat middens along the Hiwassee River between 1993 and 2007; no tan riffleshells have been documented. Three tan riffleshells were documented during an extensive mussel survey in 1993. The only other observation of a tan riffleshell on the Hiwassee was a single individual in 1998. It is unlikely all populations would be affected from any particular fire retardant application.

Sensitivity to change: The Service does not know how sensitive to change the tan riffleshell mussel is. Adult mussels in general are considered less sensitive than juveniles. Mussels in general are known to be sensitive to low levels of ammonia compounds.

Resilience: The Service does not know how resilient the tan riffleshell mussel is to this particular action. Mussels are dependent on their proper fish host being present in sufficient numbers to allow successful recruitment, so the resilience of the fish host is also a factor to be considered.

Recovery rate: The recovery rate of the tan riffleshell mussel is unknown; however, it is generally accepted by mussel biologists that mussel recovery rates are slower than those of many other invertebrates and fish, due to presence and availability of the fish host.

CONCLUSION

After reviewing the current status of the tan riffleshell mussel, the environmental baseline for the action area, and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely to jeopardize the continued existence of the tan riffleshell mussel. No critical habitat has been designated for this species; therefore, none will be affected.

Aerially applied fire retardant is not likely to jeopardize the continued existence of the tan riffleshell mussel for the following reasons: 1) The species is located in multiple locations in a large perennial stream and therefore it is unlikely all populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to be applied directly on the perennial stream that contains the tan riffleshell mussel. 3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Daniel Boone NF as well as the Cherokee NF.

The primary direct effects on this species would be from toxic ammonia compounds as the fire retardant is being applied and/or very soon thereafter. If these effects are severe enough they could possibly result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. Indirect effects could occur from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or

excystment from the fish host, resulting in loss of recruitment. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on the Big South Fork Cumberland River, a large perennial stream that contains this species. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution.

Upland Combshell (*Epioblasma metastriata*)

The proposed action is expected to have little to no impact to the upland combshell. Once found in the Coosa, Cahaba and Black Warrior river systems, the species has not been reported in the Black Warrior River system near the Bankhead National Forest since the early 1900s, and is considered by most experts to be extirpated, if not extinct (Mirarchi, et. al 2004a). Because the upland combshell is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the upland combshell will be impacted by the proposed action. This species is considered to be extirpated in Georgia, and is not currently known to exist on National Forest lands in Georgia. Therefore, it is highly unlikely that the upland combshell will be impacted by the proposed action. No specimens of this species have ever been collected within the Cherokee National Forest boundary (USFS 2007) in Tennessee. Evans (2001) conducted an extensive review of the historic mussel collections from the Conasauga River and revisited all of the known collection sites; he determined that the closest historic record for the upland combshell was eleven and one-half miles downstream of the Cherokee National Forest; he found no specimens of this species during his field surveys at any of the historic sites where it had existed. Parmalee and Bogan (1998) considered the upland combshell to be "...extinct in the Tennessee portion of its range..." Because the upland combshell is not present on or adjacent to the Cherokee National Forest, it will not be affected by the proposed action in Tennessee.

Talladega National Forest has designated critical habitat for the upland combshell, and it has also been designated adjacent to the Chattahoochee National Forest in Georgia. All of the Conasauga River within the boundary of the Cherokee National Forest (6.3 miles) has been designated as critical habitat. Since the National Forests in Alabama have not used fire retardant as part of their firefighting strategy in the past, and have written that they do not intend to do so in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008) because of the habitat types involved as well as the lack of air tanker facilities in the region, it is very unlikely that fire retardants will ever be used in the vicinity of designated critical habitat on National Forest lands

in Alabama. Chattahoochee National Forest also reports limited usage of aerial retardant from 2001-06 (U.S. Forest Service data), but since the species has not been reported in many years, it is unlikely that the use of aerial retardant would make its status change in any way. The use of fire retardant on the Cherokee National Forest is a rare event, with an average of twice per year between 2001 through 2007 on the Cherokee National Forest (Dave Martin, USFS Fire Officer, pers. comm. 2008). Therefore, it is unlikely critical habitat would be affected by fire retardant use on the Cherokee National Forest.

Conclusion

After reviewing the current status of the upland combshell and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the upland combshell, and is not likely to destroy or adversely modify designated critical habitat.

Our conclusion is based upon the following: the upland combshell is not found on National Forest lands, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future; also, since the species has not been seen in many years, the limited use of fire retardant on the Chattahoochee and Cherokee National Forests is unlikely to impact any unknown remaining animals.

Southern Acornshell (*Epioblasma othcaloogensis*)

The proposed action is expected to have little to no impact to the southern acornshell. The species has not been reported in more than 25 years, and is considered by most experts to be extinct, though it was formerly found in the upper Coosa River system near the Talladega National Forest, and adjacent to the Chattahoochee National Forest in Georgia (Mirarchi, et. al 2004a). Because the southern acornshell is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the southern acornshell will be impacted by the proposed action. Because the southern acornshell is not currently known to exist on National Forest lands in Georgia, it is highly unlikely that the southern acornshell will be impacted by the proposed action.

Talladega National Forest contains designated critical habitat for the southern acornshell, and it is also designated adjacent to the Chattahoochee National Forest in Georgia. Since the National Forests in Alabama have not used fire retardant as part of their firefighting strategy in the past, and have written that they do not intend to do so in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008) because of the habitat types involved as well as the lack of air tanker facilities in the region, it is very unlikely that fire retardants will ever be used in the vicinity of designated critical habitat on National Forest lands in Alabama. Chattahoochee National Forest also reports limited usage of aerial retardant from 2001-06, making it unlikely that a significant portion of the species' population would be affected (U.S. Forest Service data).

Conclusion

After reviewing the current status of the southern acornshell and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the southern acornshell, and is not likely to destroy or adversely modify designated critical habitat.

Our conclusion is based upon the following: southern acornshell is not found on National Forest lands, and is likely extinct; US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future. In addition, the species is considered extirpated in Georgia.

Northern Riffleshell (*Epioblasma torulosa rangiana*) and Clubshell (*Pleurobema clava*)

Allegheny National Forest Effects ANALYSIS

The clubshell (*Pleurobema clava*) and northern riffleshell (*Epioblasma torulosa rangiana*) have been found in the portion of the Allegheny River that occurs within the proclamation boundary of the Allegheny National Forest in Pennsylvania. No suitable habitat for these species has been found in other streams located on this forest (USFS 2006). The clubshell is considered extirpated from the Daniel Boone National Forest (DBNF) in Kentucky, with no suitable habitat remaining that would allow for recovery. Likewise, the northern riffleshell is not known to presently occur within the proclamation boundary of the DBNF (USFS 2003).

The Allegheny River supports the largest remaining populations of the clubshell and northern riffleshell, which have been eliminated from over 90 percent of their historic range. In the 33.5 miles of river between Warren and Tionesta (running along the western edge of the Allegheny National Forest) northern riffleshell and clubshell populations have been estimated at 6.6 million and 1.1 million animals, respectively (USFS 2006). Clubshells and northern riffleshells have been documented to occur in abundance at several locations in the Allegheny River, but their distribution is discontinuous (*i.e.*, localized to areas of suitable habitat). The condition of these populations ranges from those exhibiting successful reproduction to those with apparently depressed vigor and a predominance of older adults (USGS 2004). During extensive mussel surveys of the Allegheny River, surveyors have noted that habitat in the river is good for mussels and relatively free of fines and sediment (USFS 2006).

Clubshell populations are known from scattered locations in the middle Allegheny River (*e.g.*, near the towns of Kennerdell, Foxburg, Oil City, Parker and East Brady), downstream to river mile 58, which includes the two upper Navigation Pools (Pools 8 and 9). In many of these locations, mussel population data are based solely on qualitative surveys, and the clubshell appears to be relatively less abundant than the other more common species with which it co-occurs in the Allegheny River, such as mucketts (*Actinonaias ligamentina*) and spikes (*Elliptio dilatata*).

The most upstream location that northern riffleshells have been found alive in recent years is near the City of Warren, Pennsylvania (EnviroScience 2002). The Allegheny River in Warren is

strongly influenced by hypolimnetic releases from Kinzua Dam, and this population appears to be dependent on warmer, more nutrient-rich water coming from Conewango Creek, which confluent with the Allegheny River immediately upstream of the habitat supporting this species. Northern riffleshells appear to become a frequent member of the Allegheny River mussel community about nine miles below Warren, with peak densities documented near the Forest and Venango County line. There, northern riffleshells are the dominant mussel species, with a mean density of 7.57 individuals/m² and an estimated population of 169,622 individuals in a 100-meter-wide cross-section of the Allegheny River (USGS 2002). Sampling at a bridge site near West Hickory revealed a mean density of 0.5/m² (USGS 2004). Compared to the West Hickory site, northern riffleshells have been found to be more abundant both upstream and downstream, with a mean density of 1.8/m² at five sites quantitatively sampled between Tidioute and Tionesta. Northern riffleshell populations are known from scattered locations in the middle Allegheny River (*e.g.*, near the towns of Kennerdell, Foxburg, Oil City, Parker, East Brady, and downstream to river mile 58), where population densities are generally less than 0.1/m².

Between 1995 and 2007, approximately 150 wildfires were reported on the Allegheny National Forest. Total number of acres burned is estimated at 545 acres for an average of 3.6 acres per fire. Frequency of fire occurrence has been increasing from 9 to 11 fires per year between 1995 and 2004, to 18 fires per year between 2005 and 2007. On average, the ANF gets 1 to 2 large fires (>100 acres) per decade. Over the past 20 years, this included a fire in 1984 which burned 218 acres and one in 1990 which burned 609 acres (Brad Nelson, USFS, personal communication). Even these larger fires affected only a fraction of this 513,000-acre National Forest.

Aerial application of fire retardant has occurred twice on the ANF in the past decade, once in the late 1990's to control a 25-acre fire (estimated 1000-1500 gallons of retardant used), and once in 2007 to control an 8-acre fire (estimated 500 gallons of retardant used) (Mike Antalosky, USFS, personal communication). Based on historic wild fire data it appears that one fire every ten years may be severe enough to warrant the aerial application of fire retardant (Brad Nelson, USFS, personal communication).

The Allegheny River ranges from approximately 500 to 700 feet in width in the action area. Structurally, it is a series of riffles, runs and pools. Due to the size of this river, it is readily visible from the air, making accidental drops of retardant into the river unlikely. In addition, fire history on the ANF suggests that fires typically affect a small acreage annually, and that aerial application of fire retardant has been infrequent and limited to small areas as well. These factors, in combination with use of the 2000 *Guidelines for Aerial Delivery of Retardant or Foam near Waterways*, make it unlikely that fire retardant would enter the Allegheny River in an amount sufficient to have a significant adverse effect on clubshell or northern riffleshell populations.

Little and Calfee (2002) showed that when retardants are applied to riparian areas, the retardants remain toxic for 21 days. Consequently, any rain event that happens within three weeks after application to the riparian area of the Allegheny River would pose a risk of introducing ammonia into the river. However, considering the limited acreage that would likely be treated with retardant, and the dilution that would occur in a river of this size, it is unlikely that ammonia levels would reach acutely or chronically toxic levels, except perhaps immediately adjacent to

the bank. We would expect that ammonia levels would quickly decrease to non-detectable a short distance downstream of the point-of-entry due to the dilution available. Consequently, we anticipate that any take would only affect a small percentage of the overall clubshell and northern riffleshell population in the Allegheny River, and that the affected area would be re-colonized over time due to recruitment by the surrounding mussel population.

CONCLUSION

After reviewing the current status of the clubshell and northern riffleshell, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that aerial application of fire retardant is not likely to jeopardize the continued existence of the clubshell or the northern riffleshell. No critical habitat has been designated for these species; therefore, none will be affected.

This determination is based on the following 1) clubshell and northern riffleshell populations are widely dispersed within the Allegheny River, and appear to be large, fairly healthy, and reproducing; 2) historically, fires on the ANF have been infrequent, small, and readily controlled using methods other than fire retardant application; 3) in the unlikely event fire retardants would be used, small treatment areas in combination with 300-foot aquatic buffers will substantially reduce the risk of fire retardant entering the Allegheny River; 4) due to the visibility of the Allegheny River, accidental drops into the river itself are highly unlikely; 5) in the unlikely event that fire retardant does enter the Allegheny River in the form of runoff, dilution will reduce the risk of mussels being exposed to acutely or chronically toxic concentrations of ammonia; and 6) any take of clubshell or northern riffleshell would likely occur in a limited (probably near-bank) area of the Allegheny River, only affecting a small percentage of the overall population.

Turgid Blossom (*Epioblasma turgidula*)

The proposed action is expected to have little to no impact to the turgid blossom. Once found in the Tennessee River system in Alabama, the species has not been reported in many years and is considered extirpated, if not extinct. (Mirarchi, et. al 2004a). Because the turgid blossom is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the turgid blossom will be impacted by the proposed action.

There is no designated critical habitat for the turgid blossom; therefore there will be no effects to critical habitat.

Conclusion

After reviewing the current status of the turgid blossom and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the turgid blossom. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the turgid blossom is extirpated from Alabama and may be extinct, and the species has no designated critical habitat.

Multiple Mussel Species in the Upper Tennessee River

George Washington and Jefferson National Forests

Effects ANALYSIS

The effects of fire retardant use on the George Washington and Jefferson National Forests (GWJ) were evaluated for nineteen federally listed endangered aquatic species (Table 1). These species include 18 freshwater mussel species and 1 fish species. Most of these species do not actually occur on the National Forests, however, instream habitat, particularly water quality, is influenced by Forest Service (FS) activities within the watersheds.

Table 1. List of species included in this effects analysis and their geographic occurrence by watershed.

Scientific name	Common name	Drainage	Class
<i>Cyprogenia stegaria</i>	Fanshell	Upper TN	Mollusc
<i>Dromus dromas</i>	Dromedary Pearlymussel	Upper TN	Mollusc
<i>Epioblasma brevidens</i>	Cumberlandian Combshell	Upper TN	Mollusc
<i>Epioblasma capsaeformis</i>	Oyster Mussel	Upper TN	Mollusc
<i>Epioblasma florentina walkeri</i>	Tan Riffleshell	Upper TN	Mollusc
<i>Epioblasma torulosa gubernaculum</i>	Green-blossom Pearlymussel	Upper TN	Mollusc
<i>Fusconaia cor</i>	Shiny Pigtoe	Upper TN	Mollusc
<i>Fusconaia cuneolus</i>	Fine-rayed pigtoe	Upper TN	Mollusc
<i>Hemistena lata</i>	Cracking Pearlymussel	Upper TN	Mollusc
<i>Lampsilis abrupta</i>	Pink mucket pearlymussel	Upper TN	Mollusc
<i>Lemiox rimosus</i>	Birdwing Pearlymussel	Upper TN	Mollusc
<i>Pegias fabula</i>	Little-wing Pearlymussel	Upper TN	Mollusc
<i>Pleurobema plenum</i>	Rough Pigtoe	Upper TN	Mollusc
<i>Quadrula cylindrica strigillata</i>	Rough Rabbitsfoot	Upper TN	Mollusc
<i>Quadrula intermedia</i>	Cumberland Monkeyface	Upper TN	Mollusc
<i>Quadrula sparsa</i>	Appalachian Monkeyface	Upper TN	Mollusc
<i>Villosa perpurpurea</i>	Purple Bean Mussel	Upper TN	Mollusc

A. Factors to be considered

Use of fire retardants on the GWJ

Waterways containing listed species could be exposed to fire retardants either through an intentional planned release or accidental drop across or adjacent to a water body during aerial application or on-the-ground activities where the retardant is stored or mixed at a reload base or portable base. Although the 2000 guidelines establish standards to avoid direct application to water bodies, the incident commander has the flexibility to make exceptions to those standards. Furthermore, the *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (U.S. Forest Service et al. 2000) only address visible water bodies. Direct application within the

300 foot buffer of non-visible water bodies is likely to occur. We expect that first to third order streams could be accidentally contaminated with fire retardant. As a result of these uncertainties and estimating that the average footprint of a typical drop is 40 feet wide and spans 1000 or more feet (S. Croy, USFS, pers. comm.), it is likely that application of fire retardant across water bodies, particularly intermittent and ephemeral streams, will likely occur during drops.

Compared to other National Forest fire suppression activities, use of fire retardant on the GWJ has been minimal. Historically, the Wyers Cave air tanker base, located at Shenandoah Valley Airport, supplied fire retardant for the majority of drops on the GWJ. Between 1986 and 2000, aircraft from the Wyers Cave air tanker base dropped 306,000 gallons of unspecified fire retardant on National Forest land as well as National Park Service and private lands, mainly in the Shenandoah Valley area. Since 2001, only 21,000 gallons of fire retardant (Phos-Chek D75-R) have been applied specifically to fires on the GWJ. By comparison, 48,940,258 gallons of fire retardant were used over all National Forest lands from 2001 through 2006. Fire retardant use on the GWJ during that time frame accounts for about 0.04 % of total national usage. Given that the GWJ comprises less than 1% of the National Forest land base, the GWJ, by far, uses proportionally less fire retardant chemicals. On a per acre basis, the total National Forest usage is 26 times greater than what has been applied on the GWJ. According to the Fire and Aviation Management Web Application database, 333 wildland fires have been reported on the GWJ since 2001. Of those fires, only 5 (1.5%) were treated with fire retardant (Table 2). All five retardant applications occurred on either mid to upper slopes or ridge tops; none of the drops occurred over perennial streams. Also, all historic applications of retardant on the GWJ have been with heavy fixed-wing air tankers (2 to 4 engines) and no drops have been made using helicopters or SEATS (Single Engine Air Tankers). Therefore all retardant storage, mixing, and loading operations have been at large airports and not in the field at temporary portable bases.

Compared to pre-2000 use, application of retardants to suppress fires on the GWJ has been of a declining trend. Predicted future use of fire retardants on the GWJ is expected to decline even further. Several factors have contributed to this trend.

1. The great majority of forest fires on the GWJ are ground fires. Crown fires are extremely rare and only occur as single tree or group torching in isolated pine stands. Forests of the GWJ are dominated by a deciduous forest canopy that tends to intercept fire retardants during dispersal, especially during leaf-on conditions, inhibiting the retardant from reaching the ground and rendering the practice of aerial application as sub-effective.
2. Aerial application of fire retardant typically occurs during initial attack (i.e. during the first few hours after a fire's discovery). Many fires on the GWJ are not immediately adjacent to the wildland-urban interface and thus the need to rapidly protect human-made structures from wildland fires has been minimal.
3. Using fire retardants is expensive and is not commonly available.
4. The GWJ is migrating away from an emphasis on immediate fire control and moving toward a wildland fire doctrine of appropriate management response, focusing more on point protection.

As a result of decreasing demand for fire retardants in the GWJ area, several air tanker bases have been discontinued. Historically the GWJ was served by four possible air tanker bases located in Asheville, North Carolina, Knoxville, Tennessee, Wyers Cave, Virginia, and sometimes a portable base in Dublin, Virginia. Both the Asheville and Wyers Cave bases have been closed, and the Knoxville base is scheduled to be closed in 2008 or 2009. The Dublin base is portable and will only operate depending on conditions and fire occurrences. To replace those bases, three Southeastern permanent fixed bases are planned for Fort Smith, Arkansas, Lake City, Florida, and Chattanooga, Tennessee. Because delivery of fire retardants to the GWJ will be logistically difficult based on distance limitations and higher costs, the option to use aerial applied fire retardants will be less likely than historic use.

Table 2. Fires that were treated with fire retardant (Phos-Chek D75-R) on the GWJ since 2001. NA = not applicable

Name of fire	Year	Ranger District	Watershed	Amount of retardant (gal)	Number of drops	Distance to listed species (miles)
Huckleberry	2001	Eastern Divide	James	5,000	3	8
Marbleyard	2002	Glennwood-Pedler	James	8,000	4	3
Strike 3	2002	Lee	Shenandoah	2,000	1	NA
Cardinal	2006	Lee	Shenandoah	4,000	2	NA
Hoot-Owl	2007	Clinch	Clinch	2,000	1	35

Occurrence of fire retardant applied over streams

Although streams and rivers serve as natural breaks for fire control, fire retardant application on the GWJ has never been anchored to waterways. Fire retardant application on the GWJ has been typically anchored to rocky outcroppings, the “black” (where the fire has already burned), roads, trails, bulldozer lines, or hand lines. Most fires on the GWJ occur on higher elevation terrain with the head of the fire progressing uphill, commonly in combination with an upslope wind influence. Application of fire retardant has been used to block or deflect the movement of the fire or dampen the intensity of the fire on the mid to upper slopes. Since fire retardant use on the GWJ has been and is expected to remain isolated to ridge tops and mid to upper slopes, the potential for application of fire retardant over higher order perennial streams is very low. However, it likely that fire retardant application will occur across ephemeral, intermittent, or low order perennial streams (1 – 3 order). Monitoring of streams after a fire has not occurred, so direct effects to streams from historic application are unknown.

Proximity of species to forest boundary

Upper Tennessee Mussels

Purple bean and Tan riffleshell--The purple bean is endemic to the upper Tennessee River system above its confluence with the Clinch River. Primarily a species of the Ridge and Valley Physiographic Province, it also occurs at the eastern edge of the Cumberland Plateau. The entire range of the purple bean occurs in northeastern Tennessee and southwestern Virginia. This species has apparently been extirpated from the Powell River, North Fork Holston River, Emory River, Daddys Creek, and North Fork Beech Creek. Although tenuous, extant populations still occur in isolated portions of the Clinch River, Tazewell, Russell, and Scott Counties, Virginia; Indian Creek, Tazewell County, Virginia; Copper Creek, Scott County, Virginia; Obed River, Cumberland County, Tennessee; and Beech Creek, Hawkins County, Tennessee. Although individual specimens can be found within the Clinch River, the viable population aggregations occur in Indian Creek, Copper Creek, and Beech Creek. The tan riffleshell was once widespread throughout the Tennessee and Cumberland River drainages, occupying mainly smaller tributaries. The tan riffleshell has declined rapidly over the last 50 years and is now only known from two distinct locations, Indian Creek in Virginia, and the Big South Fork Cumberland River in Tennessee and Kentucky. Viable population centers of both the tan riffleshell and purple bean are not known to currently occur within the proclamation boundary of the GWJ. Furthermore, GWJ lands do not occur within the watersheds of those population centers, specifically Indian Creek, Copper Creek, and Beech Creek.

Green-blossom pearlymussel, and Pink mucket--The green-blossom pearlymussel once occurred in headwater tributaries of the Tennessee River, including the South and North Fork Holston Rivers, Holston River, the Clinch River, and Powell River, as well as portions of the Nolichucky River and Tennessee River northeast of Knoxville, Tennessee. The pink mucket was reported occurring in the Mississippi, Ohio, Cumberland, and Tennessee Rivers. Populations of both of these species do not occur within the proclamation boundary of the GWJ and are thought to have been extirpated from their range in Virginia.

Remaining Upper Tennessee River Mussels--Based on geographic co-occurrence and proximity to the GWJ lands, 13 species that occur in the Upper Tennessee River system were evaluated together as a group. These species include: fanshell, Dromedary pearlymussel, Cumberland combshell, oyster mussel, shiny pigtoe, fine-rayed pigtoe, cracking pearlymussel, birdwing pearlymussel, little-wing pearlymussel, rough pigtoe, rough rabbitsfoot, Cumberland monkeyface, and Appalachian monkeyface (Table 3). National Forest ownership in the upper Tennessee River system is represented by the Clinch River Ranger District and the Mount Rogers National Recreation Area and comprises approximately 6% of the watershed land base.

Species occurrences within the Powell River are greater than 10 miles downstream of the Clinch Ranger District. The major population centers for these species occur even further downstream, with distances of 35 stream miles and more from the influence of GWJ land activities. Populations of several listed mussels within the Clinch River approach GWJ lands within two miles. However, the influence of National Forest to the Clinch River is minor with the great majority of population centers occurring either upstream or far downstream (>20 miles) of National Forest ownership. Similarly, the majority of federally listed mussel populations within the Holston River system occur at significant distances downstream of National Forest.

Table 3. List of upper Tennessee River mussels species included in this effects analysis and the nearest proximity to National Forest.

Common name	General Distribution	Nearest linear distance from GWJ (miles)
Fanshell	Powell and Clinch Rivers	5+
Dromedary		
Pearlymussel	Powell and Clinch Rivers	5 - 10
Cumberlandian		
Combshell	Powell and Clinch Rivers	5+
Oyster Mussel	Powell and Clinch Rivers	5
Shiny Pigtoe	Powell, Clinch, and North Fork Holston Rivers	1
Fine-rayed pigtoe	Powell and Clinch Rivers	1+
Cracking Pearlymussel	Powell and Clinch Rivers	1+
Birdwing Pearlymussel	Powell and Clinch Rivers	1
Little-wing	Clinch River, and North, Middle, and South Fork	
Pearlymussel	Holston Rivers	2
Rough Pigtoe	Clinch River	10+
Rough Rabbitsfoot	Powell and Clinch Rivers	1
Cumberland		
Monkeyface	Powell and Clinch Rivers	5+
Appalachian		
Monkeyface	Powell and Clinch Rivers	5

Toxicity of fire retardant

Chemical components of the retardant Phos-Check D75-R, and presumably all members in the Phos-Check family, include un-ionized ammonia and total ammonia. Un-ionized ammonia is neutrally charged (Emerson et al. 1975) and easily crosses the gill membranes of fish, and presumably mussel gills as well. Because of this, it is considered the most toxic form of ammonia. A primary function of the gills is to rid the body of waste material in the form of ammonia. If enough un-ionized ammonia is in the surrounding water, ammonia will diffuse into the organism, creating a build up of ammonia. Ammonia build up can occur to such an extent that it becomes lethal to the organism.

Calfee and Little (2003) tested Phos-Chek D75-R on rainbow trout, reporting a 96 hour LC50 of 168 mg/l (between 142 and 194 mg/l). Although there are no data to quantify the toxic effects of fire retardant chemicals on freshwater mussels, ammonia is the likely toxic component of Phos-Chek retardants. Augspurger et al. (2003) developed protective water quality ammonia limits for freshwater mussels, ranging from 0.3 to 1.0 mg/L total ammonia at pH 8 at 25C. Toxic effects are expected to increase at higher pH levels. Typically, streams and creeks in the GWJ range in average pH from 7.5 - 8.5.

Environmental Persistence

Little and Calfee (2002) reported that soil composition plays a significant role in the chemical persistence and weathering of fire retardants in runoff. Retardants used on soils that are rocky or sandy are more persistent and toxic than those used on high organic soils. During toxicity tests using fathead minnows (*Pimephales promelas*), short-term weathering increased mortality from 0% at 24 hours to 55% at 96 hours of exposure on high organic soil. Weathering on low organic soils ranged from 0 to 80%, and on sand from 25 to 100%. However, mortality decreased after longer weathering on the high and low organic soils. The mortality rate of D75-R decreased 55% after 7 days of weathering and dropped to 15% after 28 to 45 days of weathering. This study classified high organic soils as loamy forest soils with an organic matter content of 3.6% and low organic soils had an organic matter of 1.4%. Typically, the surface soil has high organic matter in the GWJ (Tom Bailey, USFS pers. comm. 2008). Due to the high organic content, we expect application of the fire retardant, PhosCheckD75-R, would result in 15% mortality even after 28-45 days. Under a worst case scenario, ammonia concentrations can remain at lethal levels over 6 stream miles for fish (Norris and Webb 1989).

Dilution

Little and Calfee (2002) assumed the minimum recommended fire retardant application rate of 1 gallon per 100 square feet then calculated the dilution factor needed to reach sublethal concentrations for fish. They determined field applications of Phos-CheckD75-R would have to be diluted by a factor of greater than 5,000.

The mainstem reaches of the Powell, Clinch, North Fork Holston, and South fork Holston Rivers are considered medium sized rivers. In the event that fire retardant enters extreme headwater tributaries of the upper Tennessee River system (ephemeral, intermittent streams, and 1st and 2nd order streams), normal instream flow rates (Table 4) within the mainstem reaches would be sufficient to adequately dilute fire retardant chemicals levels by a factor greater than 5000. This scenario would be similar for the mainstem reaches of the James River. Conversely, smaller tributaries, specifically Potts and Johns Creek of the upper James River, would likely receive toxic levels of fire retardant chemicals if application were to occur in upper tributaries within those watersheds.

Table 4. Daily flow statistics in cubic feet per second based on historic USGS gage station data.

Water body	Minimum	Median	Mean	Maximum
Powell River	46	218	528	3800
Clinch River	60	695	1460	22200
North Fork Holston River	30	286	565	7190
Middle Fork Holston River	29	162	280	2600
South Fork Holston River	85	481	780	7390
Upper James River mainstem	269	1050	1960	10100
Potts Creek	15	114	200	1880
Johns Creek	17	141	237	1870
South Fork Roanoke River	10	102	118	305

B. Analysis for Effects of the Action

Freshwater mussels

Direct Effects – Direct impact to the freshwater mussels associated with this project include the potential to kill or injure freshwater mussels from ammonia toxicity derived from fire retardant chemicals that have been applied directly or indirectly to habitat. Fire retardants may potentially enter and accumulated in the water column through runoff if precipitation follows shortly after application of fire retardants. Water bodies contaminated by fire retardant chemicals could result in both acute and chronic toxic affects to the mussels. Toxicity would result from increased un-ionized and total ammonia levels and would depend on the organic level of the soil, the proximity of the application, the amount that enters the water column, the concentration of the retardant, and the volume and velocity of the stream. Acute toxicity could occur if ambient concentrations of ammonia exceeded 0.3 to 1.0 mg/L total ammonia at pH 8 at 25C within mussel habitat. Chronic toxicity may occur depending on the persistence of the retardant in the environment. Based on the high organic level of the soil surface in the GWJ, the Service expects toxic effects of the retardant to persist up to 45 days. There are many variables that factor into the toxicity level of the retardant to the mussels. Although mussels can close their valves to potentially avoid some toxic exposure, nothing is known about this behavior with respect to Phos-Check chemicals.

Indirect Effects - Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). Indirect impacts to federally listed mussels associated with this project may include altering nutrient and food base that the mussels are dependent upon.

Conclusion

Upper Tennessee mussels

After reviewing the current status of the fanshell, Dromedary pearlymussel, Cumberland combshell, oyster mussel, tan riffleshell, green-blossom pearlymussel, shiny pigtoe, fine-rayed pigtoe, cracking pearlymussel, pink mucket pearlymussel, birdwing pearlymussel, little-wing pearlymussel, rough pigtoe, rough rabbitsfoot, Cumberland monkeyface, Appalachian monkeyface, and purple bean mussel the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that aerial application of fire retardant is not likely to jeopardize the continued existence of these federally listed mussels. Critical habitat for the purple bean, Cumberland combshell, rough rabbitsfoot, and oyster mussel has been designated within the Clinch and Powell Rivers, however, this action does not affect these areas and no destruction or adverse modification of that critical habitat is expected.

This determination was based on the following: 1) historical use of fire retardant on the Clinch Ranger District and Mt. Rogers National Recreation area has been extremely infrequent, and predicted future use of fire retardant on these forests is expected to decline; 2) in the event that fire retardants are use, it is expected that application will occur on mid to upper slopes, maximizing dilution of runoff and reducing the risk of mussels being exposed to acutely and chronically toxic concentrations of ammonia; 3) most of the soils on the GWJ are composed of

high organic matter and therefore will shorten the persistence of applied fire retardant chemicals; 4) geographically, federally listed mussel population centers are distributed at significant distances from the majority of National Forest land base; 5) small treatment areas in combination with 300-foot stream buffers will substantially reduce risk of fire retardant chemicals entering mussel habitat.

Smith's Blue Butterfly (*Euphilotes enoptes smithi*) (SBB)

Fire suppression has been identified as one potential threat to the SBB. This is because suppression can lead to large, intense fires that are not conducive to the regeneration of the species' host plants, *Eriogonum latifolium* and *E. parvifolium*. Small, more frequent fires are thought to increase the germination and improve conditions for the host plants. It is not clear whether the use of fire retardants contributes to the negative effects of suppression or helps minimize catastrophic fires that remove large areas of SBB habitat. The overall management of NFS lands where fire suppression has been prevalent is likely much more problematic than incidents where retardant is used during a fire event. Because it is difficult to ascertain how individual instances of retardant drops contribute to overall fire suppression (in terms of the effects on SBB habitat), we are not considering the effects of fire suppression in this analysis.

According to the documentation provided by the USFS, the retardants are of very low toxicity to terrestrial invertebrates. We do not expect direct contact with retardant to have a substantial effect on individual SBBs. The most likely impact to the SBB would be from increased growth of invasive, non-native plant species that displace the species' host plant. The 2000 Guidelines contain measures for addressing for controlling non-native plants in habitat for listed species following a retardant drop(s). We assume that those measures would be implemented in SBB habitat to prevent loss of *Eriogonum latifolium* and *E. parvifolium*.

Given the uncertainty about the effects suppressing fires using retardant (or not) on the species, the low toxicity of the chemicals to terrestrial invertebrates, and measures in the 2000 Guidelines for controlling invasive, non-native plants, we do not expect adverse effects to SBB.

Kern Primrose Sphinx Moth (*Euproserpinus euterpe*)

The proposed project may be within the known range of Kern primrose sphinx moth. The Kern primrose sphinx moth is restricted to areas that contain the evening primrose, which supplies a food source for both adults and larvae. Because the evening primrose is known to grow in sparsely vegetated sandy washes, where the fuel continuity is not sufficient to support the spread of a wildfire, it is highly unlikely that fire retardant would be applied in these areas. Because there are no known occurrences of the Kern primrose sphinx moth on or adjacent to Forest Service lands, and the probability of a retardant drop in this listed insect's habitat is extremely low, the Service has determined that the proposed project is not likely to adversely affect this species.

Pawnee Montane Skipper (*Hesperia leonardus montana*)

Effects Analysis

Direct and Indirect Effects

The Pawnee montane skipper (*Hesperia leonardus montana*) (skipper), a small woodland butterfly, occurs only in the Front Range of central Colorado and has a very restricted range of approximately 23 miles long and 5 miles wide along the South Platte River drainage system. Of the total 24,831 acres of skipper habitat, approximately 21,020 acres (85 percent) occur on USFS lands with the remaining acreage occurring on private, State, and county lands. This area is within the Southern Rocky Mountain Ecoregion, which has a fire season from June to September (Labat 2007). Past fire history within skipper habitat indicates a peak fire season from May through August (USFS 2008), with larger fires occurring in the early summer months. Since 1996, three large fires (>10,000 acres) have occurred in skipper habitat in May, June and July. These fires burned approximately 48 percent (12,026 acres) of the known skipper habitat.

During these early summer months, the skipper is in the larval stage and pupation generally occurs in late July, though little is known of the details of these stages (Keenan et al. 1986). In the larval stage, the skipper is a soft-bodied caterpillar, feeding exclusively on blue grama (*Bouteloua gracilis*), a native grass species. The larvae are thought to exist in the basal crown of this grass. Adult butterflies emerge as early as late July and begin feeding, mating, and ultimately laying eggs. Adults likely continue to fly into the early fall until a major killing frost occurs (ERT 1986).

The effects of the aerial application of fire retardants on the skipper can be manifested as a toxicity issue and as physical hazard issue. Few studies have been conducted to determine the effects of fire retardant chemicals on terrestrial invertebrates. A toxicity study was conducted of soil exposure to earthworms; no dose-related mortalities were observed (Vyas *et al.* 1997). An observational study was conducted on ants mounds on which fire retardant had been applied; no detectable response to chemical application was observed (Vyas and Hill 1996). Physical hazards, however, are somewhat less speculative and the aerial application of fire retardant may result in some level of misting or coating of individual skippers. The effects of fire retardant on the skipper are likely influenced by the season of use and associated life-stage of the insect, canopy cover at the retardant drop site, retardant application rates, and the population density of the skipper.

The impact of the aerial application of fire retardant on the skipper is dependant on the location of the application. Skipper habitat consists of open ponderosa pine woodlands with a canopy cover of 30 percent, shrub and grass cover generally less than 10 percent, and the presence of blue grama and prairie gayfeather (*Liatris punctata*) (SERVICE 1998). Most skipper activity is concentrated in small forest openings, where feeding on nectar plants and ovipositing (i.e., egg laying) occurs. The eggs will develop into the larval caterpillar and the larva remains on the clump of blue grama grass throughout its life-stage. Fire retardant dropped in skipper habitat may be intercepted by tree canopy cover, understory shrubs, and/or large woody material before reaching ground level vegetation, whereas less interception occurs in areas of small forest openings where the skippers are most likely to occur.

Larvae and pupae within the retardant application area, especially those in small forest openings, would be exposed to varying amounts of chemical retardant depending on the application rate

and volume intercepted. The Ecological Risk Assessment (Labat 2007) indicated that 2 gallons/100ft² is the retardant coverage level for this eco-region. However, based on conversation with a local aviation officer, this rate can vary depending on fuel type in the drop area, and 4 or 6 gallons/100ft² would more typically be used in the mixed conifer forest associated with skipper habitat. The dispersion pattern on the ground of retardant applied by air tankers often results occurs in islands of higher coverage levels within in a matrix of lower coverage (Suter 2003). Other variations in retardant can result from overlapping retardant line and create areas with higher applied volumes on the ground surface.

Larval and pupal life-stages

Most fires in skipper habitat occur during the early summer months when the skipper is in the larval or pupal life-stages. Because of their limited mobility, these stages are the most vulnerable to adverse impacts from fire retardant as the insects cannot leave the area and avoid retardant. In the larval form, if the retardant application that reaches the ground is sufficient to cover the insect's body surface, tiny spiracles or openings used for gas exchange could be covered and the insect would be asphyxiated (Ellis 2008). The retardant is tacky and may impede larvae movement and could cover some feeding surfaces of the host plant, blue grama grass. While it is thought that the larval form may be able to "groom" and remove some of this material (Opler 2008), it likely would not be able to remove material from the plant surface to expose feeding surfaces. Feeding source material would be reduced short term and could affect survival of the larvae. The blue grama grass may intercept the retardant, if it were a low volume, and reduce the skipper's exposure to the retardant.

Fire retardants have been demonstrated to increase the biomass of some plant species. A field study (Larson and Newton 1996) examined the effect of Phos-Chek G75-F retardant (applied at a rate of 1 gpc) on vegetation in a North Dakota mixed grass prairie. This application produced a notable increase in herbaceous biomass for the first growing season only. Retardants could cause a short-term increase in blue grama biomass that would equate to increased food resources for the skipper larvae but could also result in the increase of less desirable plants that may compete with the blue grama.

Adult life-stage

Adult skippers begin to fly as early as late July. Adults are mobile and may fly away from sites impacted by smoke and heat, reducing the risk of exposure to retardant. Skippers are also very sensitive to motion and may be able to detect incoming retardant and move away. However, should skippers be exposed to retardant during this adult stage, the results would be similar to those discussed for larvae. If the retardant coats their wing surface, they would not be able to expand their wings and fly because of the tacky nature of the retardant and/or added weight load. If the retardant application is sufficient to coat their body, spiracles could be covered and they would be asphyxiated. Also, the force of some retardant drops may be sufficient to cause impact mortality of some individual skippers.

Population densities for the skipper are low so it is unlikely that many skippers would be affected by the dropping of retardant, unless there was a widespread application of retardant. Studies conducted in the 1980's recorded population densities of 2.1 to 3.6 skippers per acre (ERT 1986, 1988, 1989). Skipper populations were severely affected by the drought and Hayman Fire in

2002. Monitoring of burned and unburned sites skipper habitat has recorded skipper densities of 0.08 to 1.65 skippers per acre in unburned sites (ENSR 2003, 2003b; CNHP 2005, 2005b, 2007). In 2006, a population density of 0.12 skippers per acre was recorded in moderate to high burn severity sites (CNHP 2007).

Prairie gayfeather (*Liatiris punctata*) is the primary nectar plant for the adult skipper. If retardant covers the flowering plant, the nectar source would be temporarily unavailable. This plant flowers sequentially down its flowering spike, so it is likely that new flowers would continue to open and there would not be a notably loss of nectar sources.

Egg life-stage

Eggs are deposited singly on blue grama grass during the fall and the egg sticks to the leaf surface. Most fires in skipper habitat occur before eggs are laid; however, fires can occur in late August and September during the egg-laying period. It is not likely that an egg would be dislodged by a retardant drop, as that bond withstands the force of rainstorm events. The egg could be covered by retardant material. Since most eggs allow for the exchange of gases, it is suspected that a coating of retardant would cause harm to the egg.

Scope of effects

It is unlikely that the aerial application of fire retardant would result in adverse effects to the extent that it would present a problem for Pawnee montane skipper recovery for the following reasons:

1. Dose-related mortalities have not been observed from fire retardant on other terrestrial invertebrates.
2. Population densities of the skipper are low, with a mean number of 1-2 skippers per acre within their range.
3. Adult skippers are mobile and may be able to avoid exposure by moving away from smoke, heat or incoming retardant.
4. Few retardant drops are used each year on the Forest, reducing the likelihood of exposure.
5. Dispersion patterns of retardant on the ground are not consistent. Material can be intercepted by canopy cover, shrub and grass cover and woody debris creating areas with less coverage and reducing the level of exposure for all life-stages.

However, in a worse-case scenario, there are instances where individual skippers would be exposed and mortality would occur. These are:

1. When high retardant coverage rates are used, increasing the probability that more retardant will reach the ground surface, particularly in small forest openings where larvae and pupae are likely to exist.
2. Adult and egg stages may also be killed circumstantially if they are in a site that receives enough retardant to coat the wing, body or egg surface, or has enough force to cause impact mortality to the adult.

Conclusion

It is the Service's biological opinion that the direct, indirect, or cumulative effects of the proposed action is not likely to jeopardize the continued existence of the Pawnee montane skipper. While the skipper has a restricted range and may experience take of some individuals due to retardant use on a specific fire event, this take would not jeopardize the survival and recovery of the species. The risk of exposure is low based on skipper population densities and mobility of some life-stages, as well as the minimal use of retardant and inconsistent retardant dispersion patterns. Impacts to the skipper are anticipated but are expected to be offset by the benefits of reducing the spread of a catastrophic crown fire and maintaining functional skipper habitat. The proposed action is not likely to adversely modify or destroy critical habitat for the skipper, as it has not been designated.

Mountain Shagreen (*Inflectarius magazinensis*)

The Arkansas Field Office has concluded that the use of fire retardants on the Ozark-St. Francis National Forest *may affect, but is not likely to adversely affect* the Magazine Mountain Shagreen (*Inflectarius magazinensis*). The Magazine Mountain Shagreen is endemic to Magazine Mountain in Arkansas and occurs entirely on the Ozark-St. Francis National Forest. All the species known habitat is designated as part of the Magazine Mountain Special Interest Area on the Ozark-St. Francis National Forest. The Ozark-St. Francis National Forest has developed a management plan specifically for this Special Interest Area that prohibits the use of fire retardants within the area.

Koster's springsnail (*Juturnia kosteri*)

Koster's springsnail (it is no longer a tyronia) occurs only within Bitter Lake National Wildlife Refuge. It does not occur within the proposed action area.

Pink Mucket (*Lampsilis abrupta*)

The following account applies to Alabama and Tennessee. See also the fanshell analysis for the George Washington and Jefferson National Forests, Virginia, above.

Effects Analysis

The proposed action is expected to have little to no impact to the pink mucket in Alabama and Tennessee. The pink mucket is a large river species found only in the mainstem Tennessee River below Wilson and Guntersville Dams in Alabama, with a single gravid female found recently in Bear Creek, a large tributary (Mirarchi, et. al 2004a). It is also found in several drainages in Tennessee (Parmalee and Bogan 1998). Because the pink mucket is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the pink mucket will be impacted by the proposed action. Similarly, the pink mucket does not occur on any National Forest lands in Arkansas. A historic record from the Poteau River on the Ouachita National Forest was a data entry error. For the National Forest lands in Arkansas, the proposed action would have no effect on this species. In addition, the pink mucket is not known to occur

in the proposed action area on the Daniel Boone National Forest in Kentucky.

In Missouri the only National Forest that could impact the pink mucket by implementing the proposed action is the Mark Twain National Forest (MTNF). The last record of pink mucket on waters of the MTNF was found in 1982. There are records several miles downstream of the Forest boundary however, and the majority of the range of the species occurs in other states.

The MTNF uses fire retardants only in rare instances. Over the last 10 years, the MTNF had an average of 171 wildfires per year. Average acreage burned by wildfire over the same time frame was 5062 acres per year. During that timeframe an average of 24 wildfires per year were over 50 acres in size. The MTNF has used fire retardants only three times in the last 20 years. In all three instances, structures were threatened by the wildfire. The MTNF does not have an air tanker or retardant storage facilities. In order to obtain those services, the MTNF must call on resources in Arkansas, if they are available (J. Eberly, MTNF, pers. comm.). The MTNF does not plan on increasing the use of fire retardant, however wants to maintain the option to use it if structures are threatened by wildfire. In Missouri the period most likely to produce stand replacing fires is from approximately March 25 to April 15. The MTNF also has use of a helicopter for water only drops for fire control, also minimizing the need for use of fire retardant (J. Eberly, MTNF pers. comm.).

The 2005 Land and Resource Management Plan (Forest Plan) for the Mark Twain National Forest addresses wildland fire suppression on pages 2-17 to 2-19. Since the Forest rarely uses fire retardants, only one guideline for its use was written:

“Do not apply fire retardants directly over water bodies unless needed for firefighter or public safety.”

Conclusion

After reviewing the current status of the pink mucket and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the pink mucket. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the pink mucket is not found on National Forest lands, it is a large river species highly unlikely to occur in headwater streams. In addition, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Orange-nacre Mucket (*Lampsilis perovalis*)

The proposed action is expected to have little to no impact to the orange-nacre mucket. There are several populations on the Bankhead National Forest located on the Sipse Fork and Brushy Creek drainages. The orange-nacre mucket is found outside of Bankhead National Forest in the Tombigbee and lower Alabama River systems (Mirarchi, et. al 2004a). Mirarchi et. al (2004a) consider this species a Priority 2 species in Alabama's Comprehensive Wildlife Conservation Strategy, recognizing its relative abundance in the state. Because the orange-nacre mucket is found in several drainages outside of National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does

not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the triangular orange-nacre mucket will be impacted by the proposed action.

Bankhead National Forest contains critical habitat for the orange-nacre mucket. Since the National Forests in Alabama have not used fire retardant as part of their firefighting strategy in the past, and have written that they do not intend to do so in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008) because of the habitat types involved as well as the lack of air tanker facilities in the region, it is very unlikely that fire retardants will ever be used in the vicinity of designated critical habitat on National Forest lands in Alabama.

Conclusion

After reviewing the current status of the orange-nacre mucket and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the orange-nacre mucket, and is not likely to destroy or adversely modify designated critical habitat.

Our conclusion is based upon the following: orange-nacre mucket is found in several drainages outside of National Forest lands in Alabama, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Arkansas fatmucket (*Lampsilis powellii*)

Based upon the information pertaining to the U.S.D.A. Forest Service's (USFS) use of fire retardants to control wildfires on USFS lands, the Service has determined the action area to be entirely within the confines of the Middle and Alum Forks Saline River basin, upper Ouachita and South Fork Ouachita River basins, and Caddo River basin on the Ouachita National Forest. It is anticipated that direct and indirect effects to the Arkansas fatmucket (*Lampsilis powellii*) would result from the use of fire retardants in these watersheds.

Direct effects

The use of fire retardants associated with wildfire suppression techniques may have direct adverse effects on the Arkansas fatmucket, its habitat, and its host fish on the Ouachita National Forest. The Ouachita National Forest ownership exists primarily along tributaries of the Ouachita, South Fork Ouachita, and Caddo rivers and adjacent to short reaches in the headwaters of the Alum and Middle Forks Saline River. Most of the ownership adjacent to the larger rivers (i.e., floodplains) inhabited by the Arkansas fatmucket is in private ownership.

While the U. S. Forest Service has developed *2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways* to avoid aerial application of fire retardant within 300 feet of waterways, there are exceptions when the USFS may still drop fire retardants into bodies of water, both visible and out of sight. While the 2000 Guidelines are flexible, and allow for the Incident Commander to make exceptions to conduct a drop that would expose a waterbody to retardants, according to the USFS no exceptions have been taken since institution of the

Guidelines on the Ouachita National Forest (B. Crump, pers. comm., 2008). Fire retardant drops in ephemeral or intermittent streams that are difficult to see due to tree canopy closure are probably more likely to occur than exceptions to the Guidelines.

Direct adverse affects to the Arkansas fatmucket from the use of fire retardants include both lethal and sublethal impacts due to ammonia toxicity (juveniles mussels are generally more susceptible than adults, but there is no specific ammonia toxicity data available for this species) and exposure to ash and guar gum that have been identified as respiratory inhibitors in the water. The toxicity or persistence of retardant compounds in water is dependent on water chemistry, flow, and turbulence. Augspurger et al. (2003) reported ammonia toxicity (96 hour LC₅₀) for juvenile *Lampsilis siliquoides*, genetically closely related to Arkansas fatmucket, as 0.74 mg/L and 2.27 mg/L at a pH of 8.3 and temperature of 24°C. This species was among one of the more sensitive mussels tested. Toxicity tests that have been conducted on fire retardants have generally been conducted on fish or aquatic invertebrates, but not freshwater mussels that are typically more sensitive to contaminants, especially ammonia, than other aquatic taxa. Due to the exceptions allowed in the 2000 Guidelines and lack of toxicity data using different life stages of freshwater mussels and the lethal and sublethal impacts from fire retardant exposure, it is unreasonable for us to conclude with certainty that adverse impacts to the Arkansas fatmucket from fire retardants would not occur.

When fire retardant enters a stream and causes the initial spike in ammonia, it immediately begins to form a chemical equilibrium between un-ionized ammonia, which is the more toxic form, and ionized ammonia. The chemical balance between these two forms of ammonia is determined by pH, temperature, and total ammonia concentration. In most streams, the pH is sufficiently low that ionized ammonia predominates. Stream turbulence (i.e., increased aeration in riffles, etc.) also helps convert ammonia to the ionized form.

Ash has been identified as the cause of fish kills during wildfires and volcanic eruptions (Newcombe and Jensen 1996), but no information was available to determine the impacts of ash on freshwater mussels. Guar gum is an ingredient in fire retardants that would further exacerbate the effects of increased ammonia concentrations. Little *et al.* (2006) showed spikes in the salinity, as a result of the ammonia salts contained in aerially applied fire retardants, which would negatively impact all fish living in freshwater environments, even adults. Again, no information is available on the effects of guar gum on freshwater mussels, but in erring on the side of the species we conclude that if it negatively impacts fish than it will have the same impact, if not worse, on mussels. It is possible that these components may have a significant influence on the toxicity of fire retardants to Arkansas fatmucket or other freshwater mussels based on research conducted by Buhl and Hamilton (1998) on chinook salmon.

Other impacts of fire have been documented that demonstrate salmonids are more susceptible to fire retardants as well. Gresswell (1999) showed that smoke in the air is adsorbed by water and increases the ammonia concentrations in rivers even without an accidental application of retardant. Crouch *et al.* (2006) showed that in burning watersheds, prior to treatment with retardants, there is increased ammonia, phosphorous, and total cyanide. Since there is a greater background level of ammonia during a fire, the ammonia levels created by an accidental drop

may be higher than experienced in a controlled setting and as the fire retardants are diluted, they may take longer to reach nontoxic levels.

Fire retardant is designed to perform in several ways: to stay together during the drop from high up so that it all hits in the same general area, to cling to what it hits initially, and in some cases is thinned to drip through branches to the ground. The mix ratios of many formulations are variable so that the retardant can be more or less concentrated so that the appropriate application can be achieved in different environments. In forestlands for instance, to reach fires burning at ground level the retardant would be less concentrated so that it would seep through the leaves and branches and reach the ground (Johansen and Dieterich 1971). This application style would be expected when fighting ground fires in the forest land of the Ouachita National Forest. Another aspect of attempting to apply retardant to fuels beneath the canopy is that it poses a much greater risk of contaminating streams that are not visible from aircraft.

The Ouachita National Forest does not monitor long-term effects of retardant in runoff because it likely only enters streams in sub-lethal levels. There is no information available regarding lethal or sub-lethal levels of retardants in runoff to freshwater mussels. Runoff is expected to be more problematic and extensive in areas of recently disturbed riparian vegetation, areas without riparian vegetation, and areas of incomplete retardant coverage that burn but leave behind retardant. Little and Calfee (2002) showed that when retardants are applied to riparian areas or even across a dry streambed, the retardants remain toxic for 21 days. Any rain event that happens within three weeks after application to the riparian area poses a risk of introducing lethal levels of ammonia to a stream, potentially after any sort of monitoring had been conducted and after the effects to listed mussels or their host fish had been analyzed.

The Arkansas fatmucket is endemic to the Saline, Ouachita, and Caddo River watersheds in Arkansas. While the Ouachita National Forest does not own most of the property immediately adjacent (floodplain) to the rivers inhabited by Arkansas fatmucket, it does have a large ownership in these watersheds, particularly tributaries and upland areas. From 2004 – 2007, the Ouachita National Forest made fire retardant drops on 19 wildfires (145,042 gallons). Of these wildfires, only one fire burned areas adjacent to a stream (Caddo River) inhabited by the Arkansas fatmucket. The USFS dropped 4,630 gallons of fire retardant on this fire. To our knowledge, none of this retardant entered a waterbody. If it had entered a waterbody, the nearest record for Arkansas fatmucket was a considerable distance downstream and we suspect ammonia toxicity would have been diluted to non-toxic levels. While other fire retardant drops were applied in these watersheds, they occurred in areas with headwater streams and a substantial distance from any known occurrences of Arkansas fatmucket. For these reasons, we have concluded that while direct adverse impacts may occur they will likely be uncommon and negligible.

Indirect effects

The Arkansas fatmucket relies on primarily largemouth and spotted bass to complete its life cycle. Any impacts to largemouth and spotted bass populations associated with the use of fire retardants can indirectly affect Arkansas fatmucket populations by lower exposure to host fish and thereby reducing reproductive potential. The Arkansas fatmucket is a filter feeder and any

reduction in food availability (i.e., plankton die-offs) may adversely affect the health of the species. There is no information to support or refute potential indirect effects to the Arkansas fatmucket from the use of fire retardants. Biologists for the USFS on the Ouachita National Forest have never documented any adverse (direct or indirect) impacts to the Arkansas fatmucket or largemouth or spotted bass from the use of fire retardants, but closer monitoring is required to further substantiate this observation.

CONCLUSION

Possible harm to the Arkansas fatmucket resulting from the proposed action is expected to be minimal due to 1) the lack of Forest Service ownership immediately adjacent to streams occupied by the Arkansas fatmucket, 2) dilution and conversion to the ionized form of ammonia that would occur due to transport distance, water chemistry, flow, and turbulence that occurs in the mountainous headwater streams, and 3) low probability of fire retardant drops actually occurring in a waterbody. After reviewing the current status of the Arkansas fatmucket, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the USFS's proposed use of fire retardants at the Ouachita National Forest is not likely to jeopardize the continued existence of the Arkansas fatmucket. No critical habitat has been designated for this species; therefore, none will be affected.

Shinyrayed pocketbook (*Lampsilis subangulata*)

Effects Analyses:

The shinyrayed pocketbook is a fairly wide ranging mussel occurring in the Flint, Chipola, Ochlockonee and tributaries of the Chattahoochee Rivers of Alabama, Georgia and Florida. Critical habitat was designated for this species, as well as six other mussel species from northwest Florida and Georgia in 2007 (72 FR 64286). Critical habitat for the shinyrayed pocketbook includes Units 2, 3, 4, 5, 6, 7, and 9. None of these Units occur in or adjacent to the Apalachicola National Forest. Similarly, no current records of the species are known to occur within or adjacent to the National Forest. Therefore, we do not expect the proposed action, the aerial application of fire retardant, to adversely affect this species current range or designated critical habitat. While the historic range of the species does include the Ochlockonee River as it runs through the Apalachicola River, the proposed fire retardants have fairly short toxic exposure periods. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris et al.1991).

Conclusion:

After reviewing the current status of the shinyrayed pocketbook and the likely effects of the use of fire retardant on the Apalachicola National Forest, we conclude the following: (1) The current range of the species and designated critical habitat do not occur within or adjacent to the boundaries of the Apalachicola National Forest and; (2) The toxic exposure period of the fire retardants proposed for use is 24 hours or less and would not result in permanent impacts to

historic species habitat. Therefore, their use would not preclude recovery. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the shinyrayed pocketbook or result in the adverse modification or destruction of its critical habitat.

Carolina heelsplitter (*Lasmigona decorata*)

Effects Analysis

Recovery Criteria for the species require protection of existing populations, successful establishment of reintroduced populations, or the discovery of additional populations, resulting in a total of four distinct viable populations. These four populations must be distributed throughout the species' known historic range, with at least one each in the Catawba, Pee Dee, and Savannah River systems (USFWS 1996). In the Savannah River system, Carolina heelsplitter exists in Turkey Creek and three of its tributaries. This Turkey Creek population is designated as Critical Habitat and is the only dendritic population of heelsplitter known from its current range. Thus it is considered one of the most viable of the ten existing populations and targeted as a highest priority recovery population.

Based on district maps, an estimated 50 percent of the Stevens Creek watershed falls within the acquisition boundary of the USFS. Carolina heelsplitter is known to occupy portions of Mountain Creek, Sleepy Creek, Turkey Creek, Beaverdam Creek, Little Stevens Creek, and Cuffytown Creek within the Stevens Creek watershed. The portions of these streams on the National Forest are contained within the Sumter Forest Management Area 1. This 41,653-acre management area contains approximately 238.4 miles of moderate to large perennial streams, all classified as freshwater by the state (USFS 2004).

The likelihood of using aerial fire retardant in the Sumter National Forest, Long Cane Ranger District is minimal. Aerial application of fire retardant has not been used on the Long Cane District for at least 34 years (Donnie Ray, Sumter National Forest Fire Management Officer, pers. com.), and no documentation has been found indicating its use prior to 1974. Although the probability of using aerial fire retardant in Carolina heelsplitter habitat is minimal, the potential impacts of its use could be catastrophic for the species. The Guidelines for Aerial Delivery of Retardant or Foam Near Waterways (April 2000) requires a 300-foot buffer on both sides of all waterways, however the risk of accidental dropping of retardant into water bodies can never be entirely eliminated, especially for small streams (Moser 2007). The fire retardant formulations react in water to form hydrogen phosphate, hydrogen sulfate, and ionized ammonia. In low pH water, ionized ammonia becomes an un-ionized molecule which is acutely toxic to many aquatic species. Based on an analysis of water samples from streams where accidental application has occurred, un-ionized ammonia levels have ranged between 0.13 and 1.0 mg/l (Moser 2007). Stream conditions in the Stevens Creek watershed are generally acidic, with pH levels averaging around 6.5 (USEPA STORET data). Given a pH level of 6.5 and an assumed water temperature of 20 degrees Celsius, the un-ionized ammonia levels documented in Moser, 2007, would result in total ammonia levels exceeding 104 mg/L (USEPA 1976). Freshwater mussel toxicity studies indicate that lethal concentrations (LC50s, 24-96 hour) of total ammonia range between 0.74 and 19.67 mg/L, (Ausgpurger et al. 2003). Green floater (*Lasmigona subviridis*), an appropriate

surrogate for Carolina heelsplitter as it is a species within the same genus *Lasmigona*, ranked among the most sensitive of the mussel species tested. Therefore, it is likely that accidental application near or in occupied streams would result in substantial mortality of Carolina heelsplitter.

Based on the above analysis, the un-ionized ammonia levels documented in Moser, 2007, and the presence of Carolina heelsplitter in small streams that would be difficult to identify and avoid in the case of an aerial fire retardant application, we conclude that fire retardant use in habitat occupied by Carolina heelsplitter would result in take of this species. To avoid adverse impacts to Carolina heelsplitter, the Sumter National Forest has agreed to restrict the use of aerial fire retardant from Cuffytown and Turkey Creek watersheds, which contain streams known to harbor Carolina heelsplitter. Per the Sumter Forest letter dated February 1, 2008, aerial application of fire retardant on the Long Cane Ranger District will be restricted from the Cuffytown and Turkey Creek watersheds, thus eliminating potential exposure of Carolina heelsplitter or its habitat to fire retardant. Exceptions to this restriction will be made if aerial application of fire retardant is the only viable means to protect human life or property.

Conclusion

Based on the Sumter Forest's willingness to exclude Cuffytown and Turkey Creek watersheds from the use of aerial administration of fire retardant, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Carolina heelsplitter. Critical habitat for this species on National Forest land will also be protected through restricted use within Cuffytown and Turkey Creek watersheds, therefore, no adverse modifications to critical habitat is anticipated.

Scaleshell (*Leptodea leptodon*)

Ouachita National Forest

Based upon the information pertaining to the U.S.D.A. Forest Service's (USFS) use of fire retardants to control wildfires on USFS lands, the Service has determined the action area to be entirely within the confines of the South Fourche LaFave River basin on the Ouachita National Forest. It is anticipated that direct and indirect effects to the scaleshell (*Leptodea leptodon*) would result from the use of fire retardants in the South Fourche LaFave River basin.

Direct effects

The use of fire retardants associated with wildfire suppression techniques may have direct adverse affects on the scaleshell, its habitat, and its host fish on the Ouachita National Forest. There is one historic record of scaleshell within the South Fourche LaFave River in Arkansas (Harris 1992). Stoeckel and Moles (2002), resurveyed the entire stream via canoe and found no live, fresh dead, or relict scaleshell specimens. The Ouachita National Forest ownership exists primarily along tributaries of the South Fourche LaFave River and not adjacent to the South Fourche LaFave River.

While the U. S. Forest Service has developed *2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways* to avoid aerial application of fire retardant within 300 feet of waterways, there are exceptions when the USFS may still drop fire retardants into bodies of water, both visible and out of sight. While the 2000 Guidelines are flexible, and allow for the Incident Commander to make exceptions to conduct a drop that would expose a waterbody to retardants, according to the USFS no exceptions have been taken since institution of the Guidelines on the Ouachita National Forest (B. Crump, pers. comm., 2008). Fire retardant drops in ephemeral or intermittent streams that are difficult to see due to tree canopy closure are probably more likely to occur than exceptions to the Guidelines.

Direct adverse affects to the scaleshell from the use of fire retardants include both lethal and sublethal impacts due to ammonia toxicity (juveniles mussels are generally more susceptible than adults, but there is no specific ammonia toxicity data available for this species) and exposure to ash and guar gum that have been identified as respiratory inhibitors in the water. The toxicity or persistence of retardant compounds in water is dependent on water chemistry, flow, and turbulence. Toxicity tests that have been conducted on fire retardants have generally been conducted on fish or aquatic invertebrates, but not freshwater mussels that are typically more sensitive to contaminants, especially ammonia, than other aquatic taxa. Due to the exceptions allowed in the 2000 Guidelines and lack of toxicity data using different life stages of freshwater mussels and the lethal and sublethal impacts from fire retardant exposure, it is unreasonable for us to conclude with certainty that adverse impacts to the scaleshell from fire retardants would not occur.

When fire retardant enters a stream and causes the initial spike in ammonia, it immediately begins to form a chemical equilibrium between un-ionized ammonia, which is the more toxic form, and ionized ammonia. The chemical balance between these two forms of ammonia is determined by pH, temperature, and total ammonia concentration. In most streams, the pH is sufficiently low that ionized ammonia predominates. Stream turbulence (i.e., increased aeration in riffles, etc.) also helps convert ammonia to the ionized form.

Ash has been identified as the cause of fish kills during wildfires and volcanic eruptions (Newcombe and Jensen 1996), but no information was available to determine the impacts of ash on freshwater mussels. Guar gum is an ingredient in fire retardants that would further exacerbate the effects of increased ammonia concentrations. Little *et al.* (2006) showed spikes in the salinity, as a result of the ammonia salts contained in aerially applied fire retardants, which would negatively impact all fish living in freshwater environments, even adults. Again, no information is available on the effects of guar gum on freshwater mussels, but it is safe to conclude that if it negatively impacts fish than it will have the same impact, if not worse, on mussels. It is possible that these components may have a significant influence on the toxicity of fire retardants to scaleshell or other freshwater mussels based on research conducted by Buhl and Hamilton (1998) on chinook salmon.

Other impacts of fire have been documented that demonstrate salmonids are more susceptible to fire retardants as well. Gresswell (1999) showed that smoke in the air is adsorbed by water and increases the ammonia concentrations in rivers even without an accidental application of retardant. Crouch *et al.* (2006) showed that in burning watersheds, prior to treatment with

retardants, there is increased ammonia, phosphorous, and total cyanide. Since there is a greater background level of ammonia during a fire, the ammonia levels created by an accidental drop may be higher than experienced in a controlled setting and as the fire retardants are diluted, they may take longer to reach nontoxic levels.

Fire retardant is designed to perform in several ways: to stay together during the drop from high up so that it all hits in the same general area, to cling to what it hits initially, and in some cases is thinned to drip through branches to the ground. The mix ratios of many formulations are variable so that the retardant can be more or less concentrated so that the appropriate application can be achieved in different environments. In forestlands for instance, to reach fires burning at ground level the retardant would be less concentrated so that it would seep through the leaves and branches and reach the ground (Johansen and Dieterich 1971). This application style would be expected when fighting ground fires in the forest land of the Ouachita National Forest. Another aspect of attempting to apply retardant to fuels beneath the canopy is that it poses a much greater risk of contaminating streams that are not visible from aircraft.

The Ouachita National Forest does not monitor long-term effects of retardant in runoff because it likely only enters streams in sub-lethal levels. There is no information available regarding lethal or sub-lethal levels of retardants in runoff to freshwater mussels. Runoff is expected to be more problematic and extensive in areas of recently disturbed riparian vegetation, areas without riparian vegetation, and areas of incomplete retardant coverage that burn but leave behind retardant. Little and Calfee (2002) showed that when retardants are applied to riparian areas or even across a dry streambed, the retardants remain toxic for 21 days. Any rain event that happens within three weeks after application to the riparian area poses a risk of introducing lethal levels of ammonia to a stream, potentially after any sort of monitoring had been conducted and after the effects to listed mussels or their host fish had been analyzed.

The scaleshell occurs in several rivers outside the South Fourche LaFave River basin. The scaleshell population in the South Fourche LaFave River is considered to be functionally extirpated (meaning that abundance is so low that it is highly unlikely that the population is viable). From 2004 – 2007, the Ouachita National Forest used fire retardant on one wildfire (45,662 gallons) in this watershed. For these reasons, we have concluded that while direct adverse impacts may occur they will likely be uncommon and negligible.

Indirect effects

The scaleshell relies on freshwater drum to complete its life cycle. Any impacts to freshwater drum populations associated with the use of fire retardants can indirectly affect scaleshell populations by lower exposure to host fish and thereby reducing reproductive potential. The scaleshell is a filter feeder and any reduction in food availability (i.e., plankton die-offs) may adversely affect the health of the species. There is no information to support or refute potential indirect effects to the scaleshell from the use of fire retardants. Biologists for the USFS on the Ouachita National Forest have never documented any adverse (direct or indirect) impacts to the scaleshell or freshwater drum from the use of fire retardants, but closer monitoring is required to further substantiate this observation.

Mark Twain National Forest

Effects analysis

The proposed action is expected to have minor impacts to the scaleshell. Only a very small portion of the species range occurs on Forest Service land where they could be subject to the proposed action. The scaleshell occurs in the Gasconade River on the MTNF. There is a large amount of private land within the proclamation boundary of the MTNF. Most of the structures are surrounded by green fields that would slow the spread of wildfire. It is unlikely that fire retardant would be used in this area (J. Eberly, MTNF, pers.comm. 1/24/08). Even if it were, a pilot would be able to distinguish the Gasconade River easily from the surrounding habitats and would not drop the retardant within 300 feet of the stream as called for in the Interagency Guidelines.

When wildfires occur on the MTNF initial attack methods are usually sufficient to control the spread of the fires. The MTNF uses fire retardants only in rare instances. Over the last 10 years, the MTNF had an average of 171 wildfires per year. Average acreage burned by wildfire over the same time frame was 5062 acres per year. During that timeframe an average of 24 wildfires per year were over 50 acres in size. The MTNF has used fire retardants only three times in the last 20 years. In all three instances, structures were threatened by the wildfire. The MTNF does not have an air tanker or retardant storage facilities. In order to obtain those services, the Forest must call on resources in Arkansas, if they are available (J. Eberly, MTNF, pers. comm.). The MTNF does not plan on increasing the use of fire retardant, however wants to maintain the option to use it if structures or life is threatened by wildfire. In Missouri the period most likely to produce stand replacing fires is from approximately March 25 to April 15. The MTNF also has use of a helicopter for water only drops for fire control, also minimizing the need for use of fire retardant.

The 2005 Land and Resource Management Plan (Forest Plan) for the Mark Twain National Forest addresses wildland fire suppression on pages 2-17 to 2-19. Since the Forest rarely uses fire retardants, only one guideline for its use was written:

“Do not apply fire retardants directly over water bodies unless needed for firefighter or public safety.”

Conclusion

After reviewing the status of the scaleshell and the likely affects of the use of fire retardant on National Forest lands, it is the Service’s biological opinion that the proposed action is not likely to jeopardize the continued existence of the scaleshell. There is no critical habitat designated for the species; therefore, none will be affected.

Round Rocksnail (*Leptoxis ampla*)

The proposed action is expected to have little to no impact to the round rocksnail. The round rocksnail is found in the mainstem and large tributaries of the Cahaba River system in gravels, cobble and boulders less than a meter in depth (Mirarchi, et. al 2004a); it is unlikely to be found

in the fine-grained substrates of the small headwater tributaries of the Oakmulgee Ranger District of the Talladega National Forest. Because the round rocksnail is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the round rocksnail will be impacted by the proposed action.

There is no designated critical habitat for the round rocksnail; therefore, there will be no effects.

Conclusion

After reviewing the current status of the round rocksnail, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the round rocksnail. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the round rocksnail is not found on National Forest lands, it is a large river species highly unlikely to occur in headwater streams, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Painted Rocksnail (*Leptoxis taeniata*)

The proposed action is expected to have little to no impact to the painted rocksnail. The painted rocksnail is found in tributaries of the Coosa River system downstream of Forest Service lands including lower Choccolocco, Buxahatchee and Ohatchee creeks (Mirarchi, et. al 2004a); its preferred habitat of bedrock ledges and boulders may be found near the boundary of the Talladega National Forest in Alabama but it has not been reported there at this time, with the closest known population approximately 10 km downstream at the confluence of Cheaha and Choccolocco Creek. Because the painted rocksnail is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the painted rocksnail will be impacted by the proposed action.

There is no designated critical habitat for the painted rocksnail; therefore, there will be no effects.

Conclusion

After reviewing the current status of the painted rocksnail, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the painted rocksnail. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the painted rocksnail is not found on National Forest lands, it is currently found in several drainages of the Coosa River system more than 10 km downstream of Forest Service lands, US Forest Service fire managers in Alabama have never

used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Flat Pebblesnail (*Lepyrium showalteri*)

The proposed action is expected to have little to no impact to the flat pebblesnail. The flat pebblesnail rocksnail is found in the mainstem Cahaba River in one shoal series, and from one site in the Little Cahaba River, Bibb County, Alabama. (Mirarchi, et. al 2004a); it has not been reported from the Oakmulgee Ranger district of the Talladega National Forest, likely because of its specialized habitat requirements that include clean, smooth stones in the rapid current of small to large rivers. Because the flat pebblesnail is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the flat pebblesnail will be impacted by the proposed action.

There is no designated critical habitat for the flat pebblesnail; therefore, there will be no effects.

Conclusion

After reviewing the current status of the flat pebblesnail, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the flat pebblesnail. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the flat pebblesnail is not found on National Forest lands, it has specialized habitat requirements unlikely to be found in the headwater streams of the closest National Forest lands, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Cylindrical Lioplax (*Lioplax cyclostomaformis*)

The proposed action is expected to have little to no impact to the cylindrical lioplax. The cylindrical lioplax is currently extant only in the mainstream of the Cahaba River above the Fall Line, living in mud under large rocks in rapid current (Mirarchi, et. al 2004a); it is unlikely to be found in the fine-grained substrates of the small headwater tributaries of the Oakmulgee Ranger District of the Talladega National Forest. Because the cylindrical lioplax is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the cylindrical lioplax will be impacted by the proposed action.

There is no designated critical habitat for the cylindrical lioplax; therefore, there will be no effects.

Conclusion

After reviewing the current status of the cylindrical lioplax, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the cylindrical lioplax. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the cylindrical lioplax is not found on National Forest lands, it has specialized habitat requirements unlikely to be found in the headwater streams of the closest National Forest, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Karner Blue Butterfly (*Lycaeides melissa samuelis*)

Aerial fire retardant is currently not used in wildfire suppression efforts and it is highly unlikely that this tool will be used in the future on the Huron-Manistee National Forests (Keough 2008). Therefore, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Karner blue butterfly because neither the species nor its habitat will be exposed to the action and its environmental impacts. There is no critical habitat designated for the species; therefore, none will be affected.

Louisiana pearlshell mussel (*Margaritifera hembeli*)

Factors to be considered

Under the proposed action, the Forest Service would continue the aerial application of fire retardant, on NFS lands, and implementation of guidance contained in the 2000 Guidelines for Aerial Application of Fire Retardant and Foams in Waterways. Those guidelines are in place to prevent the aerial application of fire retardants to waterways (i.e., lakes, rivers, streams, ponds, etc.) via the establishment of 300-foot buffer zones. Aerial application of retardants within those waterway buffer zones should be avoided unless: 1) alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel; 2) life or property is threatened and the use of retardant can be reasonable expected to alleviate the threat; or 3) potential damage to natural resources outweighs possible loss of aquatic life.

Firefighting is done on a local, case-by-case basis as determined by unit managers who are on-sight and able to assess the current situation. Not all wildfire suppressions utilize aerial application of retardants. Fire retardants are only used when they are determined to be the most effective and efficient method of protecting the public, firefighters, resources, private property, and facilities during a fire situation. Forest Service personnel have indicated that aerial applications of retardants have not been necessary, and thus, have not been utilized for wildfire suppression on the Kisatchie National Forest for at least 18 years due to terrain, accessibility, and existing fire breaks (Cindy Dancak, Kisatchie National Forest, pers. comm. 2008).

The potential effects of wildfire on aquatic environments, depending on its severity, intensity, and subsequent seasonal weather events, include bank erosion, a reduction of habitat for aquatic life, increased sediment loads, and degraded water quality (i.e., ash toxicity). Without the use of aerially applied retardants in situations deemed necessary, wildfires would likely increase in size, intensity, and severity, and such increases could exacerbate those potential adverse impacts to aquatic environments.

Analyses for effects of the action

A risk of aerial application that will most likely never be entirely eliminated is the unintentional dropping of retardant into water bodies. Direct application of retardants onto the stream surface was identified in the EA as the primary source of retardant contamination in streams. Norris, Lorz, and Gregory (1991) found that only minor amounts of retardant enter streams from riparian areas and a buffer as small as approximately 10 feet virtually eliminates retardant entering stream waters.

Ammonia is the primary toxic compound found in those fire retardants. The principle chemical compounds present immediately after direct stream application are ammonium nitrogen and total phosphorus. The primary remaining compounds in a stream 24 hours after the initial application of retardant, however, are nitrate and soluble organic nitrogen. Those chemicals are considered

low in toxicity and are natural components of the aquatic ecosystem (Norris, Lorz, and Gregory 1991). Factors that determine whether an aquatic organism will be exposed to toxic levels of ammonia compounds are: (1) its ability to avoid the contaminated area; (2) time exposed to the toxin; (3) water quality including pH; (4) quantity of retardant spilled into freshwater; (5) type of waterbody; and (6) size of waterbody.

Species' response to a proposed action

Under the proposed action, aerial delivery of retardant into a waterway should normally not occur. The 2000 Guidelines include a minimum 300-foot buffer to guard against wind drift and surface transport of retardant into a waterway. As discussed above, buffers as small as approximately 10 feet significantly reduce the amount of retardant entering stream waters. Adverse effects on aquatic species are, therefore, not anticipated unless retardant is dropped directly into or within approximately 10 feet of a waterway. Thus, implementation of the proposed project (with successful establishment of the 300-foot buffer zones) is not expected to result in adverse impacts to the Louisiana pearlshell mussel.

Should retardant come in contact with an aquatic environment, intentionally (via exceptions to buffer zones invoked) or accidentally, the magnitude of the mortality to aquatic organisms and the distance over which it occurs varies with three elements:

1. The characteristics of the retardant application (i.e., orientation of the application line relative to the stream, size of load dropped, number of loads dropped, and timing and placement of subsequent loads).
2. The characteristics of the application zone. Narrow, deep streams have a shorter mortality zone compared to wide, shallow streams. The more dense the canopy, the less chemical that falls directly into the stream and, therefore, the smaller the mortality zone.
3. The characteristics of the stream. Streams with a smooth channel have a longer mortality zone than those with many pools and riffles. Pools and riffles cause the peak of retardant concentration to spread out, thus reducing the magnitude of exposure. In addition, increased stream discharge with distance downstream (occurring as a result of groundwater inflow and streamflow contribution) also decreases the size of the mortality zone due to increased dilution.

Louisiana pearlshell mussels require slightly acidic, clear, moderately swift-flowing, perennial streams having stable mineral substrate, such as sandy bottom with rocky outcroppings. They often occur in shallow (water 12 to 24 inches deep) (Johnson 1995), wide areas, with well-compacted substrate, or infrequent patches of larger gravel substrate and are rarely found in deep pools that have slower flowing water and silty bottoms (Johnson and Brown 2000). Shively and Vermillion (1998) reported a canopy closure of 51 to 75 percent in areas occupied by Louisiana pearlshell mussels. Thus, the relatively swift flow and riffle/pool characteristics of Louisiana pearlshell mussel streams, as well as the canopy closure of adjacent riparian habitats, should help reduce the size of the mortality zone if fire retardants enter an occupied stream.

The likelihood of fire retardants entering a Louisiana pearlshell mussel stream, however, is low. According to the EA, since the 2000 Guidelines were established, there have been no recorded incidents on Forest Service lands nationwide where an exception was invoked and adverse effects to federally listed species resulted. There have been 14 documented accidents where retardant has accidentally come in contact with a waterway. Three of those incidents resulted in fish mortalities ranging from several hundred to several thousand fish (USFS 2006). The two most significant fish kills (one in Washington State and one in Oregon) were caused by a fire retardant formula that contained sodium ferrocyanide, which is no longer used by the Forest Service. The third incident (in Oregon), which killed 260 fish, including a threatened bull trout, was a ground based accident and not from aerial application (BA 2002). In addition, approximately 128,000 aerial drops of fire retardant have occurred nationwide over the last 8 years. Assuming 14 incidents of contamination of streams per 128,000 drops, there is an approximate .012 percent chance of aerial application entering a waterway. In addition, aerial applications of fire retardant have not occurred within the Kisatchie National Forest for at least the last eighteen years due to terrain, accessibility, and natural fire breaks.

The Louisiana pearlshell mussel is located in two watersheds on opposite sides of the Red River in the Evangeline Unit of the Calcasieu Ranger District in Rapides Parish and the Catahoula Ranger District of the Kisatchie National Forest in Grant Parish. That species is restricted to small second- and third-order streams which drain into two Red River tributaries (i.e., Bayou Rigolette and Bayou Rapides) and one historical tributary of the Red River (i.e., Bayou Boeuf) (Johnson and Brown 2000). Should aerial application occur on the Kisatchie National Forest and associated chemicals enter an occupied Louisiana pearlshell stream it is highly unlikely that such an event would impact populations in both watersheds. Because the 2000 Guidelines intent is to minimize effects to waterways to the maximum extent practicable, the Service assumes that most fire retardant entering a stream would occur from aerial applications being deposited perpendicular to a stream, not parallel to or right down the center. Thus, impacts to Louisiana pearlshells should be fairly localized.

The host fish for the Louisiana pearlshell is unknown at this time. Studies, however, are ongoing and recent observations indicate that balckspotted topminnows were found to have Louisiana pearlshell glochidial encystment. That species is not considered a sensitive species or species of management concern and healthy populations are known to occur within the Kisatchie National Forest (David Byrd, Kisatchie National Forest, pers. comm. 2008). In addition, no other species of fish (i.e., potential hosts) that occur in these streams are sensitive species or species of management concern. Therefore, the loss of some balckspotted topminnows (or other fishes) via aerial application of retardants is not expected to significantly impact Louisiana pearlshells.

CONCLUSION

After reviewing the current status of the Louisiana pearlshell, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that continuation of the aerial application of fire retardants on Forest Service lands in accordance with the 2000 Guidelines for Aerial Delivery of Retardant or Foam near

Waterways, as proposed, is not likely to jeopardize the continued existence of the Louisiana pearlshell mussel. No critical habitat has been designated for this species; therefore, none will be affected.

Ochlockonee Moccasinshell (*Medionidus simpsonianus*)

Effects Analyses:

The Ochlockonee moccasinshell is an extremely rare mussel, endemic only to the main stem Ochlockonee River in Georgia and north Florida. Currently, the species persists in only a relatively short reach of the Ochlockonee River above Talquin Reservoir. In 2007, the Service designated critical habitat for this species as well as six other mussel species from northwest Florida and Georgia. Critical habitat for the Ochlockonee moccasinshell is limited to Unit 9, the Upper Ochlockonee River in Florida and Georgia (72 FR 64286). Neither the known current range of the species or designated critical habitat fall within or adjacent to the boundaries of the Apalachicola National Forest. Therefore, we do not expect the proposed action, the aerial application of fire retardant, to adversely affect this species current range or designated critical habitat. While the historic range of the species does include the Ochlockonee River as it runs through the Apalachicola River, the proposed fire retardants have fairly short toxic exposure periods. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris et al.1991).

Conclusion:

After reviewing the current status of the Ochlockonee moccasinshell and the likely effects of the use of fire retardant on the Apalachicola National Forest, we conclude the following: (1) The current range of the species and designated critical habitat do not occur within or adjacent to the boundaries of the Apalachicola National Forest and; (2) The toxic exposure period of the fire retardants proposed for use is 24 hours or less and would not result in permanent impacts to historic species habitat. Therefore, their use would not preclude recovery. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the Ochlockonee moccasinshell.

Spruce-fir moss spider (*Microhexura montivaga*)

a. Status of the Species Within the Action Area

The spruce-fir moss spider is known from only the highest mountain peaks (at and above 1,646 m (5,400 ft) in elevation) in the Southern Appalachian Mountains of North Carolina, Tennessee, and Virginia. It has been recorded from Mount Mitchell, Yancey County, North Carolina; Grandfather Mountain, Watauga, Avery, and Caldwell Counties, North Carolina; Mount Collins, Swain County, North Carolina; Clingmans Dome, Swain County, North Carolina; Roan Mountain, Avery and Mitchell Counties, North Carolina, and Carter County, Tennessee; Mount Buckley, Sevier County, Tennessee; Mount LeConte, Sevier County, Tennessee (Service 2001);

and, near Mount Rogers, Smyth and Grayson Counties, Virginia (Dr. Fredrick Coyle, Western Carolina University [recently retired], Cullowhee, NC, pers. comm. to J. A. Fridell, USFWS, Asheville Field Office, NC, 2007).

The typical microhabitat of the spruce-fir moss spider appears to be associated with moderately thick and humid, but well-drained, moss and liverwort mats growing in sheltered spots on surfaces of rock outcrops and boulders in mature high-elevation forests dominated by the Fraser fir (*Abies fraseri*) (Coyle 1981, 1997, 1999; Harp 1991, 1992; Service 1998, 2001). The portions of the moss mats supporting the spruce-fir moss spider are generally from 1 to 4 centimeters (cm) thick (roughly 0.5 to 1.25 in) and are well-shaded (Coyle 1999; Harp 1992; Service 2001). They cannot be too dry, because the spider is quite sensitive to desiccation (drying out), nor can they be too wet (Coyle 1997, 1998; Harp 1991, 1992). The humidity levels required by the spruce-fir moss spider have yet to be determined. In a study of the spruce-fir moss spider on Roan Mountain, Coyle (1999) reported that the moss/liverwort mats in which spruce-fir moss spiders were found were--(1) sheltered from the sun and the rain, (2) typically not far above either the ground or a horizontal ledge with accumulated soil, (3) included a thin layer of humid soil and/or humus (decayed vegetation and other organic material) between the moss and rock surface, (4) moderately thick (1 to 3 cm (0.5 to 1 in), and (5) humid but not wet. He reported that most rock outcrop surfaces, even those covered by bryophytes (mosses, liverworts, etc.), do not meet these microhabitat requirements and do not support the spruce-fir moss spider.

On Roan Mountain (Pisgah National Forest, North Carolina and Cherokee National Forest, Tennessee), Coyle (1999) recorded scattered occurrences of the spruce-fir moss spider at 12 small, separate rock outcrop sites but found more than two spiders living in the same discrete patch of moss/liverwort on only three occasions. He found four spiders in an 800-square-centimeter (sq cm) (approximately 1.0-sq-ft) patch of liverwort at one site, five spiders in a 900-sq-cm (1.2-sq-ft) patch of moss at another site, and four spiders in a 900-sq-cm (1.2-sq-ft) patch of moss at the third site. He reported that at none of these three sites, nor at any other sites on Roan Mountain where he found the spider, were they able to find additional spiders with ease and that the spruce-fir moss spider population densities on Roan Mountain appear to be relatively low. Critical habitat has been designated for this species. The two Primary Constituent Elements for this species are listed as follows along with the nature of the effect of this action on each.

- 1) Fraser fir or fir-dominated spruce-fir forests at and above 1,646 m (5,400 ft) in elevation.
- 2) Moderately thick and humid, but not wet, moss (species in the genus *Dicranodontium*, and possibly *Polytrichum*) and/or liverwort mats on rock surfaces that are adequately sheltered from the sun and rain (by overhang and aspect) and include a thin layer of humid soil and/or humus between the moss and rock surface.

b. Factors Affecting the Species' Environment Within the Action Area

Although past trail construction and recreational activities on Roan Mountain appear to have had an adverse effect on the spruce-fir moss spider and its habitat (Coyle 1999) within the action area

[the Pisgah and Cherokee National Forests – the species is not found near the Nantahala National Forest], following the discovery of the species on Roan Mountain, the USFS implemented measures to protect the remaining known sites supporting species from these threats. The primary factors currently affecting or threatening the species' habitat within the action area are associated primarily with infestation and resulting mortality of the Fraser fir (*Abies fraseri*) by the balsam woolly adelgid (an exotic insect pest), and possibly air pollution and other factors not yet fully understood. Other factors that threaten the species within the action area and elsewhere throughout its range include wildfires, storm damage of the sheltering fir/spruce canopy (e.g., wind, ice, and lightning), severe drought, and climate change.

a. Factors to be Considered

Proximity of the Action – If the use of fire retardant becomes necessary on the Cherokee, Pisgah or Nantahala National Forests, the location of the fire would not be predictable. However, in the southern Appalachians, lightning caused fires are more common on dry, exposed ridges and south facing slopes at higher elevations. Frost (1995) estimated presettlement fire frequency on ridges and upper slopes in the Appalachians was 7-12 years in the lower mountains and >12 years in higher mountains (>3,000 ft) (Buckner and Turrill 1999). Fires above 5000 ft. are even less frequent (Barden and Woods 1974). The locations of human-caused fires are not as predictable.

Fortunately, the habitats occupied by the noonday snail and the spruce-fir moss spider are not typically vulnerable to wildfires. Fires are extremely infrequent in the spruce-fir forest and the north-facing slope occupied by the noonday globe is typically too moist to carry a fire. The same is generally true of the riparian areas bordering the streams occupied by the Appalachian elktoe.

Timing – In the southern Appalachians, lightning set fires occur in a bimodal distribution most often in late-spring and early summer, with a less frequent peak in early fall (Komarek 1964, 1968; Barden and Woods 1974). This pattern has held true on the Nantahala and Pisgah National Forests with about half (49 percent) of all fires occurring in March and April with a smaller peak (about 12 percent of all fires) in November. The fewest fires occur between June and September. The Cherokee National Forest has two separate fire seasons. The spring season is from (approximately) February 15th through May 1st. The fall season runs from (approximately) October 15th through December 1st. However, as indicated previously, red spruce and Fraser fir are both fire intolerant species and the fire potential at the site is low.

Disturbance Duration, Frequency, and Intensity - Annually, an average of six lightning fires per one million acres occurs in the Southern Appalachians. This frequency is greater than that recorded for the Great Plains, Mississippi Basin, or northeastern United States, but less than portions of the western and southeastern United States (Schroeder and Buck 1970; SAMAB 1996). However, 88 percent of all fires in the southern Appalachians are human-caused.

On the Cherokee, Nantahala and Pisgah National Forests, most fires are very small and of short duration. Since 2001, there has been an average of 91 fires per year that have burned an average of only about 35 acres each – a total (average) of about 3185 acres a year (0.3 percent of the Nantahala and Pisgah National Forests per year). Aerial application would only be used for

wildfire suppression. Additionally, interviews with experienced US Forest Service fire fighters (Street and Myers 2008) revealed that there were only three fires on Roan Mountain in the past 35 years. All of these fires were small, low intensity, and not within spruce-fir forest. The need for a retardant drop within the spruce-fir forest on Roan Mountain is extremely limited.

Analyses of Effects of the Action

Potential Beneficial Effects

The habitats occupied by the species is dependent on high moisture regimes (see Environmental Baseline). The effects of a fire in these areas would be devastating to the species. It is possible that the use of fire retardant would be recommended to protect known and suitable habitats for the spruce-fir moss spider to avoid catastrophic loss of either species and/or their habitat. Therefore, while there could be adverse effects to the species from the use of fire retardant (though Phos-Chek's effects on arachnids has not been studied), the use of retardant (that would only affect a portion of the occupied habitat for a short duration of time) would be justified to protect the remainder of the habitat from the known detrimental affects of fire.

Direct Impacts

Given the Conservation Measures put in place on The Nantahala and Pisgah National Forest to prevent any adverse impacts to the spruce-fir moss spider, no direct impacts are expected.

On the Cherokee National Forest the primary direct effects on the spruce-fir moss spider could include physical injury to or death of spiders resulting from the force of the retardant hitting them, as well as impacts from physical changes in its sensitive habitat (force of retardant hitting the moss and rock) and chemical changes in the environment (pH, phosphorous, nitrogen, etc.) The likelihood of spiders being killed by the force of retardant hitting them or their habitat is probably minimal, as the likelihood of fire retardant use in their habitat is limited. The habitat in which the spider occurs on the Cherokee National Forest has low fire potential, as evidenced by the fact that there were only three fires on Roan Mountain in the past 35 years. The use of aerially applied fire retardant is considered a rare event on the Cherokee National Forest. In the time frame of 2001 through 2007, the Cherokee National Forest has had a total of 14 calls for retardant for an average of 2 calls per year (Martin 2008). Fire retardant appears to have minimal toxicity to invertebrates. Tests on soil plots within a retardant drop zone in the Australian heathlands up to 12 months after application found a decrease in pH and a 5-fold increase in phosphorous. Increases in nitrogen, carbon, and sulfur were noted immediately after application, but all decreased to background rates within a few months. Application rates of retardant used for tests approximated rates used for fire control (Hopmans and Bickford 2003). Samples of invertebrate numbers and diversity across the test plots before and after retardant application showed no significant difference. Critical habitat Constituent Elements for the spruce-fir moss spider are previously discussed. The proposed action may directly affect Constituent Element 2 by physically damaging the mats of moss or liverwort either through the force of the retardant hitting the area or through chemical changes as discussed above.

Indirect Impacts - Indirect effects are defined as those that are caused by the proposed action and are later in time but are still reasonably certain to occur (50 CFR 402.02). Given the Conservation Measures put in place on the Nantahala and Pisgah National Forests to prevent any adverse impacts to the spruce-fir moss spider, no indirect impacts are expected.

Similarly, on the Cherokee National Forest, the Service has not identified any significant indirect effects to the spruce fir moss spider. It is possible that post-fire fertilizer-like effects of Phos-Chek may improve habitat conditions for the spruce-fir moss spider and noonday globe by accelerating native plant growth. One exception to this would be where an invasive plant species is nearby and subject to post-fire fertilizer effects as well. This could eventually render some habitats unsuitable for the noonday globe and spruce-fir moss spider (potentially affecting Critical habitat Constituent Element 2 for the spruce-fir moss spider). However, invasive species control is of primary importance to the Forests, particularly in terms of impacts on listed species. It is very unlikely that accelerated growth of an invasive species would be allowed to impact a listed species—appropriate control methods would be applied. Additionally, on the Cherokee National Forest, the likelihood of fire retardant use in or near the spruce-fir moss spider or its critical habitat is minimal, as the likelihood of fire retardant use in their habitat is limited. The habitat in which the spider occurs on the Cherokee National Forest has low fire potential, as evidenced by the fact that there were only three fires on Roan Mountain in the past 35 years.

CUMULATIVE EFFECTS

Cumulative effects include the combined effects of any future state, local, or private actions that are reasonably certain to occur within the action area covered in this Opinion. Because the Action Area is entirely on federal land (the Cherokee, Nantahala and Pisgah National Forests), consultation pursuant to section 7 of the Act would be required for all future actions. Therefore, no cumulative impacts are expected.

CONCLUSION

After reviewing the current status of the spruce-fir moss spider; the environmental baseline for the action area (the Nantahala and Pisgah National Forests); the effects of implementation of the *Guidelines for Aerial Delivery of Retardant or Foam Near Waterways* (April 2000)]; conservation measures identified by the U.S. Forest Service for the use of fire retardant on the Nantahala and Pisgah National Forests; any potential interrelated and interdependent actions associated with the proposed action; and any potential cumulative effects, it is the Service's opinion that the use of fire retardants on the Nantahala and Pisgah National Forests is not likely to adversely affect (not likely to jeopardize the continued existence of) the spruce-fir moss spider.

This proposed action is not likely to jeopardize the continued existence of the spruce-fir moss spider on the Cherokee National Forest for the following reasons: 1) This species is located in several small areas across the Roan Mountain area on the Cherokee National Forest, as well as six other sites in North Carolina, Tennessee, and Virginia. It is unlikely all populations would be affected from any particular fire retardant application. 2) Fire retardant appears to have minimal toxicity to invertebrates. 3) The habitat in which the spider occurs on the Cherokee National

Forest has low fire potential, as evidenced by the fact that there were only three fires on Roan Mountain in the past 35 years. 4) The use of aerially applied fire retardant is considered a rare event on the Cherokee National Forest. Critical habitat will not be adversely affected or destroyed by the use of fire retardant on the Cherokee, Nantahala and Pisgah National Forests. On the Cherokee National Forest, the proposed action is not likely to affect critical habitat for the spruce-fir moss spider. The proposed action could affect Constituent Element 2 by physically damaging the mats of moss or liverwort either through the force of the retardant hitting the area or through chemical changes, but the potential for fire retardant use in this habitat would be very low. The Service has not identified any significant indirect effects to the spruce-fir moss critical habitat as a result of the proposed action. However, it is possible that post-fire fertilizer-like effects of Phos-Chek may improve habitat conditions for the spruce-fir moss spider by accelerating native plant growth. One exception to this would be where an invasive plant species is nearby and subject to post-fire fertilizer effects as well. This is unlikely to render critical habitat unsuitable, because of the Forest Service's commitment to control invasive species. This proposed action is not likely to jeopardize the continued existence of the Appalachian elktoe mussel with respect to the Cherokee National Forest for the following reasons: 1) This species likely occurs in relatively small numbers at scattered sites and therefore it is unlikely all or a large percentage of individuals or populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to occur directly on the Nolichucky River, a perennial stream that contains the Appalachian elktoe mussel. 3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Cherokee National Forest. Critical habitat has been designated for this species, but the proposed action is not likely to affect that critical habitat with respect to the Cherokee National Forest. The proposed action is not expected to alter Constituent Elements two, three, five, or six. Of the seven elements, Constituent Element 1 (as it applies to "clean" water) and Constituent Element 7 (fish hosts) can be affected by the presence of ammonia compounds in solution in the water. Constituent Element 4 (as it applies to sediment) can be beneficially affected by fire suppression activities, in general. Reasons why fire retardant effects to critical habitat designated for the Appalachian elktoe are not likely would be the same as those previously discussed for the species in this paragraph.

American Burying Beetle (*Nicrophorus americanus*)

Ohio

Aerial fire retardant is currently not used in wildfire suppression efforts and it is highly unlikely that this tool will be used in the future on the Wayne National Forest (Rebecca Ewing, Forest Biologist, personal communication, 2008).

Oklahoma

In Oklahoma, ABBs are typically active at night from mid-May to late-September when nighttime ambient temperatures are consistently above 60°F. The ABB is an annual species and typically only reproduces once in its lifetime. Weather, such as rain and strong winds, result in reduced ABB activity. During the daytime ABBs are believed to bury under the vegetation litter. During the winter months (late September to mid-May), ABBs bury themselves into the soil and become inactive (USFWS 1991).

At the time of listing in 1989, the prevailing theory on the ABB's decline was habitat fragmentation (USFWS 1991). The Service concluded that the best explanation for the decline of ABBs involved habitat fragmentation, which reduced the carrion prey base and increased the vertebrate scavenger competition for this prey (USFWS 1991).

Historically the geographic range of the ABB encompassed over 150 counties in 35 states, covering most of temperate eastern North America (USFWS 1991; Peck and Kalbars 1987). During the 20th century, the ABB disappeared from over 90 percent of its historical range (Ratcliffe 1995). Currently, the ABB is known to occur in only eight states: Rhode Island, Massachusetts, Oklahoma, Arkansas, Nebraska, Kansas (Sikes and Raithel 2002), South Dakota (Ratcliffe 1996; Bedick *et al.* 1993), and Texas (Godwin 2003). Most existing populations are located on private land. Populations known to exist on public land include the Ouachita National Forest in Arkansas and Oklahoma.

Survey data for ABB in the Ouachita National Forest is limited and has been sporadic and random since 1992. Only 58 ABB have been captured on the Oklahoma portion of the Ouachita National Forest between 1992 and 2006. Of the 58 captured, 47 were captured in 2006. Since 2006 only 11 ABBs have been captured. The reasons for the fluctuations in captures are not clearly understood.

The ABB may be adversely affected by the application of fire retardant in the Ouachita National Forest in Oklahoma. Means of direct take would be in the form of the fire retardant coating the ABB; thereby, blocking the spiracles and prohibiting breathing. No critical habitat has been designated for the ABB; therefore, none will be affected. In addition, the ABB could be indirectly affected by consumption of animals killed and contaminated with the fire retardant. .

Nebraska

The proposed action is expected to have minor impacts to the American burying beetle (ABB) in Nebraska. If fire retardant were to be dropped on individuals of the species, they might be adversely affected. However, only a small proportion of the entire known Nebraska ABB population occur on Forest Service lands where they could be subjected to the proposed action. ABB observations have been confirmed in Nebraska counties across approximately 60,347 km² (23,300 mi²). The National Forest Lands within the ABB range in Nebraska comprise 971 km² (375 mi²), approximately 0.01 percent of the area occupied by ABB in the state. Within the Nebraska range, ABB occur in two separate populations. One population of greater than 500 individuals occurs in the southern loess hills in Lincoln and Dawson Counties (Bedick et al 1999, Peyton 2003). The second population is in the Sandhills of northern Nebraska extending into southern South Dakota (Hoback and Sneath unpublished). The overall population size in the Nebraska Sandhills is unknown but the geographic area is much larger than that of the southern loess hills population.

ABB habitat is unlikely to be subject to fires and fire retardant use. The species has been

observed in Nebraska in a range of habitat types: mesic areas such as wet meadows, riparian areas, and wetlands associated with relatively undisturbed semi-arid, sandhill and loam grasslands. Such areas have been observed to have a thick stand of grassland vegetation with some woody vegetation. Soils composed of some clay with a prominent duff (litter) layer have also been observed at these sites. However, no strong correlation with soil type or land use has been identified for the species in Nebraska (Bishop et al 2002; Bishop and Hoback unpublished). The habitats in Nebraska that ABB have been observed are not likely to carry a fire that would need fire suppressant chemicals.

In the past six years, five aerial drops of fire suppressant have occurred on Nebraska National Forest Lands (USFS unpublished data). However, the majority of fires on the National Forest Lands in Nebraska, within the known ABB population, are primarily smaller, controlled burns and not likely to involve the use of fire suppressant chemicals (Dobesh 2008). Most fires in Nebraska are likely to occur during July and August. Little is known about the effects of fire on ABB populations and the specific impacts of fire retardant chemicals on ABB. However, some recent studies in grassland habitats that have undergone prescribed burns or natural burns have observed increased carrion beetle (including ABB) trap numbers suggesting that fire is not a major disrupter of carrion beetle community dynamics and potentially beneficial for habitat management (Howard et al 2007, Dobesh 2007).

The ABB's active periods in Nebraska typically occurs from April 1 to October 29, with peak periods of activity extending from June through August. The first period in early summer (approximately June 7th to July 1st) is after beetles have emerged from hibernation and prior to beetles going underground during the larvae rearing cycle. The second activity period occurs in late summer (approximately August 7th to September 1st), after the larval cycle when both senescent and teneral beetles are present. The ABB is nocturnal, fossorial and subterranean during the daytime. Whether underground or buried in the leaf litter, ABB would likely be protected from direct contact with the retardant unless the drop occurs at night, and during the ABB active period (early summer to early fall). At other times of year, it will be overwintering underground (no exposure to fire retardant) and even during the summer active period, the most critical period/life stage (brood rearing) occurs underground, so exposure to fire retardant should be minimal.

Conclusion

After reviewing the current status of the ABB and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the ABB.

Our conclusion is based upon the following: 1) very few individuals have been identified on Nebraska National Forest lands where it could be in a position to be affected by the proposed action; 2) the species is widely distributed across approximately 60,347 km² (23,300 mi²); 3) the species' habitats are unlikely to carry a fire which would need fire suppressant in Nebraska; and 4) the ABB's life history requirements minimize likelihood of exposure to fire retardant. Due to the unlikely potential of fire and use of fire retardant in combination with small representation of ABB on Forest Service Lands in Nebraska, we determine that the use of fire retardant is not

likely to jeopardize the existence of the ABB. No critical habitat has been designated for this species; therefore, none will be affected.

The ABB population within the Oklahoma portion of the Ouachita NF is limited in numbers and distribution. This population is not representative of that which would be considered most critical to ABB recovery in Oklahoma or throughout its range, as compared to higher density areas. The Ouachita NF in Oklahoma and Arkansas averaged 5 drops over the last 6 years. This information provides a general indication of the low probability of a drop occurring on a given area in which the species is found.

Shasta Crayfish (*Pacifastacus fortis*) (SC)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) indicated 22 occurrences for this species in Shasta County (CNDDDB 2007). None of these locations are on Forest Service lands; however six are near Forest Service lands.

Direct, Indirect, and Cumulative Effects

Given the distribution of the six occurrences that are near Forest Service lands, it is highly unlikely that more than a single occurrence would be impacted by fire suppression activities in any given year.

Fire retardant is slight to moderately toxic to amphipods (Adams and Simmons 1999, Mc Donald et al. 1997). Limited studies have been done on crayfish species with no assessment for effects to SC. One study did report that crayfish climbed out of the stream during exposure to a retardant (Little and Calfee 2004), however SC cannot leave the water due to biological limitations of this species. Guar gum, a flocculant additive to retardants, may inhibit respiration and egestion in bottom-dwelling invertebrates such as amphipods (referenced in Adams and Simmons 1999). Although crayfish were not discussed in this study, since they are bottom-dwelling invertebrates, we presume they could be adversely affected as well. If a retardant drop were to occur on or adjacent to a SC-occupied water body, the retardant is expected to injure or kill SC.

Conclusion

After reviewing the current status of the Shasta crayfish, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of Shasta crayfish. The proposed action would not lead to a substantial decline in number of SC, a substantial reduction in range of SC and it would not preclude the recovery of SC. This conclusion is based on the following reasons: (1) the spatial extent of the species outside the proposed action area is large with no populations known on Forest Service lands; and (2) the likelihood of a population being exposed to retardant is extremely low.

Noonday globe (*Patena clarki nantahala*)

a. Status of the Species Within the Action Area

The noonday globe is endemic only to the southeast side of the Nantahala River Gorge in the Nantahala National Forest, Swain County, North Carolina (Van Devender 1984). The species entire known range is within the action area. It has been documented from the vicinity of Silver Mine Creek at the northern end of the gorge, southwest to the vicinity of the North Carolina Highway 19 Bridge crossing of the Nantahala River near the southern end of the gorge (Fridell pers. observ. 1985 and 2002). Within this area of the gorge, it has been found at scattered sites along southeast slope of the gorge from the southeast side of North Carolina Highway 19 to near the top ridge of the gorge (Fridell pers. observ. 1985). The steep southeastern side of the gorge is forested with a mix of various species of hardwood trees and hemlock (*Tsuga canadensis*) and has a rich herbaceous undergrowth - strikingly different in richness from the immediate surroundings slopes, due to underlying calcareous rock and its northern exposure (Braun 1967). *Rhododendron* and *Leucothoe* (dog hobble) are also found in the understory. The noonday globe appears to be most abundant on and around moist rocky outcrops, often covered with a variety of bryophytes and fungi, along the streams and scattered seeps draining the southeastern slope, but can also be found in thick leaf litter and humus layers around the base of ferns and underneath *Rhododendron* and *Leucothoe*, and other moist habitats (Fridell pers. observ. 1985 and 2002). Moist conditions appear to be critical for the species. No estimates of population size have attempted because of the difficulty in determining total occupied/available habitat due the steepness of the southeast slope of the gorge, but the species appears to relatively abundant within the gorge, though extremely restricted in range.

b. Factors Affecting the Species' Environment Within the Action Area

Noonday globe – The USFS has designated the southeast slope of Nantahala Gorge (the portion of the gorge occupied by the Noonday globe) as a National Forest Special-Interest Management Area (Nantahala Gorge/Bowing Spring Management Area). Accordingly, the primary factors affecting the Noonday globe and its habitat within the action area [the Nantahala National Forest – the species is not found near the Pisgah National Forest], are associated with commercial development (off of USFS lands) at the northern end of the gorge and the maintenance of North Carolina Highway 19 (NC 19), which runs between the Nantahala River and the southeast slope of the Nantahala Gorge. The Nantahala River and Nantahala Gorge are extremely popular recreational areas. As a result, much of the private land adjacent to the action area has been developed or is being developed to cater to rafters, kayakers, day hikers and other recreational users. The forest clearing and disturbance associated with the development has and is contributing to encroachment of kudzu, Japanese honeysuckle, and other invasive exotic plants that could eliminate suitable habitat for the snail. Also, the North Carolina Department of Transportation routinely conducts vegetative clearing for right-of-way and ditch maintenance along NC 19. This clearing and disturbance adversely affects Noonday globe habitat in a narrow corridor along the highway and also appears to be contributing to the spread of invasive exotic plants within the gorge. Additionally, because the Noonday globe requires cool, moist habitat, wildfire, drought, and exotic insect tree pests pose a significant threat to the species.

Effects of the Action

a. Factors to be Considered

Proximity of the Action – If the use of fire retardant becomes necessary on the Cherokee, Pisgah or Nantahala National Forests, the location of the fire would not be predictable. However, in the southern Appalachians, lightning caused fires are more common on dry, exposed ridges and south facing slopes at higher elevations. Frost (1995) estimated presettlement fire frequency on ridges and upper slopes in the Appalachians was 7-12 years in the lower mountains and >12 years in higher mountains (>3,000 ft) (Buckner and Turrill 1999). Fires above 5000 ft. are even less frequent (Barden and Woods 1974). The locations of human-caused fires are not as predictable.

Fortunately, the habitats occupied by the noonday snail and the spruce-fir moss spider are not typically vulnerable to wildfires. Fires are extremely infrequent in the spruce-fir forest and the north-facing slope occupied by the noonday globe is typically too moist to carry a fire. The same is generally true of the riparian areas bordering the streams occupied by the Appalachian elktoe.

Timing – In the southern Appalachians, lightning set fires occur in a bimodal distribution most often in late-spring and early summer, with a less frequent peak in early fall (Komarek 1964, 1968; Barden and Woods 1974). This pattern has held true on the Nantahala and Pisgah National Forests with about half (49 percent) of all fires occurring in March and April with a smaller peak (about 12 percent of all fires) in November. The fewest fires occur between June and September. The Cherokee National Forest has two separate fire seasons. The spring season is from (approximately) February 15th through May 1st. The fall season runs from (approximately) October 15th through December 1st. However, as indicated previously, red spruce and Fraser fir are both fire intolerant species and the fire potential at the site is low.

Disturbance Duration, Frequency, and Intensity - Annually, an average of six lightning fires per one million acres occurs in the Southern Appalachians. This frequency is greater than that recorded for the Great Plains, Mississippi Basin, or northeastern United States, but less than portions of the western and southeastern United States (Schroeder and Buck 1970; SAMAB 1996). However, 88 percent of all fires in the southern Appalachians are human-caused.

On the Cherokee, Nantahala and Pisgah National Forests, most fires are very small and of short duration. Since 2001, there has been an average of 91 fires per year that have burned an average of only about 35 acres each – a total (average) of about 3185 acres a year (0.3 percent of the Nantahala and Pisgah National Forests per year). Aerial application would only be used for wildfire suppression. Additionally, interviews with experienced US Forest Service fire fighters (Street and Myers 2008) revealed that there were only three fires on Roan Mountain in the past 35 years. All of these fires were small, low intensity, and not within spruce-fir forest. The need for a retardant drop within the spruce-fir forest on Roan Mountain is extremely limited.

B. Analyses of Effects of the Action

Potential Beneficial Effects

The habitats occupied by the species are dependent on high moisture regimes (see Environmental Baseline). The effects of a fire in these areas would be devastating to the species. It is possible that the use of fire retardant would be recommended to protect known and suitable habitats for the spruce-fir moss spider to avoid catastrophic loss of the species and/or its habitat. Therefore, while there could be effects to the species from the use of fire retardant (though Phos-Chek's effects on land snails has not been studied), the use of retardant (that would only affect a portion of the occupied habitat for a short duration of time) would be justified to protect the remainder of the habitat from the known detrimental affects of fire.

Given the Conservation Measures put in place on The Nantahala and Pisgah National Forest to prevent any adverse impacts to the noonday globe, no impacts are expected.

CUMULATIVE EFFECTS

Cumulative effects include the combined effects of any future state, local, or private actions that are reasonably certain to occur within the action area covered in this Opinion. Because the Action Area is entirely on federal land (the Cherokee, Nantahala and Pisgah National Forests), consultation pursuant to section 7 of the Act would be required for all future actions. Therefore, no cumulative impacts are expected.

CONCLUSION

After reviewing the current status of the noonday globe; the environmental baseline for the action area (the Nantahala and Pisgah National Forests); the effects of implementation of the *Guidelines for Aerial Delivery of Retardant or Foam Near Waterways* (April 2000)]; conservation measures identified by the U.S. Forest Service for the use of fire retardant on the Nantahala and Pisgah National Forests; any potential interrelated and interdependent actions associated with the proposed action; and any potential cumulative effects, it is the Service's opinion that the use of fire retardants on the Nantahala and Pisgah National Forests is not likely to adversely affect (not likely to jeopardize the continued existence of) the noonday globe.

Little-wing pearl mussel (*Pegias fabula*)

The following account applies to the Daniel Boone National Forest, Kentucky, and the Pisgah and Nantahala National Forests, North Carolina. See also the fanshell analysis for the George Washington and Jefferson National Forests, Virginia, above.

a. Factors to be considered

Proximity of the action: The little-wing pearl mussel, *Pegias fabula*, is known to occur in certain perennial streams on the Daniel Boone National Forest, in perennial streams that flow from the Daniel Boone NF, and/or in perennial streams off the Daniel Boone NF that receive flow from tributary streams from the Daniel Boone NF. The aerial application of retardant could be applied on or adjacent to some of these streams.

No critical habitat has been designated for this species.

Distribution: In Kentucky, the little-wing pearl mussel is found on or near the Daniel Boone NF in the upper Cumberland River drainage of Eastern Kentucky. In North Carolina, this species does not occur on the Pisgah or Nantahala National Forest. Given the conservation measures in place and that the species is found several miles away from the Nantahala National Forest (the species is not found near the Pisgah National Forest), any potential impacts from the use of fire retardant on the Nantahala National Forest would be insignificant or discountable. Therefore the Service concludes that in North Carolina, the proposed action would have no effect on the little-wing pearl mussel.

Timing: Periods for which the little-wing pearl mussel may be particularly sensitive to the constituents of fire retardant include the fall and winter when spawning occurs along with the development of larvae or glochidia in the female mussel. Glochidia are released in late winter and into spring at which time they attach to a fish host for about two to three weeks and then drop off the fish host and settle in the stream bottom. Therefore the time period from late fall till late spring may be especially sensitive periods for this species. The Daniel Boone NF has two separate fire seasons that generally last around 10 weeks each. The spring season is from (approximately) February 1st through May 15th. The fall season runs from (approximately) October 1st through December 15th.

Nature of the effect: The primary effect on the little-wing pearl mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a mussel or result in an interruption of spawning activity or cause the abortion of larvae. Indirect effects could occur to mussels from the retardant interfering with fish host activity and/or presence, at critical times of larval mussel release and encystment on the fish host, or larval mussel excystment from the fish host.

No critical habitat has been designated for this species.

Duration: The effects of this proposed action would most likely be considered a short term (pulse) event; however, depending on stream conditions (i.e., rainfall, flow) the duration could extend over a greater extent of stream length.

Disturbance frequency: The Service is not able to make a precise assessment regarding disturbance frequency; however, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. Aerial application would only be used for wildfire suppression. The use of fire retardant is thought to have been used only once in the last four years on the Daniel Boone Forest.

Disturbance intensity: The Service is not able to make a precise assessment regarding disturbance intensity; however, it is likely the intensity of fire retardant application would be dependent on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

Disturbance severity: The Service is not able to make a precise assessment regarding disturbance severity; however, severity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

b. Analyses for effects of the action

Beneficial effects: The Service does not believe the effects of the action are wholly beneficial to this species.

Direct effects: A direct effect on the little-wing pearl mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the fire retardant is applied and/or very soon thereafter. If these effects are severe enough they could result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain the little-wing pearl mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

Interrelated and interdependent actions: Based on the information provided the Service has not identified any interrelated or interdependent actions applicable to this proposed aerial application of fire retardant.

Indirect effects: Indirect effects could occur to little-wing pearl mussels from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is

reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain the little-wing pearl mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and that this use is considered to be a rare event.

c. Species' response to a proposed action

Numbers of individuals/populations in the action area affected: The exact number of individuals/populations of the little-wing pearl mussel in the action area is not known; however, is likely occurs in at least four tributaries in the upper Cumberland River drainage with the best population in the Big South Fork Cumberland River. This species is located in multiple locations in the action area and therefore it is unlikely all populations would be affected from any particular fire retardant application.

Sensitivity to change: The Service does not know how sensitive to change the little-wing pearl mussel is. Adult mussels in general are considered less sensitive than juveniles. Mussels in general are known to be sensitive to low level changes in ammonia compounds.

Resilience: The Service does not know how resilient the little-wing pearl mussel is to this particular action. Mussels are dependent on their proper fish host being present in sufficient numbers to allow successful recruitment, so the resilience of the fish host is also a factor to be considered.

Recovery rate: The recovery rate of the little-wing pearl mussel is unknown; however, it is generally accepted by mussel biologists that mussel recovery rates are slower than those of many other invertebrates and fish, due to presence and availability of the fish host.

CONCLUSION

After reviewing the current status of the little-wing pearl mussel, the environmental baseline for the action area, and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely to jeopardize the continued existence of the little-wing pearl mussel. No critical habitat has been designated for this species, therefore, none will be affected.

Aerially applied fire retardant is not likely to jeopardize the continued existence of the little-wing pearl mussel for the following reasons: 1) The species is located in several streams and therefore it is unlikely all populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to be applied directly on perennial streams that contain this species. 3) The accidental application of fire retardant is

unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Daniel Boone NF, it is thought to have been used once in the last four years. In North Carolina, the Service concludes that the proposed action would have no effect on the little-wing pearl mussel.

The primary direct effects on this species would be from toxic ammonia compounds as the fire retardant is being applied and/or very soon thereafter. If these effects are severe enough they could possibly result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. Indirect effects could occur from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain this species. However, the accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution.

Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*)

The proposed action is expected to have little to no impact to the Mitchell's satyr butterfly. A disjunct population of the Mitchell's satyr was discovered on the Oakmulgee Ranger District of the Talladega National Forest in the late 1990s, and preliminary DNA analysis is consistent with other more well-known populations in Michigan and Indiana; surveys subsequent to the discovery located 15 Mitchell's satyr colonies on the Oakmulgee Ranger District (Hart 2004). Because the Mitchell's satyr is located in multiple locations several miles apart on the Ranger district, is found in several other states including Michigan, Ohio and Indiana, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the Mitchell's satyr will be seriously impacted by the proposed action.

There is no designated critical habitat for the Mitchell's satyr; therefore, there will be no effects.

Conclusion

After reviewing the current status of the Mitchell's satyr, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mitchell's satyr. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the Mitchell's satyr is found in widely scattered locations within the Oakmulgee Ranger District, as well as in multiple locations in several other states, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Dark Pigtoe (*Pleurobema furvum*)

The proposed action is expected to have little to no impact to the dark pigtoe. There are several small, isolated populations on the Bankhead National Forest located on the Lower and Upper Sipsey Fork and Brushy Creek drainages (Mirarchi, et. al 2004a). Mirarchi et. al (2004a) consider this species a Priority 1 species in Alabama's Comprehensive Wildlife Conservation Strategy, recognizing its relative rarity in the state. Because the dark pigtoe is located in an area managed as designated wilderness, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the dark pigtoe will be impacted by the proposed action. If fire retardants were ever to be used in proximity to the remaining populations of this mussel on the Bankhead National Forest, impacts from fire retardant toxicity potentially could be significant because of the small number of mussels remaining.

Bankhead National Forest contains critical habitat for the dark pigtoe. Since the National Forests in Alabama have not used fire retardant as part of their firefighting strategy in the past, and have written that they do not intend to do so in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008) because of the habitat types involved as well as the lack of air tanker facilities in the region, it is very unlikely that fire retardants will ever be used in the vicinity of designated critical habitat on National Forest lands in Alabama.

Conclusion

After reviewing the current status of the dark pigtoe and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the dark pigtoe, and is not likely to destroy or adversely modify designated critical habitat.

Our conclusion is based upon the following: dark pigtoe is found in several drainages in the Bankhead National Forest located more than 10 km from each other, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Ovate Clubshell (*Pleurobema perovatum*)

The proposed action is expected to have little to no impact to the ovate clubshell. There were once several small, isolated populations on the Bankhead National Forest located on the Lower and Upper Sipsey Fork and Brushy Creek drainages, but the ovate clubshell has not been found there recently. The ovate clubshell is found downstream of Talladega National Forest in Hatchet Creek in small, isolated populations, as well as in the Tombigbee and Tallapoosa drainages elsewhere in Alabama and Mississippi (Mirarchi, et. al 2004a). Parmalee and Bogan (1998)

report the species in the Conasauga drainage of Georgia and Tennessee. Mirarchi et. al (2004a) consider this species a Priority 1 species in Alabama's Comprehensive Wildlife Conservation Strategy, recognizing its relative rarity in the state. Because the ovate clubshell is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the ovate clubshell will be impacted by the proposed action. Since this species is regarded as extirpated in Georgia, it is no longer thought to exist on the Chattahoochee National Forest.

Bankhead National Forest and Talladega National Forest in Alabama both contain critical habitat for the ovate clubshell, and critical habitat is also found adjacent to the Chattahoochee National Forest in Georgia. The species is now considered to be extirpated in Georgia, however. Since the National Forests in Alabama have not used fire retardant as part of their firefighting strategy in the past, and have written that they do not intend to do so in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008) because of the habitat types involved as well as the lack of air tanker facilities in the region, it is very unlikely that fire retardants will ever be used in the vicinity of designated critical habitat on National Forest lands in Alabama.

Conclusion

After reviewing the current status of the ovate clubshell and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the ovate clubshell, and is not likely to destroy or adversely modify designated critical habitat.

Our conclusion is based upon the following: ovate clubshell is found in several drainages outside of National Forest lands in Alabama, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future. In Georgia, the species is considered to be extirpated, so the proposed action would likely have no effect on this species.

Mirarchi, R.E., J.T. Garner, M.F. Mettee, and P.E. O'Neil, editors. Alabama Wildlife, vol. 2: Imperiled Aquatic Mollusks and Fishes. University of Alabama Press; 2004a.

Dagmar Thurmond, 2008. Email from US Forest Service state biologist to Dan Everson, US Fish and Wildlife Service, Daphne, AL describing non-use of fire retardants on National Forests in Alabama, January 29, 2008.

Parmalee, P.W. and A.E Bogan 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville. 328 pp.

Oval Pigtoe (*Pleurobema pyriforme*)

Effects Analyses:

The oval pigtoe is a fairly wide ranging mussel occurring in Econfina Creek, the Santa Fe, New, Flint, Chipola, Ochlockonee and tributaries of the Chattahoochee Rivers of Alabama, Georgia

and Florida. Critical habitat was designated for this species, as well as six other mussel species from northwest Florida and Georgia in 2007 (72 FR 64286). Critical habitat for the oval pigtoe includes Units 1, 2, 4, 5, 6, 7, 9, and 11. None of these Units occur in or adjacent to the Apalachicola National Forest. Similarly, no current records of the species are known to occur within or adjacent to the National Forest. Therefore, we do not expect the proposed action, the aerial application of fire retardant, to adversely affect this species current range or designated critical habitat. While the historic range of the species does include the Ochlockonee River as it runs through the Apalachicola River, the proposed fire retardants have fairly short toxic exposure periods. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris et al.1991).

Conclusion:

After reviewing the current status of the oval pigtoe and the likely effects of the use of fire retardant on the Apalachicola National Forest, we conclude the following: (1) The current range of the species and designated critical habitat do not occur within or adjacent to the boundaries of the Apalachicola National Forest and; (2) The toxic exposure period of the fire retardants proposed for use is 24 hours or less and would not result in permanent impacts to historic species habitat. Therefore, their use would not preclude recovery. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the oval pigtoe or result in the adverse modification or destruction of its critical habitat.

Heavy Pigtoe (*Pleurobema taitianum*)

The proposed action is expected to have little to no impact to the heavy pigtoe. Once found in the Cahaba, Coosa, and Tombigbee Rivers of the Mobile River basin, the species is now limited to several short reaches in the lower Alabama and Tombigbee Rivers, more than 20 km from the Oakmulgee Ranger District of the Talladega National Forest (Mirarchi, et. al 2004a). Because the heavy pigtoe is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the heavy pigtoe will be impacted by the proposed action.

There is no designated critical habitat for the heavy pigtoe; therefore there will no effects to critical habitat.

Conclusion

After reviewing the current status of the heavy pigtoe and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the heavy pigtoe. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the heavy pigtoe is not found on National Forest lands, there is no designated critical habitat, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Rough Pigtoe (*Pleurobema plenum*)

The following account applies to Alabama. See also the fanshell analysis for the George Washington and Jefferson National Forests, Virginia, above.

The proposed action is expected to have little to no impact to the rough pigtoe. The rough pigtoe is a large river species found in Alabama only in the Tennessee River below Wilson Dam, and has not been reported from headwater streams on Forest Service lands in Alabama (Mirarchi, et. al 2004a). The species is also reported to occur in Indiana, Kentucky, Pennsylvania, Tennessee and Virginia. Because the rough pigtoe is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the rough pigtoe will be impacted by the proposed action.

There is no designated critical habitat for the rough pigtoe; therefore there will be no effects to critical habitat.

Conclusion

After reviewing the current status of the rough pigtoe and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the rough pigtoe. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the rough pigtoe is not found on National Forest lands, it is a large river species highly unlikely to occur on headwater streams, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Fat pocketbook (*Potamilus capax*)

Based upon the information pertaining to the U.S.D.A. Forest Service's (USFS) use of fire retardants to control wildfires on USFS lands, the Service has determined the action area to be entirely within the confines of the St. Francis River basin on the Ozark-St. Francis National Forest. It is anticipated that direct and indirect effects to the fat pocketbook (*Potamilus capax*) would result from the use of fire retardants in the St. Francis River basin.

Direct effects

The use of fire retardants associated with wildfire suppression techniques may have direct adverse effects on the fat pocketbook, its habitat, and its host fish on the Ozark-St. Francis

National Forest. The fat pocketbook occurs within the St. Francis River and many of its larger tributaries and ditches in Arkansas and Missouri. While the U. S. Forest Service has developed *2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways* to avoid aerial application of fire retardant within 300 feet of waterways, there are exceptions when the USFS may still drop fire retardants into bodies of water, both visible and out of sight. While the 2000 Guidelines are flexible, and allow for the Incident Commander to make exceptions to conduct a drop that would expose a waterbody to retardants, according to the USFS no exceptions have been taken since institution of the Guidelines on the Ozark-St. Francis National Forest (R. Odegard, pers. comm., 2008). Fire retardant drops in ephemeral or intermittent streams that are difficult to see due to tree canopy closure are probably more likely to occur than exceptions to the Guidelines.

Direct adverse affects to the fat pocketbook from the use of fire retardants include both lethal and sublethal impacts due to ammonia toxicity (juveniles mussels are generally more susceptible than adults, but there is no specific ammonia toxicity data available for this species) and exposure to ash and guar gum that have been identified as respiratory inhibitors in the water. The toxicity or persistence of retardant compounds in water is dependent on water chemistry, flow, and turbulence. Toxicity tests that have been conducted on fire retardants have generally been conducted on fish or aquatic invertebrates, but not freshwater mussels that are typically more sensitive to contaminants, especially ammonia, than other aquatic taxa. Due to the exceptions allowed in the 2000 Guidelines and lack of toxicity data using different life stages of freshwater mussels and the lethal and sublethal impacts from fire retardant exposure, it is unreasonable for us to conclude with certainty that adverse impacts to the fat pocketbook from fire retardants would not occur.

When fire retardant enters a stream and causes the initial spike in ammonia, it immediately begins to form a chemical equilibrium between un-ionized ammonia, which is the more toxic form, and ionized ammonia. The chemical balance between these two forms of ammonia is determined by pH, temperature, and total ammonia concentration. In most streams, the pH is sufficiently low that ionized ammonia predominates. Stream turbulence (i.e., increased aeration in riffles, etc.) also helps convert ammonia to the ionized form.

Ash has been identified as the cause of fish kills during wildfires and volcanic eruptions (Newcombe and Jensen 1996), but no information was available to determine the impacts of ash on freshwater mussels. Guar gum is an ingredient in fire retardants that would further exacerbate the effects of increased ammonia concentrations. Little *et al.* (2006) showed spikes in the salinity, as a result of the ammonia salts contained in aerially applied fire retardants, which would negatively impact all fish living in freshwater environments, even adults. Again, no information is available on the effects of guar gum on freshwater mussels, but it is safe to conclude that if it negatively impacts fish than it will have the same impact, if not worse, on mussels. It is possible that these components may have a significant influence on the toxicity of fire retardants to fat pocketbook or other freshwater mussels based on research conducted by Buhl and Hamilton (1998) on chinook salmon.

Other impacts of fire have been documented that demonstrate salmonids are more susceptible to fire retardants as well. Gresswell (1999) showed that smoke in the air is adsorbed by water and

increases the ammonia concentrations in rivers even without an accidental application of retardant. Crouch *et al.* (2006) showed that in burning watersheds, prior to treatment with retardants, there is increased ammonia, phosphorous, and total cyanide. Since there is a greater background level of ammonia during a fire, the ammonia levels created by an accidental drop may be higher than experienced in a controlled setting and as the fire retardants are diluted, they may take longer to reach nontoxic levels.

Fire retardant is designed to perform in several ways: to stay together during the drop from high up so that it all hits in the same general area, to cling to what it hits initially, and in some cases is thinned to drip through branches to the ground. The mix ratios of many formulations are variable so that the retardant can be more or less concentrated so that the appropriate application can be achieved in different environments. In forestlands for instance, to reach fires burning at ground level the retardant would be less concentrated so that it would seep through the leaves and branches and reach the ground (Johansen and Dieterich 1971). This application style would be expected when fighting ground fires in the forest land of the Ozark-St. Francis National Forest. Another aspect of attempting to apply retardant to fuels beneath the canopy is that it poses a much greater risk of contaminating streams that are not visible from aircraft.

The Ozark-St. Francis National Forest does not monitor long-term effects of retardant in runoff because it likely only enters streams in sub-lethal levels. There is no information available regarding lethal or sub-lethal levels of retardants in runoff to freshwater mussels. Runoff is expected to be more problematic and extensive in areas of recently disturbed riparian vegetation, areas without riparian vegetation, and areas of incomplete retardant coverage that burn but leave behind retardant. Little and Calfee (2002) showed that when retardants are applied to riparian areas or even across a dry streambed, the retardants remain toxic for 21 days. Any rain event that happens within three weeks after application to the riparian area poses a risk of introducing lethal levels of ammonia to a stream, potentially after any sort of monitoring had been conducted and after the effects to listed mussels or their host fish had been analyzed.

The fat pocketbook occurs in several rivers outside the St. Francis River basin. The largest population occurs upstream of the Ozark-St. Francis National Forest and would not be impacted by the use of fire retardants. Additionally, this upstream population would likely serve as a source for natural recolonization in areas impacted by fire retardants. The Ozark-St. Francis National Forest occupies less than 0.7 percent (21,215 acres) of the St. Francis River basin. Additionally, the St. Francis River basin portion of the Ozark-St. Francis National Forest only comprises approximately two percent of the total forest ownership. The National Forest borders approximately 55 miles of the lower St. Francis River and 7 miles of the L'Anguille River, both represent a very small percentage of the overall stream length. From 2004 – 2007, the Ozark-St. Francis National Forest applied fire retardants to one wildfire in the St. Francis River basin (9 percent of wildfires that occurred on the forest during that time period). There was 2,550 gallons of fire retardant applied to this fire with no documented adverse impacts to aquatic fauna. For this reason, we have concluded that while direct adverse impacts may occur they will likely be uncommon and negligible.

Indirect effects

The fat pocketbook relies on freshwater drum to complete its life cycle. Any impacts to freshwater drum populations associated with the use of fire retardants can indirectly affect fat pocketbook populations by lower exposure to host fish and thereby reducing reproductive potential. The fat pocketbook is a filter feeder and any reduction in food availability (i.e., plankton die-offs) may adversely affect the health of the fat pocketbook. There is no information to support or refute potential indirect effects to the fat pocketbook from the use of fire retardants. Biologists for the USFS on the Ozark-St. Francis National Forests have never documented any adverse (direct or indirect) impacts to the fat pocketbook or freshwater drum from the use of fire retardants, but closer monitoring is required to further substantiate this observation.

CONCLUSION

Possible harm to the fat pocketbook resulting from the proposed action would only occur on a minute portion of the total known range. The fat pocketbook population within the action area is not representative of that which would be considered most critical to fat pocketbook recovery because it is not reproductively isolated from a large population upstream and a smaller population that occurs in the Mississippi River. After reviewing the current status of the fat pocketbook, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the USFS's proposed use of fire retardants at the Ozark-St. Francis National Forest is not likely to jeopardize the continued existence of the fat pocketbook. No critical habitat has been designated for this species; therefore, none will be affected.

Hine's emerald dragonfly (*Somatochlora hinea*)

Effects analysis

The Hine's emerald dragonfly occurs on two National Forests, the Hiawatha National Forest and the Mark Twain National Forest (MTNF). Aerial fire retardant is currently not used in wildfire suppression efforts and it is highly unlikely that this tool will be used in the future on the Hiawatha National Forest (Piehler 2008). There are 12 known occupied sites on the MTNF. The majority of the range of the species occurs on lands not owned by the Forest Service.

When wildfires occur on the MTNF initial attack methods are usually sufficient to control the spread of the fires. The MTNF uses fire retardants only in rare instances. Over the last 10 years, the MTNF had an average of 171 wildfires per year. Average acreage burned by wildfire over the same time frame was 5062 acres per year. During that timeframe an average of 24 wildfires per year were over 50 acres in size. The MTNF has used fire retardants only three times in the last 20 years. In all three instances, structures were threatened by the wildfire. None of the drops affected Hine's emerald dragonfly habitat. The MTNF does not have an air tanker or retardant storage facilities. In order to obtain those services, the Forest must call on resources in Arkansas, if they are available (J. Eberly, MTNF, pers. comm.). The MTNF does not plan on increasing the use of fire retardant, however wants to maintain the option to use it if structures or life is threatened by wildfire. In Missouri the period most likely to produce stand replacing fires is from approximately March 25 to April 15. The MTNF also has use of a helicopter for water only drops for fire control, also minimizing the need for use of fire retardant.

The 2005 Land and Resource Management Plan (Forest Plan) for the Mark Twain National

Forest addresses wildland fire suppression on pages 2-17 to 2-19. Since the Forest rarely uses fire retardants, only one guideline for its use was written:

“Do not apply fire retardants directly over water bodies unless needed for firefighter or public safety.”

Conclusion

After reviewing the status of the Hine’s emerald dragonfly and the likely effects of the use of fire retardant on National Forest lands, it is the Service’s biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hine’s emerald dragonfly. There is no critical habitat designated for the species on National Forests; therefore, none will be affected.

Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*)

Oregon and Washington

There is significant overlap or close proximity of occupied butterfly habitat with Forest Service land. However, butterfly habitat is patchily distributed across a large area such that the risk of fire and retardant drops at multiple occupied sites is very low. Fire intervals on the coast where this species occurs are naturally long (200-400 years), although human activity may be changing that. Fire managers have had difficulty inducing and sustaining controlled burns for management purposes during the late summer or early fall in areas occupied by this species. For those reasons, there is a very low likelihood that this species will be exposed to retardant or, if exposed, that more than a few localized patches of occupied habitat would be affected.

California

Nearest National Forest: Six Rivers

Proximity to NF: Nearest contact 5 miles due east from occupied habitat

The current known distribution of Oregon silverspot butterfly in California is restricted to an area extending approximately one mile by 3 miles, located north and west of Lake Earl, Del Norte County (USFWS 2007). Six Rivers National Forest is located approximately 5 miles due east of the occupied habitat, and is hydrologically isolated from the butterfly habitat by both Lake Earl and the Smith River. Therefore, aerial retardant releases on Six Rivers National Forest should have no effect on the Oregon silverspot butterfly or its habitat.

Tulotoma Snail (*Tulotoma magnifica*)

The proposed action is expected to have little to no impact to the tulotoma snail. The tulotoma snail is a large river species found only in the mainstem Coosa and Alabama Rivers (Mirarchi, et. al 2004a), and is unlikely to be found on or in proximity to the headwater streams of National Forest lands in Alabama. Because the tulotoma snail is not currently known to exist on National Forest lands in Alabama, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the tulotoma snail will be impacted by the proposed action.

There is no designated critical habitat for the tulotoma snail; therefore, there will be no effects.

Conclusion

After reviewing the current status of the tulotoma snail, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the tulotoma snail. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the tulotoma snail is not found on National Forest lands, it is a large river species highly unlikely to occur in headwater streams, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Alamosa Springsnail (*Tyronia alamosae*)

Effects of the Action

Alamosa springsnails are endemic to two thermal spring complexes (Alamosa Warm Springs and Ojo Caliente), and associated outflows on private property in the headwaters of Alamosa Creek, Socorro County, New Mexico. The two spring complexes occur within 0.5 miles of each other. Neither the species nor its habitat occur on FS lands, however, both spring complexes occur within one mile downstream of two New Mexico Forests (Cibola and Gila National Forests). The species inhabits suitable aquatic environments downstream from the thermal spring sources along the north stream bank of Alamosa Creek to the Monticello Box.

Both the abundance and distribution of Alamosa springsnails appear to be stable. Lang (2001a) noted that sampling of the thermal springs in 2000, are consistent with the patterns of distribution and abundance reported by Taylor (1987) and Mehlhop (1993). Although the species does not occur on FS lands, it may be indirectly affected by the use of fire retardants on FS lands upstream of the springs. According to the recovery plan for the Alamosa springsnail (U.S. Fish and Wildlife Service 1994), threats to the species include any activity that would interrupt the flow of water from these springs, lessen the quantity of both the aquatic and terrestrial habitat, or degrade the water quality of the habitats inhabited by these species. Despite the continued abundance and distribution of this springsnail, the limited range of the species makes it vulnerable to habitat loss or alteration (U.S. Fish and Wildlife Service 1994).

Although, the use of fire retardant is not identified as a threat, there is a potential for adverse effects from the use the retardants on FS lands upstream of the species habitat. Based on the proposed action for this consultation, it is unlikely that there will be any direct application of fire retardant into the spring complexes as they occur outside FS lands and the guidelines direct pilots to avoid using fire retardant within 300 ft of a stream. However, there is some potential for long-term retardants to be transported down stream to the area through run-off. If a retardant drop was made at the FS boundary, the chemical would have to be transported downstream approximately .25 miles before it reaches occupied Alamosa springsnail habitat. In addition, Alamosa Creek is ephemeral up-stream of the springs, so it would take a significant run-off event to transport the chemical downstream. Studies show that after a retardant is dropped on organic soils, the level of ammonia detected is negligible as soon as three hours after the drop. Therefore,

the run-off event would have to occur simultaneously with the drop in order to create those conditions and that is highly unlikely.

Conclusion

After reviewing the current status of the Alamosa springsnail, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Alamosa springsnail. No critical habitat has been designated for the species, thus, none would be affected. We base these conclusions on the following:

1. The Alamosa springsnail does not occur within FS lands.
2. The spring complexes occupied by the springsnail occur downstream of the FS land in an ephemeral stream that likely flows only during spring and monsoon flood events. If the chemical is transported downstream immediately during a flood event, the water would volatilize the chemical before it reached the spring complexes.

Cumberland bean mussel, *Villosa trabalis*

a. Factors to be considered

Proximity of the action: In Kentucky, the Cumberland bean mussel, *Villosa trabalis*, is known to occur in certain perennial streams on the Daniel Boone National Forest, in perennial streams that flow from the Daniel Boone NF, and/or in perennial streams off the Daniel Boone NF that receive flow from tributary streams from the Daniel Boone NF. In Tennessee, it is known to occur on the Cherokee National Forest in the Hiwassee River where it has been taken from the state line (at Shuler Creek confluence) downstream 11 miles to Appalachia Powerhouse (USFS 2007). The aerial application of retardant could be applied on or adjacent to some of these streams.

No critical habitat has been designated for this species.

Distribution: In Kentucky, the Cumberland bean mussel is found on or near the Daniel Boone NF in the upper Cumberland River drainage of Eastern Kentucky. In Tennessee, the Cumberland bean pearlymussel is extant in at least 10 localities. The Cumberland bean pearlymussel is found on the Cherokee National Forest in the Hiwassee River and off the National Forest in the Little Chucky Creek, both in the Tennessee River drainage. In the Cumberland River drainage within Tennessee, the Cumberland bean pearlymussel occurs in the Big South Fork drainage, also off the Cherokee National Forest (TRMC 2008).

Timing: Periods for which the Cumberland bean mussel may be particularly sensitive to the constituents of fire retardant include the fall and winter when spawning occurs along with the development of larvae or glochidia in the female mussel. Glochidia are released in late winter and into spring at which time they attach to a fish host for about two to three weeks and then drop off the fish host and settle in the stream bottom. Therefore the time period from late fall till late spring may be especially sensitive periods for this species. The Daniel Boone NF has two

separate fire seasons that generally last around 10 weeks each. The spring season is from (approximately) February 1st through May 15th. The fall season runs from (approximately) October 1st through December 15th. The Cherokee National Forest has two separate fire seasons. The spring season is from (approximately) February 15th through May 1st. The fall season runs from (approximately) October 15th through December 1st.

Nature of the effect: The primary effect on the Cumberland bean mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a mussel or result in an interruption of spawning activity or cause the abortion of larvae. Indirect effects could occur to mussels from the retardant interfering with fish host activity and/or presence, at critical times of larval mussel release and encystment on the fish host, or larval mussel excystment from the fish host.

Many studies have concluded that ammonia is the primary toxic component in fire retardants (for example, see Buhl and Hamilton 2000 and McDonald and others 1997). Several factors determine whether an aquatic organism will be exposed to toxic levels of the ammonia compounds that make up roughly 10 percent of the retardant mixture: (1) avoidance of the contaminated area, (2) time exposed to the toxin, (3) water quality, including pH, (4) quantity of retardant spilled into freshwater, (5) type of water body, and (6) size of water body (Norris, Lorz, and Gregory 1991; Van Meter and Hardy 1975). Norris, Lorz, and Gregory (1991) reported that direct application of retardants onto the stream surface was the primary source of retardant contamination in streams. They found that only minor amounts of retardant entered streams from riparian areas and as small as a 3-meter buffer virtually eliminated retardant entering stream waters. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris, Lorz, and Gregory 1991).

No critical habitat has been designated for this species.

Duration: The effects of this proposed action would most likely be considered a short term (pulse) event; however, depending on stream conditions (i.e., rainfall, flow) the duration could extend over a greater extent of stream length.

Disturbance frequency: The Service is not able to make a precise assessment regarding disturbance frequency; however, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. Aerial application would only be used for wildfire suppression. The use of fire retardant is thought to have been used only once in the last four years on the Daniel Boone Forest. The use of fire retardant is thought to have occurred an average of twice per year between 2001 through 2007 on the Cherokee National Forest (Martin 2008). This use is considered to be a rare event

Disturbance intensity: The Service is not able to make a precise assessment regarding disturbance intensity; however, intensity of the applied fire retardant to this species would likely

depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

Disturbance severity: The Service is not able to make a precise assessment regarding disturbance severity; however, severity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

b. Analyses for effects of the action

Beneficial effects: The Service does not believe the effects of the action are wholly beneficial to this species.

Direct effects: A direct effect on the Cumberland bean mussel would be from toxic ammonia compounds coming into contact with a stream containing mussels, including federally listed species, as the fire retardant is applied and/or very soon thereafter. If these effects are severe enough they could result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain the Cumberland bean mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and an average of twice per year between 2001 through 2007 on the Cherokee National Forest (Martin 2008). This use is considered to be a rare event.

Interrelated and interdependent actions: Based on the information provided the Service has not identified any interrelated or interdependent actions applicable to this proposed aerial application of fire retardant.

Indirect effects: Indirect effects could occur to Cumberland bean mussels from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or

Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain the Cumberland bean mussel. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution. The Forest Service indicates that aerial applied fire retardant has been used only once in the last four years on the Daniel Boone NF, and an average of twice per year between 2001 through 2007 on the Cherokee National Forest (Martin 2008). This use is considered to be a rare event.

c. Species' response to a proposed action

Numbers of individuals/populations in the action area affected: The exact number of individuals/populations of the Cumberland bean mussel in the action area is not known; however, it occurs in multiple locations in at least 5 tributaries of the upper Cumberland River drainage, and in the Hiwassee, Cumberland bean pearlymussel typically makes up about 1% of the shells collected from muskrat middens. Quadrat surveys produce about the same proportion. The Hiwassee River population of Cumberland bean pearlymussel on the Cherokee National Forest may be the most robust extant population. This species is located in several streams and therefore it is unlikely all populations would be affected from any particular fire retardant application.

Sensitivity to change: The Service does not know how sensitive to change the Cumberland bean mussel is. Adult mussels in general are considered less sensitive than juveniles. Mussels in general are known to be sensitive to low levels of ammonia compounds.

Resilience: The Service does not know how resilient the Cumberland bean mussel is to this particular action. Mussels are dependent on their proper fish host being present in sufficient numbers to allow successful recruitment, so the resilience of the fish host is also a factor to be considered.

Recovery rate: The recovery rate of the Cumberland bean mussel is unknown; however, it is generally accepted by mussel biologists that mussel recovery rates are slower than those of many other invertebrates and fish, due to presence and availability of the fish host.

CONCLUSION

After reviewing the current status of the Cumberland bean mussel, the environmental baseline for the action area, and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely

to jeopardize the continued existence of the Cumberland bean mussel. No critical habitat has been designated for this species; therefore, none will be affected.

Aerially applied fire retardant is not likely to jeopardize the continued existence of the Cumberland bean mussel for the following reasons: 1) The species is located in several streams and therefore it is unlikely all populations would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to be applied directly on perennial streams that contain the Cumberland bean mussel. 3) The accidental application of fire retardant is unlikely to impact mussels significantly due to dilution. 4) The use of aerially applied fire retardant is considered a rare event on the Daniel Boone NF as well as on the Cherokee NF.

The primary direct effects on this species would be from toxic ammonia compounds as the fire retardant is being applied and/or very soon thereafter. If these effects are severe enough they could possibly result in the death of a mussel, an interruption of spawning activity, or cause the abortion of larvae. Indirect effects could occur from the fire retardant interfering with fish host activity and/or presence at critical times of larval mussel encystment to its fish host or excystment from the fish host, resulting in loss of recruitment. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instructs pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that it is more likely ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to be applied directly on perennial streams that could contain this species. However, the accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact mussels significantly due to dilution.

FISH

Modoc sucker (*Catostomus microps*)

Effects Analysis

Moyle and Marciochi (1975) indicated that Modoc suckers are most successful in small, relatively undisturbed, pool-dominated streams where they are isolated from Sacramento suckers (*Catostomus occidentalis*). Modoc sucker habitat is characterized by high water flows in winter and spring months, but by mid-summer, large reaches of habitat dry up (Studinski 1993). During these times, fish populations are confined to relatively small, permanent pools.

Modoc suckers only occur in Modoc and Lassen Counties in California and Lake County, Oregon in a few drainages that connect to (or in the past connected to) the Pit River. In the Turner Creek drainage, Modoc suckers occur in all permanent tributaries, including: Turner, Washington, Hulbert, and Garden Gulch. They were also introduced to Coffee Mill Gulch, a

tributary to Washington Creek, and have maintained a self-sustaining population there. In the Ash Creek drainage, Modoc suckers occur in upper Ash Creek, upper Willow Creek, Dutch Flat Creek, Rush Creek, and Johnson Creek - a tributary to Rush Creek. Modoc suckers were confirmed in Thomas Creek in the Goose Lake Basin in 2001. Goose Lake and its tributaries represent a disjunct sub-basin of the Upper Pit River which has not been connected to the North Fork of the Pit River since the 1800's.

There are no known populations in the mainstem Pit River or the lower reaches of its principal tributaries, although there are no apparent constraints to prevent individuals from moving through these areas (Reid et al. 2003). Modoc sucker habitat is nearly evenly divided between private lands and National Forest lands. The private lands tend to be located immediately downstream from the National Forest lands.

Currently, the Forest Service has been managing and restoring Modoc sucker streams for riparian health and aquatic habitat improvement since the early 1980's. Recent observations of historically occupied habitat in the Ash and Turner Creek systems show extensive improvement of habitat conditions on National Forest lands, while those reaches of stream on private lands on Ash Creek, Willow Creek, Turner Creek, and Rush Creek appear to be stabilized and improving as well.

Critical habitat was designated for the Modoc sucker in Modoc County, California to include a total of approximately 26 miles of the following streams and a 50-foot riparian zone on either side of the stream channel (USFWS 1985): Turner Creek, Washington Creek (including the tributary Coffee Mill Gulch), Hulbert Creek (Including its tributary Cedar Creek), Johnson Creek (including its tributaries Rice Flat and Higgins Flat), and Rush Creek (see Map).

The following items may help mitigate the effects of retardant on Modoc suckers:

- Very few private structures are located adjacent to the Modoc sucker streams that would require retardant drops to protect them.
- Most of the streams have very low flows or no surface flow at all in late summer, when fire activity is highest. This will greatly reduce the likelihood that a retardant misapplication would be carried downstream for miles.
- There has been some success containing retardant chemicals in an isolated segment if it does get into a small stream.

Consequently, while the Forest Service Guidelines may help prevent some exposures, they cannot prevent endangered species, threatened species, and designated critical habitat from being exposed in all instances. As the number of fires increases across the landscape, the potential for listed species to be exposed to fire retardants will increase in the future. We believe it is reasonable to expect that the exposure is likely to increase commensurate with the Forest Service's use of fire retardants. Therefore, we do not believe the Forest Service can assure that their continued use of fire retardants will be able to avoid adverse effects to Modoc suckers or their critical habitat.

Conclusion

Based on information provided by the Forest Service, past consultations, and other sources, the Service concludes exposure of listed fish is possible. The Forest Service Guidelines allow for intentional retardant drops near streams when life or property is at risk. This exposure could result in harm to some individual listed suckers, but should not appreciably reduce the likelihood of survival and recovery of the populations. We anticipate that a limited portion of the sucker population would be harmed by retardant, because they are distributed across a number of small watersheds. Therefore, the Service concludes that the Forest Service's use of fire retardant as proposed is not likely to jeopardize the continued existence of the species.

Warner Sucker (*Catostomus warnerensis*)

The Warner sucker is not found on Forest Service land, but it does occur downstream of the Fremont-Winema National Forest, as close as one mile downstream of the forest boundary in the Honey Creek drainage. A fire retardant drop into the creek on Forest Service land would likely result in significant mortality of Warner suckers in the mainstem of Honey Creek, but would not likely impact the sucker population in the Snyder Creek tributary of Honey Creek because that population occurs off Forest Service land and upstream of the main channel of Honey Creek below Forest Service land. Snyder Creek supports a sizable sucker population that is likely to serve as the source for recolonizing Honey Creek in the short term if that population were impacted by an accidental retardant drop. Therefore, under a worse-case scenario, the proposed action is not likely to result in the extirpation of the Warner sucker from the mainstem of Honey Creek, and is not likely to affect any other populations of the Warner sucker.

Warner sucker populations in other sub-basins within the Warner Valley are much farther downstream from Forest Service lands: 20 miles in the Deep Creek drainage and at least 10 miles in the Twentymile and Twelvemile Creeks drainages. This spatial gap, combined with very low stream flows during the fire season, create an extremely low likelihood that fire retardant dropped on Forest Service land would move downstream far enough and in sufficient concentration to adversely affect the sucker.

Shortnose suckers (*Chasmistes brevirostris*)

Lost River suckers (*Deltistes luxatus*)

Effects Analysis

Lost River suckers (*Deltistes luxatus*) and shortnose suckers (*Chasmistes brevirostris*) occur in the Klamath Basin in Klamath County, Oregon and Modoc and Siskiyou Counties, California in six different locations. There are three areas of concern for this consultation which are on or immediately adjacent to Forest Service land. These areas are Upper Klamath Lake and several of its tributaries, Clear Lake and its tributary, and the Lost River.

Upper Klamath Lake and its tributaries

The Upper Klamath Lake populations of Lost River and shortnose suckers are large and estimated to be over 10,000 of each species; however, owing to periodic die-offs and low recruitment, the populations are vulnerable, especially the shortnose suckers that has not recovered from die-offs a decade ago (USFWS 2007 a,b). The Upper Klamath Lake populations of both species are thought to be the largest of all the known populations and are essential to survival and recovery of both species (USFWS 2007 a,b).

Radio-telemetry studies by Bureau of Reclamation and U.S. Geological Survey (USGS) have shown that adult suckers are primarily found at the north end of Upper Klamath Lake from June to September (Reiser et al. 2001, USGS 2003, Banish et al. 2007; Banish et al. in review). At that time, adult suckers are found in open water areas of the lake typically at depths of greater than 9 ft and avoid depths less than 6 ft (Reiser et al. 2001, USGS 2003, Banish et al. 2007; Banish et al. in review). By the end of July, most sucker larvae have reached a size greater than 1 inch (25 millimeters) in length and most have transformed to juveniles. Juveniles are primarily near-bottom dwellers.

Pelican Bay is one of the areas on Upper Klamath Lake that adult and juvenile suckers move into during the summer months (Banish et al. 2007) although the timing of their move and the number of that move into the bay depends on water quality. Pelican Bay would be the area to be mostly likely affected if retardant or foam entered the lake because of the bay's proximity to Forest Service land and presence of the community of Rocky Point, Oregon on the lakeshore. If we were to assume the worst water quality conditions and the highest number of suckers present at the time when retardant or foam enters the bay, approximately 10 percent of the population of both species could be exposed to the chemicals based on radio-telemetry studies that are assumed to be representative of the population distribution in the lake. Although a loss of 10 percent of the population of Lost River and shortnose suckers in Upper Klamath Lake would be an adverse, undesirable reduction, the population numbers of each species are sufficiently large to withstand that kind of loss.

Forest Service land also occurs along parts or all the tributaries that empty into Upper Klamath Lake. Adult suckers primarily reside in lakes and spawning occurs in tributaries and in some shoreline areas in the spring. Spawning suckers are not likely to be affected by the Proposed Action because the spawning season occurs outside of fire season. Suckers do not occur in the section of river bordered by Forest Service Land year round, they do reside immediately downstream of the Forest. Small numbers of adult suckers are found in the major tributaries (Sprague and Sycan rivers) of Upper Klamath Lake as far upstream as 80 miles throughout the year.

If retardant or foam did enter any of the tributaries, it is unlikely that chemical concentrations would be high enough to be toxic to suckers in Upper Klamath Lake because of the dilution of the chemicals by the time they reach the lake. If suckers were present in these tributaries during the time when retardant or foam entered these waterways, there could be some loss of individual fish. Although the numbers of fish exposed in these tributaries represent a very small percentage of the entire population, the loss of these fish is significant and therefore, an adverse effect.

Clear Lake

The Clear Lake National Wildlife Refuge encompasses Clear Lake. The Forest Service land surrounds the Refuge. When the lake is full, Forest Service land is less than 0.2 miles from shoreline of the lake, justifying consideration of the lake an area in the Proposed Action. Clear Lake has one major tributary, Willow Creek, which mostly flows in the winter and spring and is a series of pools in summer. Willow Creek occurs almost in its entirety on the Forest. Clear Lake contains a substantial population of Lost River and shortnose suckers. No population estimates are available but they likely number about 10,000 adults. This population of suckers in

this lake is essential to survival and recovery of both species (USFWS 2007 a,b). This population of suckers is isolated from other populations by the dam on the lake.

If retardant or foam were applied to Willow Creek, there is little over-land flow of Willow Creek during the summer months, making delivery of the chemicals to Clear Lake nearly impossible. Shortnose and Lost River suckers in the Willow Creek watershed are found in small numbers during the summer. If these chemicals did enter Willow Creek, they would likely kill all of the suckers exposed to them, although this would represent a low the number of fish exposed when compared to the overall population estimates. However, the loss of Lost River and shortnose suckers in Willow Creek would be significant and therefore, an adverse effect.

If retardant or foam were accidentally applied to Clear Lake, it would likely occur along the shoreline and not the deeper water where the adult suckers occur in the summer. Like the Upper Klamath Lake suckers, adult suckers in this system likely respond to changes in water quality as the summer progresses and move to deeper water. Because of the dilution of the chemicals in a large water body like Clear Lake, it is unlikely that chemical concentrations would be high enough to be toxic to adult suckers in other areas of the outside of the location of the retardant drop or spill. Additionally, it is likely that adult suckers would avoid areas in the lakes that have detectable amounts of the chemical based on information presented in the report by Little, Wells and Calfee (2006). There may be some loss of individual adult and juvenile fish resulting from the instantaneous exposure to concentrated chemicals at the site of the drop or spill. The loss of these fish is significant and therefore, an adverse effect.

Lost River

Forest Service land also borders one short section (less than one mile) of the Lost River near the Oregon-California border occupied by both sucker species. The population of suckers in this section of the Lost River is limited in number and is isolated from other populations. If suckers were present during the time when retardant or foam entered this section of river, there could be some loss of individual fish at the location of the retardant drop or spill. Although the numbers of exposed fish in river represent a very small percentage of the entire meta-population of the species, the loss of these fish is significant and adverse.

Conclusion

If retardant did enter waterways where Lost River and/or shortnose suckers occur on or near Forest Service land, there could be some lethal or sublethal effects to both species. These effects are adverse. However, because the meta-population is sufficiently large enough in number and widely distributed across the Klamath Basin, the Service believes both species could withstand such a loss from exposure to retardant or foam. Therefore, the Service believes that an accidental spill or retardant drop on Forest Service land on or near occupied sucker habitat is not likely to jeopardize the continued existence of the species.

June Sucker (*Chasmistes liorus*)

Effects Analysis

The proposed action is not expected to adversely affect the June sucker. The June sucker occurs only in Utah Lake and the lower portions of the Provo River. There is no Forest Service land immediately around Utah Lake; consequently the potential for fires and a need to use fire

retardant near the lake is unlikely. Higher elevation areas of the watersheds that contribute to Utah Lake are managed by the Forest Service lands and are likely locations for fires. However, the 2007 Uinta and Wasatch-Cache NF fire Management Plan provides guidelines that would avoid retardant drops within 300 feet of waterways.

Conclusion

After reviewing the current status of the June sucker and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the June sucker. Our conclusion is based on the following: 1) No Forest Service lands occur adjacent to Utah Lake; and 2) the 2007 Uinta and Wasatch-Cache NF fire Management Plan provides guidelines that would prevent retardant drops within 300 feet of waterways.

Railroad Valley springfish (*Crenichthys nevadae*)

Effects Analysis

Direct and indirect adverse effects to Railroad Valley springfish (*Crenichthys nevadae*) from the proposed action may occur in the form of harm and harassment, including mortality. No springfish populations are located on National Forest lands, but one introduced population is located adjacent to the Humboldt-Toiyabe National Forest on private lands in Hot Creek Canyon at the Old Dugan Ranch, Nye County, Nevada. There may be a high likelihood that retardant could enter the spring because of the proximity of existing structures near the spring and the need for structure protection during a wildfire event. High mortality would be likely because of the small size of the spring and no escape routes available for the springfish. This self-sustaining population was established as a refugium for the species during the early to mid 1980's. Visual surveys in 2007 at the Ranch estimated that the springfish population was less than 1,000 individuals. Two other sites west of the Ranch were also visually surveyed, and springfish there numbered in the hundreds despite the small size of the springs. A total of five refugia populations of Railroad Valley springfish have been established outside of the species' historic range and across a large area of Nevada. Hot Creek Canyon/Old Dugan Ranch is one of only three known to be currently self-sustaining. The Recovery Plan states that existing refugia populations such as Hot Creek Canyon/Old Dugan Ranch should be maintained, but they are not required for recovery of the species (U.S. Fish and Wildlife Service 1997).

Railroad Valley springfish were historically found in six spring systems distributed in two areas representing the remnants of pluvial Lake Railroad. Big Warm Spring and Little Warm Spring are on the Duckwater Shoshone Indian Reservation at Duckwater, Nye, County, Nevada. Big Warm Spring is now being managed by the Tribe under a Safe Harbor Agreement to enhance and conserve the recently (2007) repatriated springfish population. Approximately 43 kilometers (26.7 miles) to the south of the Reservation, Big Spring, Hay Corral Spring, North Spring, and Reynolds Springs originate on Lockes Ranch, Nye County, Nevada. Lockes Ranch was recently acquired by the Nevada Department of Wildlife, and these historical springfish habitats are now also being managed for springfish conservation.

Conclusion

After reviewing the current status of Railroad Valley springfish, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's

biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of Railroad Valley springfish. The Hot Creek Canyon/Old Dugan Ranch population is an introduced population outside the species' historic range, and the loss of this population would not jeopardize the continued existence of this species.

Pygmy Sculpin (*Cottus paulus*)

The proposed action is expected to have little to no impact to the pygmy sculpin. The endemic pygmy sculpin is found only in Coldwater Spring and its spring run in Calhoun County, Alabama (Mirarchi, et. al 2004a). While a direct application of fire retardant to the spring would likely have dire consequences for this species, this is unlikely to occur because the spring is located more than 6 km from the Talladega National Forest, separated by an interstate highway, and is surrounded by other major infrastructure associated with a highway corridor; the spring is also part of a municipal water supply, providing a second level of interest for anyone contemplating using fire retardant in the area. Because the pygmy sculpin is not found on or in proximity to Forest Service lands, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the pygmy sculpin will be impacted by the proposed action.

There is no designated critical habitat for the pygmy sculpin; therefore, there will be no effects.

Conclusion

After reviewing the current status of the pygmy sculpin, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the pygmy sculpin. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the pygmy sculpin is not found on National Forest lands; it is located in a protected spring more than 6 km from Talladega National Forest in a spring used as a municipal water supply; US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Desert pupfish (*Cyprinodon macularius*)

As described above in the general effects discussion for Arizona native fish species accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a waterway. Because site specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to desert pupfish occupied habitat.

At this time no natural populations of desert pupfish occur in Arizona. Naturally occurring populations of desert pupfish are currently restricted in the United States to California in two streams tributary to, and a few shoreline pools and irrigation drains of, the Salton Sea. The

species is found in Mexico at scattered localities along the Colorado River Delta and in the Laguna Salada basin.

Reintroduced populations may occur on FS lands in the future. Suitable habitat for the desert pupfish includes shallow water of desert springs, small streams, and marshes below 5,000 feet in elevation. If the desert pupfish is introduced on FS lands, populations will be in isolated waters and at lower elevations. Should populations be transplanted on FS land in the future, further consultation would be required, per section 7 consultation reinitiation criteria.

Conclusion

After reviewing the current status of desert pupfish, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the desert pupfish. No critical habitat has been designated for the species, thus, none would be affected. The desert pupfish does not occur in the action area.

Cherokee Darter (*Etheostoma scotti*)

Effects of the Action

The US Forest Service (USFS) lists eight long-term fire retardants as approved for use in fighting wildland fires:

Phos-Chek D75-R	Phos-Chek 259-R
Phos-Chek D75-F	Phos-Chek 259-F
Phos-Chek G75-F	Phos-Chek LV-R
Phos-Chek G75-W	Phos-Chek LC-95A-R

These products are supplied as either dry or wet concentrates and contain ammonium salts as the active fire retardant ingredient (from 7.6 to 11.3 percent of the individual product). These products also contain some or all of the following ingredients: gum thickeners, viscosity stabilizers, bactericides, corrosion inhibitors, and coloring agents (www.PhosChek.com 2008).

Normal use of these fire retardants involves mixing the concentrate with water (1.12 lb/gal to 1.60 lb/gal for the dry concentrates and 3.6:1 to 5.5:1 for the wet concentrates) (www.PhosChek.com 2008) and applying the retardant mixture ahead of a fire via fixed-wing airtanker (400 to 3,600 gallon capacity), helicopter (100 to 3,000 gallon capacity), or ground apparatus. Application rates vary from 1 to >6 gallons of mixed retardant per 100 ft² (435 to 2,600 gallons per acre) depending on vegetation type and other conditions (Labat Environmental 2007).

The primary environmental hazard associated with the use of these fire retardants is the toxicity of ammonia to aquatic organisms (Buhl and Hamilton 1998, 2000). The ammonium salts in fire retardants readily dissolve in water and form two chemical species, NH₃ (considered the most toxic form) and NH₄⁺. The chemical equilibrium of the two forms is highly dependant on pH and, to a lesser extent, temperature of the receiving water body, with higher pH and temperature causing a higher proportion of total ammonia forming the toxic NH₃ (USEPA 1999). Because of

these and other factors, direct comparisons of ammonia toxicity data is problematic and must be done with care.

Several scientific studies assess the aquatic toxicity of ammonia-based fire retardants, including three approved for use by the USFS: Phos-Chek D75-F, D75-R, and 259-F; the other five approved compounds have not been tested. The studies show the LC₅₀ (the concentration that causes mortality to 50 percent of the test organisms) for rainbow trout (*Oncorhynchus mykiss*) ranges from 102 to 237 mg/L (24 to 96 hour exposure scenarios). The most sensitive life stage tested was swim-up fry exposed to 102 mg/L Phos-Chek 259-F for 24 hours (Labat Environmental 2007).

Sublethal effects of fire retardants on aquatic species have not been studied; however, low-level concentrations of ammonia are known to cause various physiological responses in fish and freshwater mussels. Responses may include loss of equilibrium, increased respiratory activity and heart rate, reduction in growth rate, and increased susceptibility to disease, among others (Wang *et al.* 2007a, 2007b; Wicks 2002; Shingles, *et al.* 2001; Carballo 1995).

The potential for mortality due to introduction of an approved fire retardant into an aquatic system is difficult to predict, but factors to consider include:

- Sensitivity of the resident organisms: Aquatic species differ in their sensitivity to ammonia. Coldwater fish, especially the salmonids, darters (genus *Etheostoma*), and shiners (genus *Notropis*) are highly sensitive to ammonia (USEPA 1999).
- Quantity of retardant introduced into the stream: All things being equal, a higher concentration of fire retardant in a stream will cause higher mortality over a larger area.
- Stream flow: Larger streams with higher flows have greater capacity for diluting a given amount of fire retardant and lessening the potential for toxicity.
- Ambient water quality: The potential for toxicity increases with higher pH, lower dissolved oxygen, higher temperature, and higher nitrogen loading of the receiving water.
- Stream morphology: Assuming similar flows, a narrow, deep stream will likely have a shorter zone of mortality than a broad, shallow stream. Additionally, streams with smooth, straight channels are likely to have longer mortality zones than those with many riffles and pools, which tend to cause the peak concentration to mix and spread out (Norris, *et al.* 1983).
- Vegetative cover: Dense canopy cover may reduce or slow the deposition of air-dropped fire retardants into the underlying water.

In 2007, the USFS funded an ecological risk assessment to examine the effects of wildland fire retardants on terrestrial and aquatic species (Labat Environmental 2007). Seven of the eight approved fire retardants were reviewed (Phos-Chek LC-95A-R is a new product and was not included). Several different exposure scenarios were modeled to assess risk to aquatic species: risk from runoff, risk from accidental application across a stream, and risk from an accidental spill into a stream. Streams were described as either small (6,400 acre drainage basin, 12cfs flow) or large (147,200-acre drainage, 350cfs flow). For this report, risk was defined as “the identified exposure level [that] could be associated with loss of at least half of a local population of non-sensitive species or puts individual animals of sensitive species at risk of mortality” (Labat Environmental 2007).






Models indicated that all seven of the approved fire retardants assessed for the USFS posed a risk to sensitive (e.g., threatened and endangered) aquatic species if they are applied across a small stream. The risk assessment also determined that significant risk existed if any of the retardants were accidentally spilled into a small or large stream (assumed spill volumes included a 2,000-gal tank of mixed, diluted retardant). Toxicity and dilution of fire retardants in medium streams (6400-147,200-acre drainage basin [10-230 square miles] and 12-350 cfs flow) were not evaluated.

Earlier studies by Norris and Webb (1989) documented the downstream affects of aerial retardant application in aquatic systems; their simulations of retardant dispersal in streams 2.4-31-feet wide showed fish mortality associated with a 2114-gallon drop of fire retardant might occur more than 6.2 miles below the point of chemical entry, depending on

- Orientation of the line of flight to the stream,
- Size of load dropped and number of loads dropped on the same stream,
- Timing and placement of subsequent loads relative to the first load,
- Site characteristics, including stream shape and vegetative canopy, and
- Stream flow characteristics.

Equipment currently used in fire operations may carry over 3000 gallons of retardant, or 50% more than the amount of retardant used in Norris and Webb's (1988) simulations.

Table 1. Fish mortality related to orientation of stream relative to the aerial drop of fire retardants and to amount of retardant dropped. A standard drop was defined as 4000 liters (from Norris and Webb 1988).

Application zone and stream direction	Angle between long axis zone and stream ¹	Distance over which 100 pct mortality occurs	
		Standard drop	Standard drop times two
	degrees	----- meters -----	
	90	50	480
	67.5	50	560
	45.0	100	1000
	22.5	240	>1000
	0	1000	>1000

¹The mortality zone, where fish kills of 0-100%) might occur increased by a factor of 10 or more when models simulated the effects of two standard drops applied to the same stream.

Effects of Fire Retardant Application on Aquatic Species in the Chattahoochee and Cherokee National Forests

Headwater and tributary systems to the Conasauga River, Etowah River, and Coosawattee River drain portions of the Chattahoochee and Cherokee National Forests in northwest Georgia and southeast Tennessee. The listed fish considered here that occur in these river systems on or adjacent to the National Forests:

- Cherokee darter (*E. scotti*) - threatened
- Goldline darter (*P. aurolineata*) – threatened

Many reaches in the Conasauga, Etowah, and Coosawattee basins that support listed fish and mussels drain an area less than 230 square miles, a size that places them in Labat Environmental's (2007) medium stream category (Table 2). During droughts, however, low flows in many reaches more closely approximate flows in Labat Environmental's (2007) small streams. For example, flows in Holly Creek, at the gage downstream of known listed fish and

mussel habitat, were only 0.4 cfs in September 2000, with an average low monthly flow in October 2000 of 2.6 cfs. Lowest daily flows in the Conasauga and Etowah at the gages at Eton and Dawsonville, in the middle of most listed fish and mussel ranges in each basin, were only 16 and 30 cfs in September 2007. USGS gage data indicate the lowest flows for most gaged streams in these basins typically occurred during the July-September fire season.

Table 2. Flow data at USGS gage stations within the range of listed aquatic species in the Chattahoochee and Cherokee National Forests, Georgia and Tennessee.

Basin	Drainage Area (mi ²)	Current Flow (cfs) (1/29/08)	Long-term Median flow (cfs)	Lowest Ave. Annual Flow (cfs)	Year	Lowest Ave. Monthly Flow (cfs)	Month/Year	Lowest Daily Flow (cfs) (est)	Date
Conasauga									
Holly Creek at Chatsworth	64	17	120	32.2	2007	2.6	Oct. 2000	0.4	Sept. 2000
Conasauga River at Eton	252	132	494	154.2	2007	34.7	Aug. 2007	16	Sept. 2007
Coosawattee									
Coosawattee River at Ellijay	236	120	571	207.4	1988	75.8	Sept. 2007	54	Sept. 2007
Etowah									
Etowah River near Dahlonega	69.7	64	New gage – data not available					21	Sept. 2007
Etowah River at 9 near Dawsonville	131	107	271	193.8	2006	86.8	Aug. 2006	30	Sept. 2002
Amicalola River near Dawsonville	89	89	211	136.3	1941	64.4	Aug. 2006	32	July 2007
Etowah River at Canton	613	334	1260	510.2	1986	135	Sept. 2007	80	Oct. 2002 2007

Since we had no data on dilution of fire retardants in medium streams, we based our effects analyses and jeopardy determinations on a worse-case scenario that assumed (1) fire retardants were not diluted and remained lethal to listed fish and mussels in medium streams and (2) multiple drops of retardant could occur in one or more headwater tributary streams to reaches with listed species, amplifying toxicity and increasing the length of downstream habitat where impacts would be expected (as described by Norris and Webb 1989). We used GIS mapping to determine the point on the mainstem Conasauga, Etowah, and Coosawattee Rivers, as well as major tributaries with listed species, where the upstream drainage basin exceeded 147,200 acres. Application of fire retardant to aquatic habitats within this upstream drainage basin was assumed to result in take of listed fish and mussels, and their eggs, larvae, and glochidea downstream from the entry site to the point where the stream was large enough to sufficiently dilute the retardant to reduce the threat of mortality (i.e., 147,200-acre drainage basin). GIS identified the vulnerable reaches as

- The Conasauga mainstem from the headwaters in the Chattahoochee Forest, through the Cherokee National Forest and private lands in Tennessee, to the confluence of Sumac Creek in Georgia (total of 126,457-acre upstream drainage basin, before Sumac Creek's flows are added to the Conasauga River; Fig. 1).

- Holly Creek and tributaries in the Conasauga basin from the headwaters in the Chattahoochee National Forest to the confluence with the Conasauga River (total drainage area of 69,200 acres) (Fig. 1).
- The Etowah mainstem from the headwaters in the Chattahoochee National Forest in Georgia downstream to the confluence with Amicalola River, Dawson County (total of 114,062-acre upstream drainage basin, before Amicalola's flows are added to the Etowah River; Fig. 2).
- Amicalola River and tributaries in the Etowah Basin from the headwaters in the Chattahoochee National Forest to the confluence with the Etowah River (total drainage area of 62,595 acres) (Fig. 2)
- The Coosawattee basin from tributary headwaters in the Chattahoochee National Forest to the confluence of the Cartecay and Ellijay Rivers (Fig. 3).
- Mountaintown Creek from its headwaters in the Chattahoochee National Forest to its confluence with the Coosawattee River (Fig. 3).

There is reasonable expectation that application of fire retardants in these vulnerable reaches will:

- Kill, harm, or harass all listed fish and mussel species in the Conasauga River mainstem between the application point and the mainstem's confluence with Sumac Creek
- kill, harm, or harass all listed fish in the Holly Creek system between the application point and the confluence with the Conasauga River;
- kill, harm, or harass all listed fish species in the Etowah River mainstem between the application point and the mainstem's confluence with Shoal Creek, Dawson County;
- kill, harm, or harass all listed fish species in the Amicalola River system between the application point and the confluence with the Etowah River;
- kill, harm, or harass listed fish eggs and larvae in the above areas;

Direct mortality of listed fish and mussels is anticipated, as well as sub-lethal physiological responses that affect survival (harass). The fire retardants are likely to kill macroinvertebrate food items in the above areas and to kill host fishes for listed mussel species in the above areas, resulting in significant habitat degradation that affects foraging and breeding (harm). Extirpation of populations in areas of highest mortality may reduce species range in upstream areas that have natural or manmade dams, falls, or other knick points that prevent species recolonization.

Fig. 1. The shaded 12-digit HUCs in the Conasauga River and Holly Creek watersheds were considered vulnerable to fire retardant application on the National Forests (cross-hatched). The Conasauga mainstem basins are shaded light brown, and Holly Creek is shaded green. Other shaded basins are tributaries that contribute to flows in the Conasauga mainstem in the vulnerable reach.

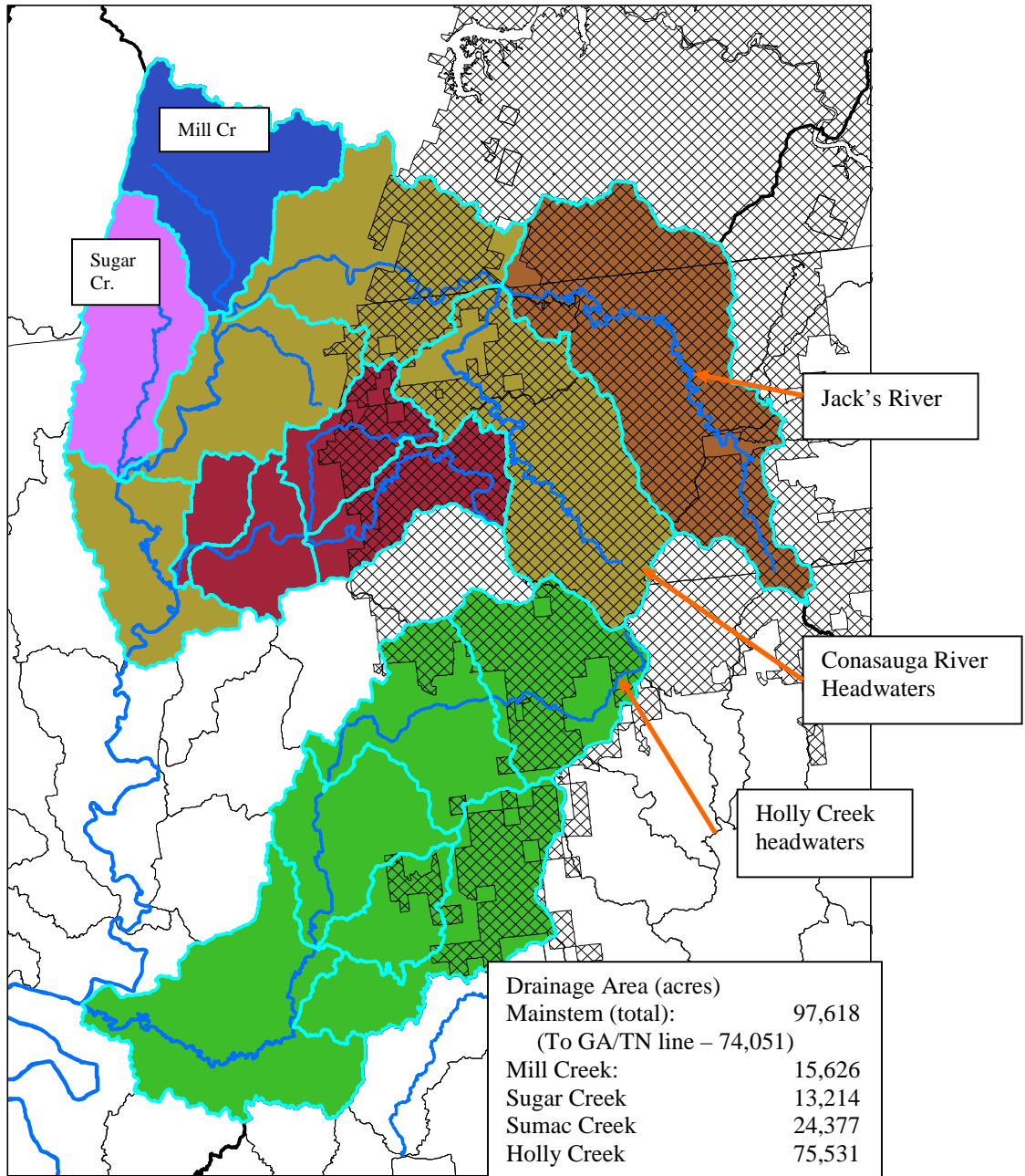


Fig. 2. The shaded 12-digit HUCS in the Etowah River (shaded red) and Amicalola River (shaded green) were considered vulnerable to fire retardant application on the National Forests (cross-hatched).

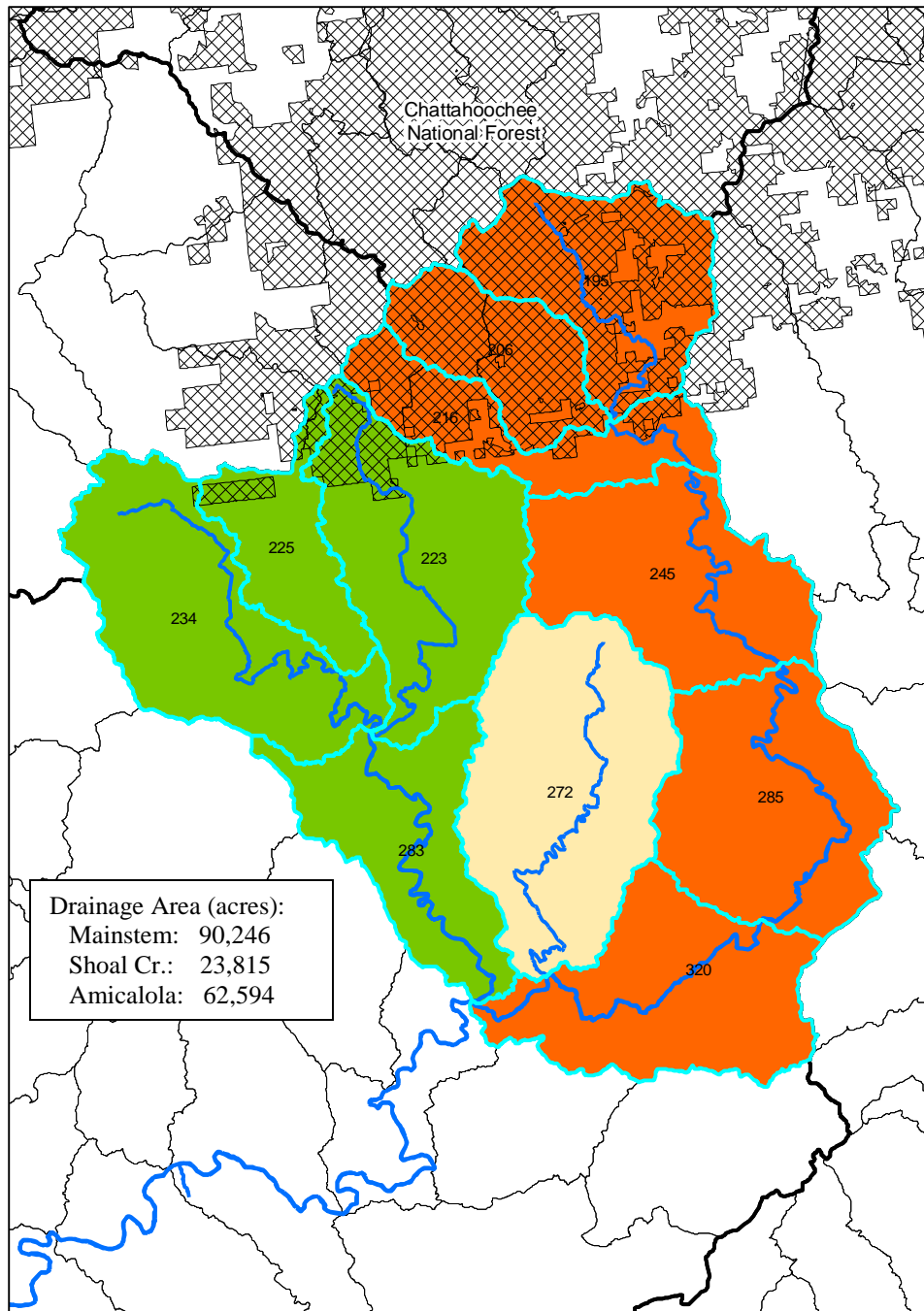
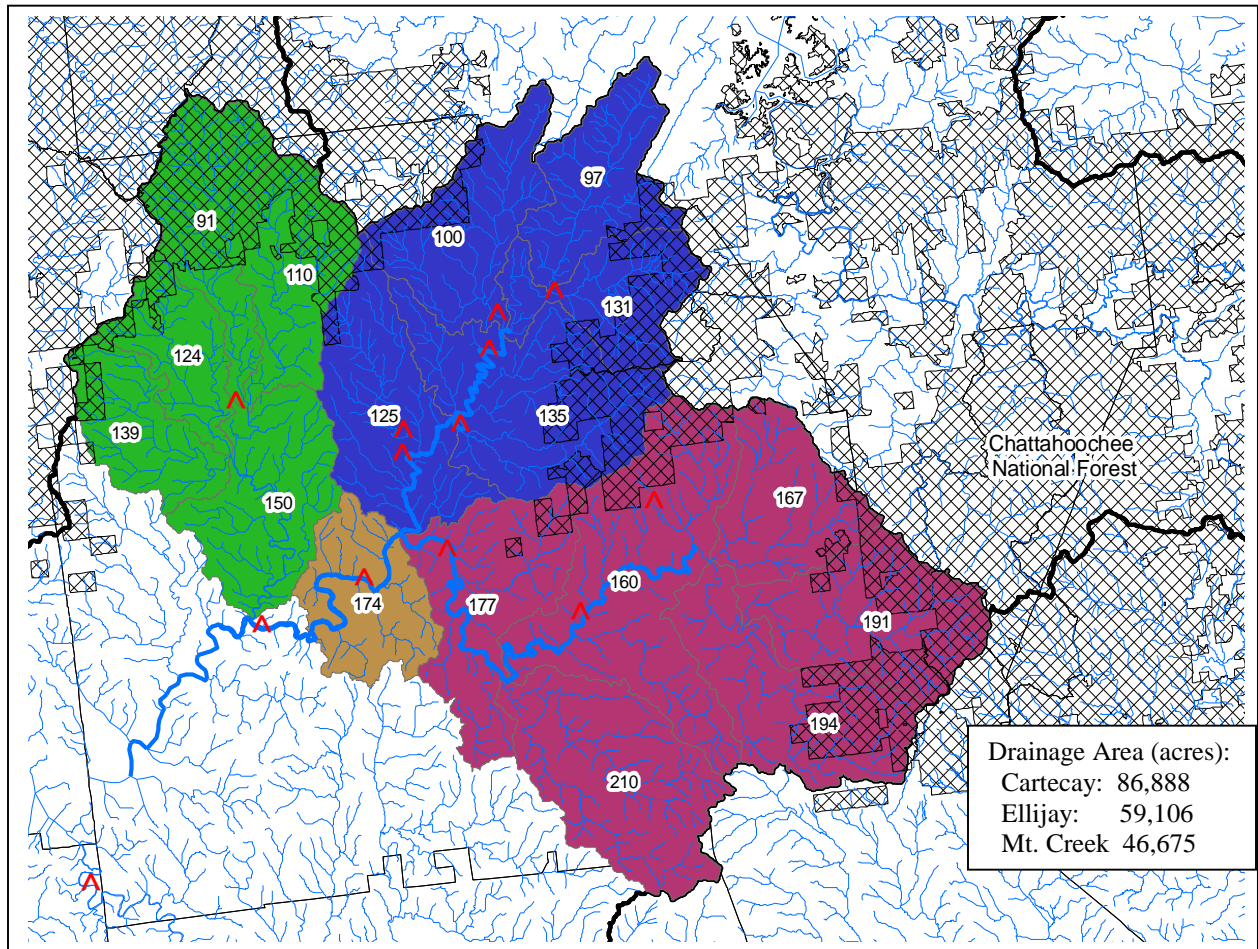
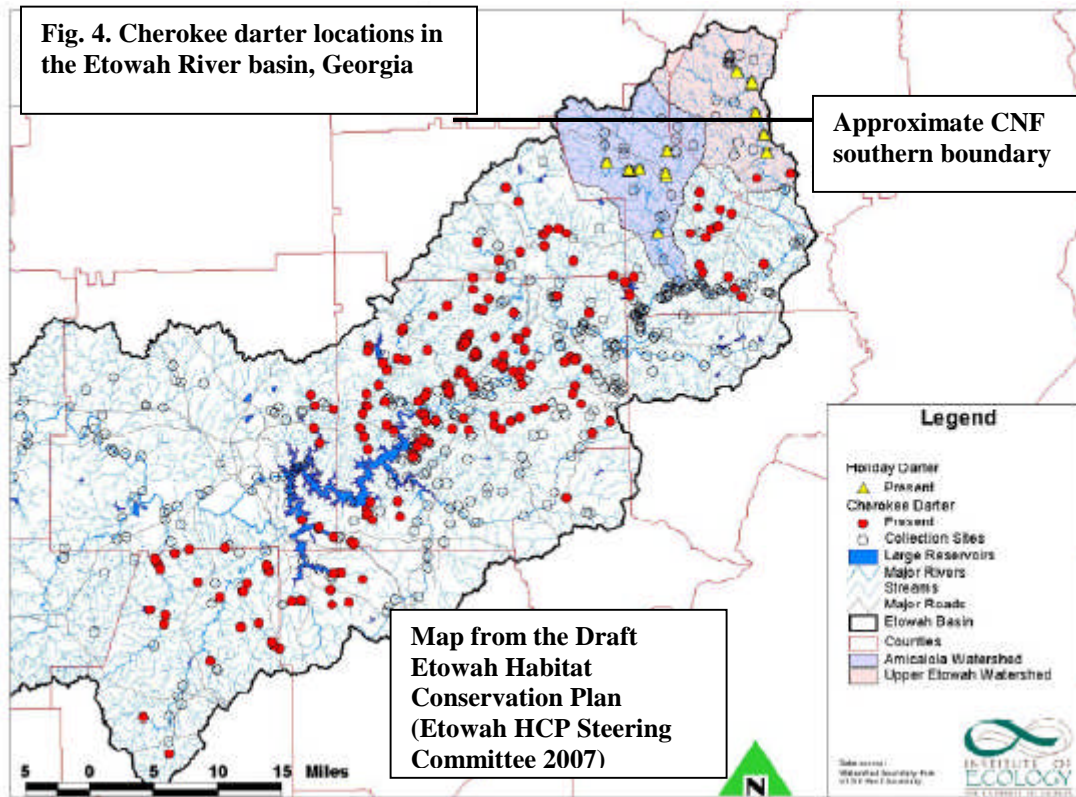


Fig. 3. The shaded 12-digit HUCS in the Cartceay River (red shading), Ellijay River (blue shading), and Mountaintown Creek (shaded green) watersheds were considered vulnerable to fire retardant application on the National Forests (cross-hatched). The brown area is the most upstream 12-digit HUC of the Coosawattee River, formed by the confluence of the Cartceay and Ellijay Rivers.



Several of the above listed species are also present in Alabama, and are included in the discussions below. Fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future. In addition, National Forests in Alabama lack air tanker facilities in the region, making it is very unlikely that fire retardants will ever be used in the vicinity of federally-listed species or any designated critical habitat (Dagmar Thurmond, USFS biologist, pers. comm. 2008).

The Cherokee darter, an Etowah River endemic, is the only species under consideration that commonly is found in small- to medium streams (Bauer et al. 1995). No Cherokee darter populations are known to occur in tributaries that drain the Chattahoochee National Forest (Fig. 4), but some tributaries with suitable habitat have not sampled. Take of Cherokee darters in these headwater streams may occur but the species is widely distributed in the Etowah basin, and limited take is not likely to jeopardize the species' continued existence.



CONCLUSION

After reviewing the current status of these species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Cherokee darter.

Goldline Darter (*Percina aurolineata*)

This account incorporates the information contained in the Cherokee darter account. The goldline darter is endemic to two disjunct systems in the Alabama River Basin: the middle Cahaba River system in Alabama and the Coosawattee River system in Georgia (Mirarchi, et. al 2004a). Currently, the species in Alabama occupies only about half of its historic range; it is found in the mainstem Cahaba River and two of its larger tributaries, the Little Cahaba River and Schultz Creek, but probably has been extirpated from the Cahaba River above Piper Bridge and in the Little Cahaba above Bulldog Bend (Boschung and Mayden 2004). The relatively large channel of the Cahaba River bisects two main sections of the Oakmulgee Ranger District of the Talladega National Forest, but Forest Service ownership does not include the banks of the river which is privately owned. The goldline darter does not occur within Forest Service boundaries, but is limited to the mainstem Cahaba and its large tributaries mostly upstream of any small Forest Service influence to the Cahaba. In Georgia, the goldline darter is found in the Ellijay and Cartecay Rivers above the City of Ellijay; in the Coosawattee River below the Ellijay and Cartecay Rivers; in Mountaintown Creek, a tributary of the Ellijay River, just downstream of the Chattahoochee National Forest's Cohutta WMA; and in several Ellijay and Cartecay tributaries that drain the Rich Mountain Wilderness (Fig. 3; red symbols represent known populations).

Application of fire retardant on the Chattahoochee National Forest in the headwaters of the Cartecay River, Ellijay River, or Mountaintown Creek could take all goldline darters, their eggs, and their larvae in that basin. Goldline darters populations in other Coosawattee basins would not be affected. This limited take is not likely to jeopardize the species' continued existence. There is no designated critical habitat for the goldline darter; therefore, there will be no effects.

In Alabama, the proposed action is expected to have little to no impact to the goldline darter, *Percina aurolineata*. Because the goldline darter is found in large riverine habitats not on Forest Service lands, it is found in additional streams in Georgia, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the goldline darter in Alabama will be impacted by the proposed action. US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

CONCLUSION

After reviewing the current status of these species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the goldline darter.

Gila chub (*Gila intermedia*)

As described above in the general effects discussion for Arizona native fish species accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a waterway. Because site specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to Gila chub occupied and critical habitat.

To date the Gila chub has been restricted to small, isolated populations scattered throughout its historical range. The number of Gila chub extant populations total 34 natural and four reintroduced. Of the 38, there are 17 natural and two introduced populations of on FS lands.

Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in small artificial impoundments (Miller 1946, Minckley 1973, Rinne 1975). Most known extant Gila chub populations are small. Only one, Cienega Creek, is considered stable and secure; about two thirds are considered stable but threatened, and a third are unstable and threatened (Weedman *et al.* 1996). Small pools, springs, and cienegas where Gila chub occur are likely to be adversely affected by introduced retardants. We believe adverse effects to individuals and/or populations will occur from the application of retardants on FS lands; however, these effects will not preclude recovery or survival of the species.

Critical Habitat

There are 25 Gila chub critical habitat units with 15 of those on FS lands. Primary constituent elements for Gila chub include, but are not limited to: space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. Considering the toxicity studies of Phos-Chek to algae and benthic macroinvertebrates were shown to have adverse effects to primary producers and aquatic invertebrates (MacDonald et al. 1995), and the toxicity of field applications are higher than the lab studies (for accidental retardant delivery); the application of retardants to Gila chub critical habitat will likely alter the biodiversity and trophic dynamics in the stream and will result in short term adverse effects to the food source for Gila chub.

Conclusion

After reviewing the current status of the Gila chub, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Gila chub, and is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

1. There are 19 Gila chub populations that exist beyond FS lands; therefore, adverse effects to the species on FS lands will not preclude recovery and survival of the species.
2. The environmental persistence of the Phos-Chek chemicals will cause short-term adverse effects to the aquatic food source for Gila chub; however, the effects will dissipate over time and will not render the affected area unsuitable for Gila chub establishment in the future.

Chihuahua chub (*Gila nigrescens*)

The introduced population on the Gila National Forest was introduced into marginal habitat and have not reproduced nor persisted. Surveys done over the last six years have failed to detect any individuals of the species.

Yaqui Chub (*Gila purpurea*)

As described above in the general effects discussion for Arizona native fish species accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a waterway. Because site specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to Yaqui chub occupied and critical habitat.

Status of the Species

Yaqui chub live in deep pools in creeks, ciénegas, and other stream-associated quiet waters. Habitat preferences vary by life stage, with young fish preferring marginal habitats and lower ends of riffles and adults preferring deep, permanent pools, undercut banks next to large boulders, debris piles, and roots of large trees (Hendrickson *et al.* 1980). Breeding males are a bluish-grey color while females are straw-yellow to light brown color (Minckley 1973).

Spawning is protracted throughout the warmer months with the greatest activity in spring. Under the right conditions, spawning can also occur during the autumn (W. Radke, pers. comm.). Growth to maturity is rapid, often within the first summer of life; reproductive potential is therefore high and large populations can develop quickly from a few adults (DeMarais and Minckley 1993). Diet consists mostly of algae, insects, and detrital material (Galat and Gerhardt 1987).

Managed populations of this species are currently reproducing and thriving on San Bernardino NWR in Bathhouse Spring, Black Draw, Double PhD Pond, the Hay Hollow Ponds, House Pond, the Minckley Ponds, North Fork, Oasis Pond, and the Twin Ponds, and in up to seven different ponds on El Coronado Ranch and throughout portions of West Turkey Creek (W. Radke, pers. comm.) in and adjacent to the Coronado National Forest. Virtually all of those populations have been stocked into enhanced or artificially created habitats as part of the recovery program and have adapted well to the off-channel ponds established as refugia for this and other fish species. The population in Leslie Creek was stocked in 1969 with individuals taken from Astin Spring (Minckley and Brooks 1985). A population in Lower Chalk Tank in the Leslie Creek drainage on the Bar Boot Ranch was documented in 2007. A population in Turkey Creek in the Chiricahua Mountains was stocked in 1986 and 1991 from Astin Spring (via Leslie Creek) stock raised at Dexter NFH. A population is also held at a pond at Douglas High School. They are also found in most wetlands just south of San Bernardino NWR in Mexico and can pioneer upstream during flood events. Current populations have responded well to intensive management and have established large, viable populations in diverse habitats. Yaqui chub have not been documented in Astin Spring for several years, but could easily re-occupy the site during flood conditions.

Effects of the Action

We believe that the proposed action is likely to adversely affect the Yaqui chub for the following reasons:

- The information above outlines the potential adverse effects to aquatic species from aerial application of fire retardants. The population of Yaqui chub in West Turkey Creek is the only one on the Coronado National Forest. The El Coronado Ranch populations in West Turkey Creek and in ponds on the Ranch are connected with and adjacent to the Coronado National Forest population and may also be affected by the application in case of drift and runoff. The Leslie Creek population of Yaqui chub may, in a case of extreme fire events on the watershed, be subject to exposure to retardants entering the stream via post-application stormwater runoff that carries retardant off the Forest to the occupied habitat.
- The West Turkey Creek populations are in several locations along an intermittent stream and managed ponds and all of them are unlikely to be affected by a retardant drop such that the population would be entirely lost. Further, the creek and the El Coronado Ranch are visible on maps and the creek has been marked with a 300 foot buffer zone on maps maintained by the Coronado National Forest to avoid overspraying the stream during retardant drops (USDA-CNF 2007) and this may also protect the off-Forest pond areas.
- The populations of the Yaqui chub on the San Bernardino National Wildlife Refuge and in adjoining portions of Mexico would not be affected by the aerial application of fire

retardants on the Coronado National Forest. These populations would be available to replace any losses of the introduced populations on the Forest or El Coronado Ranch after a retardant-related mortality event.

- Critical habitat would not be affected by the proposed action.
- The life of the proposed action has not been defined, so direct or cumulative impacts from the action may occur over a long period of time, increasing the likelihood for adverse effects to be felt by the populations on Forest Service lands, particularly if additional populations are established for recovery purposes on or adjacent to the Coronado National Forest.

Conclusion

After reviewing the current status of Yaqui chub, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of Yaqui chub and is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

1. The effects may be felt only be reintroduced populations that do not represent unique genetic forms of the species.
2. The core population area for the species would not be affected by the proposed action. Reintroduction habitat would experience only temporary adverse effects from a retardant drop, and reintroduction into affected areas from the core population is feasible post-fire.
3. Critical habitat would not be affected by the proposed action.

Delta Smelt (*Hypomesus transpacificus*)

The nearest known occurrence of delta smelt is located greater than 50 miles from Forest Service lands in the upper San Francisco Estuary. While the application of fire retardant to waterways is likely to result in the mortality of exposed fish species, due to the toxic effect of increased ammonia levels, the Service anticipates that any increased ammonia levels in waterways inadvertently exposed to retardant drops on Forest Service lands will be diluted to less-than-toxic levels when the affected waters reach the range of this listed fish. Because the proposed project is outside the range of the delta smelt and the fire retardant is not likely to affect fish in the San Francisco Estuary, the Service has determined that the proposed project is not likely to adversely affect the delta smelt.

Yaqui Catfish (*Ictalurus pricei*)

As described above in the general effects discussion for Arizona native fish species accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a waterway. Because site-specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to Yaqui catfish occupied and critical habitat.

Status of the Species

The Yaqui catfish is a medium to large fish of the family Ictaluridae (Minckley 1973), with lengths of 15 inches (in) (40 centimeter [cm]) and weights of two pounds (lbs) (one kilogram [kg]) or more common in wild-caught specimens. A captive specimen at Dexter NFH weighs about 17 lbs (eight kg). The species is most commonly caught in larger rivers in areas of medium to slow current over gravel and sand substrates. These catfish are found in deeper pools in the canyon-bound reaches of the Río Yaqui among Mexican roundtail chubs (*Gila minaceae*) and Yaqui suckers. Yaqui catfish will frequent riffles and runs at night during feeding activity. Diet includes aquatic invertebrates, other fishes, and organic debris. Adults spawn in a depression or hole in the bank, and males will defend the nest and young for a period of time. Juveniles eventually move to riffles where they occupy shallow water between heavier substrates (Rinne and Minckley 1991).

Extirpated from the U.S., the species has subsequently been reestablished in Arizona. Initial collections of wild Yaqui catfish were made in 1987 and 1990 from the Río Aros sub-basin. Additional collections totaling 100 catfish were made with electro-fishing equipment from three sites within the Río Bavispe sub-basin (Tres Ríos, La Taranga, & Cobora) during June 1995 and October 1995 and from Cajon Bonito during March 1996. These fish were transported to Dexter NFH to develop culture techniques, and fish were ultimately induced to spawn at Uvalde National Fish Hatchery during 1995, 1996, 1997 and 1999. On November 13, 1997, a total of 60 12-inch catfish and 100 6-inch catfish were stocked into Twin Pond on San Bernardino NWR, and a total of 100 12-inch catfish and 100 6-inch catfish were stocked into House Pond at Slaughter Ranch. All of the larger fish were implanted with Passive Integrated Transponder tags for future identification.

A total of 1,464 Yaqui catfish were released on October 26, 1999 at El Coronado Ranch. This population has since failed. Limited population monitoring of this species has occurred at Twin Pond and House Pond on the Refuge during 2001, 2003, 2005, and 2006. Yaqui catfish are currently present, in unknown numbers, in Twin Pond on San Bernardino NWR and in House Pond on the Slaughter Ranch. While natural spawning in these two locations has yet to be documented, multiple age class catfish were first documented in House Pond by refuge staff during October 2005 monitoring efforts, indicating the possibility of natural reproduction. Numerous Yaqui catfish representing multiple age classes were present in Sonora's Cajon Bonito during fish surveys conducted in November 2006, but it is not known how far up the Río San Bernardino this species currently occurs (W. Radke, pers. comm.). It is anticipated that with current management activities and watershed improvements that aquatic sites within Black Draw will continue to improve and Yaqui catfish will reestablish in Black Draw on San Bernardino NWR.

Effects of the Action

The Yaqui catfish is not currently found on the Coronado National Forest; however, within the term of this consultation, reintroductions may be made on or adjacent to the Forest and those individuals may be at risk of effects of retardant drops as described in the General Effects discussion and the effects of the action analysis for the Yaqui chub.

Conclusion

After reviewing the current status of the Yaqui catfish, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Yaqui catfish and is not likely to destroy or adversely modify designated critical habitat. We base these conclusions on the following:

1. The effects may be felt only by reintroduced populations that do not represent unique genetic forms of the species.
2. The core population of the species would not be affected by the proposed action. Reintroduction habitat would experience only temporary adverse effects from a retardant drop, and reintroduction into affected areas from the core population is feasible post-fire.
3. Critical habitat would not be affected by the proposed action.

Cahaba Shiner (*Notropis cahabae*)

The proposed action is expected to have little to no impact to the Cahaba shiner. The Cahaba shiner is found in two river systems of Alabama: a 28 km section of the mainstem Cahaba River above the Fall Line, and a 118 km section of the Locust Fork (Mirarchi, et. al 2004a). The relatively large channel of the Cahaba River bisects two main sections of the Oakmulgee Ranger District of the Talladega National Forest, but Forest Service ownership does not include the banks of the river which is privately owned, and the Cahaba shiner is limited to the mainstem Cahaba and is not found in the headwater streams on National Forest lands. Because the Cahaba shiner is found in large riverine habitats not on Forest Service lands, and fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008), it is highly unlikely that the Cahaba shiner will be impacted by the proposed action.

There is no designated critical habitat for the Cahaba shiner; therefore, there will be no effects.

Conclusion

After reviewing the current status of the Cahaba shiner, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Cahaba shiner. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the Cahaba shiner is not found on National Forest lands, it is a large river species highly unlikely to occur in headwater streams, US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Cape Fear Shiner (*Notropis mekistocholes*)

The Cape Fear shiner is a small (approximately 2 inches long), yellowish minnow with a black band along the sides of its body. The Cape Fear shiner is generally associated with gravel, cobble, and boulder substrates, and has been observed in slow pools, riffles, and slow runs. The

Cape Fear shiner is endemic to the upper Cape Fear River Basin in the Central Piedmont of North Carolina. The species is known from tributaries and mainstreams of the Deep, Haw and Rocky Rivers in Chatham, Harnett, Lee, Moore and Randolph counties. Only five populations of the shiner are thought to exist.

While nearly all of the Uwharrie National Forest is located in the Yadkin - Pee Dee River Basin, two small parcels (U-197 and U-352) occur in the Cape Fear River Basin. The nearest known population of Cape Fear Shiner is located approximately 5.5 miles east (straight-line distance) of parcel U-197 and approximately 10 river miles downstream from parcel U-197 in the Deep River.

Based on conversations with staff with the Uwharrie Ranger District, they have never used fire retardant chemicals on these two parcels and due to their small size and the surrounding land uses it is highly unlikely that they would ever use fire retardant chemicals on these parcels. Therefore, we believe that the proposed project may affect, but is not likely to adversely affect the Cape Fear shiner. Critical Habitat has been designated for the Cape Fear Shiner and the nearest location is more than five miles from parcel U-197 and this project

SMOKY MADTOM (*Noturus baileyi*)

a. Factors to be considered

Proximity of the action: The smoky madtom, *Noturus baileyi*, is known to occur in 8 miles of Citico Creek on the Cherokee National Forest and will likely inhabit 7 miles of the Tellico River as part of a nonessential, experimental population. Although the aerial application of retardant could occur on or adjacent to either of these streams, for purposes of this consultation, our jeopardy analysis is focused largely on the likelihood of effects to the fully protected population occurring in Citico Creek. The extent of success in the Tellico River reintroduction is currently not fully realized.

Citico Creek, from the Cherokee National Forest boundary at Mountain Settlement Road (CCM 4.3) upstream to the confluence of Citico Creek with Barkcamp Branch (CCM 10.8), has been designated as critical habitat for the smoky madtom (USFWS 1985).

Distribution: At the time of listing, the smoky madtom was known only from the Citico Creek population. The type locality, Abrams Creek, had been extirpated in 1957. Beginning in 1985, attempts were made to re-establish a smoky madtom population into Abrams Creek using adults and fry raised in captivity from nests collected from Citico Creek. This effort was declared a success after 20 years of stocking when several years of natural recruitment were documented in Abrams Creek (Rakes and Shute 2005). An ongoing effort (begun in 2003) to re-establish smoky madtoms into the Tellico River appears to be having more rapid success. The Tellico River is a nonessential experimental population. In Citico Creek, smoky madtoms occupy about eight miles of the stream almost all of it managed by the Cherokee National Forest. In the Tellico River, smoky madtoms are expected to eventually occupy about 8 miles of river with 7 of those miles managed by the Cherokee National Forest.

Timing: The most sensitive times for smoky madtoms are likely from late May through August, corresponding with the nesting period followed by a period of larval development (Dinkins and Shute 1996). The Cherokee National Forest has two separate fire seasons. The spring season is from (approximately) February 15th through May 1st. The fall season runs from (approximately) October 15th through December 1st.

Nature of the effect: The primary effect on the smoky madtom would be from toxic ammonia compounds coming into contact with a stream containing madtoms, including federally listed species, as the retardant is applied or very soon after application. If these effects are severe enough they could result in the death of a madtom, interruption of spawning activity, or other behavioral changes. For example, male smoky madtoms guard nests after eggs are laid. Responses to nest disturbances (n=4) varied, ranging from reluctance to leave the cavity to complete abandonment and subsequent predation of the nest (Dinkins and Shute 1996). Indirect effects could occur to madtoms from the retardant adversely affecting the aquatic invertebrates that comprise the madtoms' diet.

Many studies have concluded that ammonia is the primary toxic component in fire retardants (for example, see Buhl and Hamilton 2000 and McDonald and others 1997). Several factors determine whether an aquatic organism will be exposed to toxic levels of the ammonia compounds that make up roughly 10 percent of the retardant mixture: (1) avoidance of the contaminated area, (2) time exposed to the toxin, (3) water quality, including pH, (4) quantity of retardant spilled into freshwater, (5) type of water body, and (6) size of water body (Norris, Lorz, and Gregory 1991; Van Meter and Hardy 1975). Norris, Lorz, and Gregory (1991) reported that direct application of retardants onto the stream surface was the primary source of retardant contamination in streams. They found that only minor amounts of retardant entered streams from riparian areas and as small as a 3-meter buffer virtually eliminated retardant entering stream waters. Twenty-four hours after the initial application of retardant, nitrate and soluble organic nitrogen were the primary chemical components remaining in the stream. These chemicals are considered low in toxicity and are natural components of the aquatic ecosystem (Norris, Lorz, and Gregory 1991).

Critical habitat has been designated for this species. The two Primary Constituent Elements for this species are listed as follows along with the nature of the effect of this action on each.

- 1) Good quality water in Citico Creek.
- 2) Run/pool areas with relatively silt-free pea-size gravel substrate containing scattered large flat rocks for breeding habitat.

Constituent Element 1 (as it applies to "good quality" water) can be affected by the presence of ammonia compounds in solution in the water.

Duration: The effects of this proposed action on both this species and designated critical habitat would most likely be considered a short term (pulse) event; however, depending on stream conditions (i.e., rainfall, flow) the duration could extend over a greater extent of stream length.

Disturbance frequency: The Service is not able to make a precise assessment regarding disturbance frequency for this species or its designated critical habitat; however, it is likely that the frequency of the aerial application would be directly related to conditions favorable for fire to occur. Aerial application would only be used for wildfire suppression. In the time frame of 2001 through 2007, the Cherokee National Forest has had a total of 14 calls for retardant for an average of 2 calls per year (Martin 2008). This use is considered to be a rare event.

Disturbance intensity: The Service is not able to make a precise assessment regarding disturbance intensity for this species or its designated critical habitat; however, it is likely the intensity of fire retardant application would be dependent on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

Disturbance severity: The Service is not able to make a precise assessment regarding disturbance severity for this species or its designated critical habitat; however, severity of the applied fire retardant to this species would likely depend on the location and proximity to ephemeral, intermittent, and perennial streams in the action area.

b. Analyses for effects of the action

Beneficial effects: The Service does not believe the effects of the action are wholly beneficial to this species.

Direct effects: A direct effect on the smoky madtom would be from toxic ammonia compounds coming into contact with a stream containing madtoms, including federally listed species, as the fire retardant is applied and/or very soon thereafter. If these effects are severe enough they could result in the death of a madtom, an interruption of spawning activity, or other behavioral changes (as discussed in “Nature of the Effect” above). However, several factors contribute to the likelihood of exposure to ammonia (as discussed above). Additionally, the Forest Service’s Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service’s April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instruct pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to occur directly on perennial streams such as Citico Creek. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact the smoky madtom significantly due to dilution. In the time frame of 2001 through 2007, the Cherokee National Forest has had a total of 14 calls for retardant for an average of 2 calls per year (Martin 2008). This use is considered to be a rare event.

Critical habitat Constituent Elements are previously noted in Nature of Effects. Of the two elements, water quality (1) may be directly affected by toxic ammonia compounds released into designated critical habitat waters. The direct effects are the same as those provided in the species discussion above.

Interrelated and interdependent actions: Based on the information provided the Service has not identified any interrelated or interdependent actions applicable to the species or designated critical habitat, regarding this proposed aerial application of fire retardant.

Indirect effects: Indirect effects could occur to madtoms from the retardant adversely affecting the aquatic invertebrates that comprise the madtoms' diet. However, several factors contribute to the likelihood of exposure to ammonia (as discussed above). Additionally, the Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instruct pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to occur directly on a perennial stream such as Citico Creek. The accidental application of fire retardant is unlikely to occur over a widespread area; and, if so is unlikely to impact the smoky madtom significantly due to dilution. In the time frame of 2001 through 2007, the Cherokee National Forest has had a total of 14 calls for retardant for an average of 2 calls per year (Martin 2008). This use is considered to be a rare event.

Critical habitat Constituent Elements are previously noted in Nature of Effects. We are unaware of any indirect effects likely to affect the Constituent Elements.

c. Species' response to a proposed action

Numbers of individuals/populations in the action area affected: The exact number of individuals of the smoky madtom in the action area is not known; however, based on recent records it persists in three streams in Tennessee. This species is located in several streams and therefore it is unlikely all populations would be affected from any particular fire retardant application.

Sensitivity to change: The Service does not know how sensitive to change the smoky madtom is. The majority of madtoms are nocturnal and are presumed to rely heavily on chemoreception for finding food and raising young. The more sensitive members of the genus may be detrimentally affected by small changes in water quality (Dinkins and Shute 1996). The fact that the smoky madtom was extirpated from Abrams Creek following the 1957 reclamation project documents the species susceptibility to catastrophic events; however, it should be noted that the smoky

madtom was later propagated, reared, and released successfully into Abrams Creek (Dinkins and Shute 1996).

Resilience: The Service does not know how resilient the smoky madtom is to this particular action. The smoky madtom is among the least fecund of madtoms (Dinkins and Shute 1996), possibly making it less resilient to catastrophic events. The fact that the smoky madtom was extirpated from Abrams Creek, while many other fish species recolonized following the 1957 reclamation project documents the species susceptibility to catastrophic events (Dinkins and Shute 1996) and may indicate a lack of resilience. Additionally, smoky madtoms are dependent on aquatic invertebrates being present in sufficient numbers to meet the madtoms' dietary needs, so the resilience of the aquatic invertebrates that comprise the madtoms' diet is also a factor to be considered.

Recovery rate: The recovery rate of the smoky madtom is unknown. The fact that the smoky madtom was extirpated from Abrams Creek may also be indicative of a slow recovery rate.

CONCLUSION

After reviewing the current status of the smoky madtom, the environmental baseline for the action area, and the effects of the proposed aerial application of fire retardant, it is the Service's biological opinion that the aerial application of fire retardant, as proposed, is not likely to jeopardize the continued existence of the smoky madtom, and is not likely to destroy or adversely modify designated critical habitat.

This proposed action is not likely to jeopardize the continued existence of the smoky madtom for the following reasons: 1) This species is located through 8 miles of Citico Creek, as well as in reintroduced populations in Abrams Creek and the Tellico River and, therefore, it is unlikely all populations, or individuals within the Citico Creek population, would be affected from any particular fire retardant application. 2) The Service believes that aerial application of retardant is unlikely to occur directly on Citico Creek, the perennial stream that contains the smoky madtom. 3) The smoky madtom has been successfully propagated, reared, and released in reintroduction efforts. 4) The use of aerially applied fire retardant is considered a rare event on the Cherokee National Forest. In the time frame of 2001 through 2007, the Cherokee National Forest has had a total of 14 calls for retardant for an average of 2 calls per year (Martin 2008).

The primary direct effects on this species would be from toxic ammonia compounds as the fire retardant is being applied and/or very soon thereafter. If these effects are severe enough they could possibly result in the death of a smoky madtom, an interruption of spawning activity, or other behavioral changes. Indirect effects could occur from the retardant adversely affecting the aquatic invertebrates that comprise the madtoms' diet. The Forest Service's Environmental Assessment indicates most retardant delivery is applied to ridge tops and adjacent to human-caused natural fire breaks, and occasionally adjacent to aquatic environments. The Forest Service's April 2000 Guidelines for Aerial Delivery of Retardant or Foam near Waterways, instruct pilots to avoid known water bodies; however, there are exceptions when life or property are threatened, potential damage to natural resources outweighs possible loss of aquatic life, or when alternative line construction tactics are not available due to terrain constraints, congested

area, life and property concerns or lack of ground personnel. It is reasonable to assume that ephemeral and intermittent streams are more likely to experience accidental application and/or receive less precise placement of the fire retardant, relative to the 300 foot buffer area. Perennial streams on Forest Service lands are more highly visible to pilots than ephemeral or intermittent streams and are not located on ridge tops. The Service believes that accidental aerial application of retardant is less likely to occur directly on perennial streams that could contain this species. However, the accidental application of fire retardant is unlikely to occur over a widespread area; and, if so, is less likely to impact smoky madtoms significantly due to dilution.

Critical habitat has been designated for this species, but the proposed action is not likely to affect that critical habitat. Critical habitat Constituent Elements are previously noted in Nature of Effects above. The proposed action is not expected to alter Constituent Element two. Constituent Element one (water quality) can be affected by the presence of ammonia compounds in solution in the water. The direct effects are the same as those provided in the species discussion above. We are unaware of any indirect effects likely to affect the Constituent Elements.

Gila trout (*Onchorhynchus gilae gilae*)

Effects Analysis

Gila trout occur in New Mexico in the four original pure populations (Main Diamond, South Diamond, Whiskey, and Spruce Creeks) and each population has been replicated at least once. Main Diamond has been replicated four times, South Diamond and Whiskey Creek have been replicated once, and Spruce Creek three times. The Service believes all of the replicated populations are secure, and the viability of the Gila trout is sufficiently protected throughout these populations. In 2006, Gila trout was downlisted from endangered status to threatened based on the replication of the original four populations and the overall increase in the total wild population of Gila trout from less than 10,000 in 1992 to 37,000 fish in 2001 (Brown *et. al.* 2001). Replicated populations in New Mexico are successfully reproducing, indicating that suitable spawning and rearing habitats are available. In addition, Gila trout were more recently replicated in Arizona; as such, we do not have estimated numbers of fish at this time.

In the past, Gila trout populations were threatened by habitat degradation resulting from livestock grazing, timber harvest, and wildfires as well as watershed disturbances (52 FR 37424) and nonnative salmonids. In 2003, fire retardant was dropped on Black Canyon, affecting approximately 200 meters (m) (218 yards) of stream (J. Monzingo, U.S. Forest Service, Gila National Forest, in litt. 2003e). Although some Gila trout were killed, the number of mortalities is unknown (J. Monzingo, U.S. Forest Service, Gila National Forest, in litt. 2003e) because dead fish were carried by the current out of the area by the time fire crews arrived. However, a week after the retardant drop, live Gila trout were observed about 400 m (438 yards) below the drop site (J. Monzingo, U.S. Forest Service, Gila National Forest, in litt. 2003e).

High-severity forest fires remain a threat to isolated populations because natural repopulation is not possible. However, populations have been reestablished after forest fires (Main Diamond and South Diamond creeks), and an Emergency Evacuation Plan (Service 2004) has been developed that outlines procedures to be taken in case of a high-severity forest fire. In 2002, the

Emergency Evacuation Plan (Service 2004) was successfully implemented during the Cub Fire to evacuate fish from Whiskey Creek (Brooks 2002), and in 2003, the plan was again successfully implemented during the Dry Lakes Fire to remove fish from Mogollon Creek (J. Brooks, U.S. Fish and Wildlife Service, in litt. 2003b). Implementation of the Emergency Evacuation Plan has been a joint effort between the US Forest Service, Gila NF, the New Mexico Game and Fish Department and the Service. Most populations of Gila trout are sufficiently disjunct (e. g., separated by mountain ridges), thereby ensuring that one fire would not affect all populations simultaneously. Fires have occurred in recent times in many areas occupied by Gila trout. Thus, the risk of fire in these areas, especially one that would affect all populations, is reduced due to an overall reduction in fuel loads and likely reduces the risk of retardant on these fires. Populations may still be extirpated because of forest fires and/or fire retardant use, but through management activities (rescue of fish, reestablishment of populations, hatchery management) populations can be, and have been, reestablished successfully once the habitat recovers. We currently have an active captive propagation of Gila trout at the Mora National Fish Hatchery and Technology Center, guided by a genetic broodstock management plan.

Conclusion

After reviewing the current status of the Gila trout, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Gila trout. No critical habitat has been designated for the species, thus, none would be affected. We base these conclusions on the following:

1. Cooperative management activities (rescue of fish, reestablishment of populations, hatchery management) efforts between the Service, Forest Service, State Game and Fish Agencies, have been successful in the past and will continue to be implemented.
2. Most populations of Gila trout are sufficiently disjunct (e. g., separated by mountain ridges), thereby ensuring that one event would not affect all populations simultaneously.

Oregon Chub (*Oregonichthys crameri*)

About 6 of 34 populations of Oregon chub occur on Forest Service land or in areas downstream of Forest Service lands where retardant might reach. However, the vast majority of Oregon chub habitat is seasonally or always hydrologically disconnected from mainstem rivers within the Willamette River Basin, and this species is restricted primarily to low elevation sites in the Willamette Valley that are typically not subject to retardant exposure. For those reasons, the chances of retardant being introduced into occupied chub habitat are very low to none.

Roanoke Logperch (*Percina rex*)

George Washington and Jefferson National Forests

Effects ANALYSIS

The effects of fire retardant use on the George Washington and Jefferson National Forests (GWJ) were evaluated for nineteen federally listed endangered aquatic species (Table 1). These species

include 18 freshwater mussel species and 1 fish species. Most of these species do not actually occur on the National Forests, however, instream habitat, particularly water quality, is influenced by Forest Service (FS) activities within the watersheds.

Table 1. List of species included in this effects analysis and their geographic occurrence by watershed.

Scientific name	Common name	Drainage	Class
Percina rex	Roanoke Logperch	Roanoke	Fish

Factors to be considered

Use of fire retardants on the GWJ

Waterways containing listed species could be exposed to fire retardants either through an intentional planned release or accidental drop across or adjacent to a water body during aerial application or on-the-ground activities where the retardant is stored or mixed at a reload base or portable base. Although the 2000 guidelines establish standards to avoid direct application to water bodies, the incident commander has the flexibility to make exceptions to those standards. Furthermore, the *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (U.S. Forest Service et al. 2000) only address visible water bodies. Direct application within the 300 foot buffer of non-visible water bodies is likely to occur. We expect that first to third order streams could be accidentally contaminated with fire retardant. As a result of these uncertainties and estimating that the average footprint of a typical drop is 40 feet wide and spans 1000 or more feet (S. Croy, USFS, pers. comm.), it is likely that application of fire retardant across water bodies, particularly intermittent and ephemeral streams, will likely occur during drops.

Compared to other National Forest fire suppression activities, use of fire retardant on the GWJ has been minimal. Historically, the Wyers Cave air tanker base, located at Shenandoah Valley Airport, supplied fire retardant for the majority of drops on the GWJ. Between 1986 and 2000, aircraft from the Wyers Cave air tanker base dropped 306,000 gallons of unspecified fire retardant on National Forest land as well as National Park Service and private lands, mainly in the Shenandoah Valley area. Since 2001, only 21,000 gallons of fire retardant (Phos-Chek D75-R) have been applied specifically to fires on the GWJ. By comparison, 48,940,258 gallons of fire retardant were used over all National Forest lands from 2001 through 2006. Fire retardant use on the GWJ during that time frame accounts for about 0.04 % of total national usage. Given that the GWJ comprises less than 1% of the National Forest land base, the GWJ, by far, uses proportionally less fire retardant chemicals. On a per acre basis, the total National Forest usage is 26 times greater than what has been applied on the GWJ. According to the Fire and Aviation Management Web Application database, 333 wildland fires have been reported on the GWJ since 2001. Of those fires, only 5 (1.5%) were treated with fire retardant (Table 2). All five retardant applications occurred on either mid to upper slopes or ridge tops; none of the drops occurred over perennial streams. Also, all historic applications of retardant on the GWJ have been with heavy fixed-wing air tankers (2 to 4 engines) and no drops have been made using helicopters or SEATS (Single Engine Air Tankers). Therefore all retardant storage, mixing, and loading operations have been at large airports and not in the field at temporary portable bases.

Compared to pre-2000 use, application of retardants to suppress fires on the GWJ has been of a declining trend. Predicted future use of fire retardants on the GWJ is expected to decline even further. Several factors have contributed to this trend.

5. The great majority of forest fires on the GWJ are ground fires. Crown fires are extremely rare and only occur as single tree or group torching in isolated pine stands. Forests of the GWJ are dominated by a deciduous forest canopy that tends to intercept fire retardants during dispersal, especially during leaf-on conditions, inhibiting the retardant from reaching the ground and rendering the practice of aerial application as sub-effective.
6. Aerial application of fire retardant typically occurs during initial attack (i.e. during the first few hours after a fire's discovery). Many fires on the GWJ are not immediately adjacent to the wildland-urban interface and thus the need to rapidly protect human-made structures from wildland fires has been minimal.
7. Using fire retardants is expensive and is not commonly available.
8. The GWJ is migrating away from an emphasis on immediate fire control and moving toward a wildland fire doctrine of appropriate management response, focusing more on point protection.

As a result of decreasing demand for fire retardants in the GWJ area, several air tanker bases have been discontinued. Historically the GWJ was served by four possible air tanker bases located in Asheville, North Carolina, Knoxville, Tennessee, Wyers Cave, Virginia, and sometimes a portable base in Dublin, Virginia. Both the Asheville and Wyers Cave bases have been closed, and the Knoxville base is scheduled to be closed in 2008 or 2009. The Dublin base is portable and will only operate depending on conditions and fire occurrences. To replace those bases, three Southeastern permanent fixed bases are planned for Fort Smith, Arkansas, Lake City, Florida, and Chattanooga, Tennessee. Because delivery of fire retardants to the GWJ will be logistically difficult based on distance limitations and higher costs, the option to use aerial applied fire retardants will be less likely than historic use.

Table 2. Fires that were treated with fire retardant (Phos-Chek D75-R) on the GWJ since 2001. NA = not applicable

Name of fire	Year	Ranger District	Watershed	Amount of retardant (gal)	Number of drops	Distance to listed species (miles)
Huckleberry	2001	Eastern Divide	James	5,000	3	8
Marbleyard	2002	Glennwood-Pedler	James	8,000	4	3
Strike 3	2002	Lee	Shenandoah	2,000	1	NA
Cardinal	2006	Lee	Shenandoah	4,000	2	NA

Hoot-Owl	2007	Clinch	Clinch	2,000	1	35
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Occurrence of fire retardant applied over streams

Although streams and rivers serve as natural breaks for fire control, fire retardant application on the GWJ has never been anchored to waterways. Fire retardant application on the GWJ has been typically anchored to rocky outcroppings, the “black” (where the fire has already burned), roads, trails, bulldozer lines, or hand lines. Most fires on the GWJ occur on higher elevation terrain with the head of the fire progressing uphill, commonly in combination with an upslope wind influence. Application of fire retardant has been used to block or deflect the movement of the fire or dampen the intensity of the fire on the mid to upper slopes. Since fire retardant use on the GWJ has been and is expected to remain isolated to ridge tops and mid to upper slopes, the potential for application of fire retardant over higher order perennial streams is very low. However, it likely that fire retardant application will occur across ephemeral, intermittent, or low order perennial streams (1 – 3 order). Monitoring of streams after a fire has not occurred, so direct effects to streams from historic application are unknown.

Proximity of species to forest boundary

The Roanoke logperch is influenced by the Eastern Divide and Glenwood Ranger Districts, and is found only in the Roanoke and Chowan River drainages. The Forest Service owns and manages less than 1% of the land base in the Upper Roanoke River drainage. The range of the Roanoke logperch extends upstream within 2-3 linear miles of the proclamation boundary of the GWJ. However, the majority of the Upper Roanoke population occurs greater than 20 miles downstream of Forest Service lands.

Analysis for Effects of the Action

Direct Effects – Direct impact to the Roanoke logperch associated with this project include the potential to kill or injure fish from ammonia toxicity derived from fire retardant chemicals that have been applied directly or indirectly to habitat. Fire retardants may potentially enter and accumulated in the water column through runoff if precipitation follows shortly after application of fire retardants. Water bodies contaminated by fire retardant chemicals could result in both acute and chronic toxic affects to the logperch. Toxicity would result from increased un-ionized and total ammonia levels and would depend on the organic level of the soil, the proximity of the drop to the stream, the amount dropped, the concentration of the retardant, amount of runoff, the volume and velocity of the stream, and life-stage of the logperch. Assuming logperch are similar to fathead minnows, exposure to the retardant could potentially kill 55% of the fish within the first 96 hours at an LC50 concentration of 170mg/liter of Phos CheckD75-R (Litte and Calfee 2002). Chronic toxicity may occur depending on the persistence of the retardant in the environment. Based on the high organic level of the soil surface in the GWJ, the Service does not expect the retardant to persist long in the environment. There are many unknown variables that factor into the toxicity level of the retardant to the logperch.

Indirect Effects - Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). Indirect impacts to the Roanoke logperch associated with this project include killing the benthic invertebrates,

thereby decreasing the logperch's food base. Recovery time of the benthic invertebrates would depend on the persistence of the retardant.

Conclusion

After reviewing the current status of the Roanoke logperch, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that aerial application of fire retardant is not likely to jeopardize the continued existence of the logperch. No critical habitat has been designated for these species; therefore, none will be affected.

This determination is based on the following: 1) logperch populations are wide ranging in the Roanoke, Nottoway, and Meherrin River systems; 2) the first known occurrence of logperch is two to three miles downstream of the Forest Service boundary; 3) use of fire retardant within the Upper Roanoke River drainage is highly unlikely since less than 1% of the land base of the watershed is in Forest Service ownership; 4) there is no historic use of fire retardant within the watershed and predicted future use on the GWJ is expected to decline; 5) persistence of fire retardant is expected to be short lived as a result of high organic soils; 6) the Service expects the logperch will shift foraging grounds if the retardant negatively affects its food source.

Gila topminnow (*Poeciliopsis occidentalis occidentalis*)

As described above in the general effects discussion for Arizona native fish species accidental delivery, drift, and surface run-off are three avenues considered for potential retardant delivery into a waterway. Because site specific information for retardant drops is not available, and there is no limit or timeframe for the use of retardants mentioned in this consultation, we must consider the effects of all possible scenarios to Gila topminnow occupied habitat.

The status of the species is poor and declining. Gila topminnow has gone from being one of the most common fishes of the Gila basin to a total of 35 extant populations (15 natural, 20 reintroduced). Of these, nine occur on FS lands (1 extant, 8 reintroduced). Many of these extant populations are small and highly threatened.

Gila topminnow are known to occur in streams fluctuating from 43 to 97°F, pH from 6.6 to 8.9, dissolved oxygen levels of 2.2 to 11 milligrams/liter, and can tolerate salinities approaching those of sea-water (Meffe *et al.* 1983). Topminnow can burrow under mud or aquatic vegetation when water levels decline (Deacon and Minckley 1974, Meffe *et al.* 1983). Sonoran topminnows, *Poeciliopsis occidentalis*, regularly inhabit springheads with high loads of dissolved carbonates and low pH (Minckley *et al.* 1977, Meffe 1983, Meffe and Snelson 1989). Although the species is capable of persisting in streams with a wide variation in temperature, pH, and salinity Gila topminnow are likely to be adversely affected by retardants introduced into an occupied stream. We believe adverse effects to individuals and/or populations will occur from the application of retardants on FS lands; however, these effects will not preclude recovery and survival of the species.

Conclusion

After reviewing the current status of the Gila topminnow, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's

biological opinion that the proposed action is not likely to jeopardize the continued existence of the Gila topminnow. We base these conclusions on the following:

1. There are 26 Gila topminnow populations that exist beyond FS lands; therefore, adverse effects to the species on FS lands will not preclude recovery and survival of the species.

AMPHIBIANS

Flatwoods Salamander (*Ambystoma cingulatum*)

Effects Analysis:

The salamander's range is now limited to sites in Georgia, Florida, and South Carolina, with known populations in the Apalachicola and Osceola National Forests in Florida, and the Francis Marion National Forest in South Carolina. The last reported sightings of the salamander in Alabama were in Covington and Houston Counties in the early 1980s. While the Conecuh National Forest in southern Alabama has the appropriate habitat for the salamander, repeated surveys of the Conecuh National Forest area for reptiles and amphibians over the past decade have not found the flatwoods salamander to be present, and intensive surveys specifically for the salamander in the early 1990s, described by Godwin (1994), also turned up negative (Mirarchi, et. al 2004b).

This section includes an analysis of the direct and indirect effects of the proposed action on the flatwoods salamander within the Apalachicola, Osceola and Ocala National Forests in Florida, and the Francis Marion National Forest in South Carolina. Flatwoods salamanders have not been documented on the Ocala National Forest and will not be affected by the proposed action. The Osceola NF has one population of flatwoods salamanders which has three breeding ponds. In South Carolina, the flatwoods salamander was historically known from five counties (Beaufort, Berkeley, Charleston, Jasper, and Orangeburg). Presently, it is known to occur in Berkeley and Charleston counties on the Francis Marion National Forest (FMNF) and Santee Coastal Reserve, respectively. One population is known from private land managed as a quail plantation in Jasper County. Based on reports and museum specimen, 6 adult and an unknown number of larvae have been collected from the FMNF in the past 20 years. The most recent larva collected on the Forest was from Old Railroad Pond in 2003 (Fauth pers. com. 2006). Due to the lack of water, survey attempts in 2004, 2005, and 2006, found no larval salamanders in the historic breeding ponds on the FMNF. Although the FMNF is the most recent location of flatwoods salamander in South Carolina, due to the poor habitat conditions and lack of recent breeding opportunities, this population is thought to be small and likely declining. On the Francis Marion National Forest, flatwoods salamander breeding ponds and proposed critical habitat exist in compartments 114, 115, and 116. This portion of the Forest, commonly referred to as the Cainhoy area, is located on the south western extent of the Forest, bisected by Highway 41. Several private inholdings exist in this area in addition to the urban interface and Highway 41, making opportunities for prescribed fire rare. This has resulted in high fuel loads in the Cainhoy area, increasing the potential for large-scale wildfire. The anticipated effects of the proposed action on flatwoods

salamanders are physical trauma (direct impact during aerial release), loss of habitat due to changes in vegetation because of the nitrogen and phosphorus inputs, and direct toxicity. Long term fire retardants (LTFR) are broadcast aerially in long (1-5 mi.), narrow (50 yards) strips on or adjacent to the leading edge of the fire. Larval flatwoods salamander (*Ambystoma cingulatum*) may be adversely affected by the proposed action; however, due to the life history of the species, post-larval salamanders are not likely to be adversely affected. Post-larval flatwoods salamanders leave breeding ponds and move into upland flatwoods sites where they are fossorial (live underground) and occupy burrows (Goin 1950; Ashton and Ashton 2005). Thus, the potential for direct physical trauma and/or exposure to LTFR is minimal. It is assumed that flatwoods salamanders eat small invertebrates that share their fossorial habitat (Goin 1950). As earthworms are their only known prey, and earthworms are also fossorial, we would not expect flatwoods salamanders to be exposed to LTFR through the food chain. Concerning LTFR effects on flatwoods salamander habitat, we considered this to be a pulsed event occurring over a relatively small area. In aquatic and terrestrial habitats, short term vegetative changes are likely to occur. In aquatic habitats, increased plant growth may lead to eutrophication. However, because of the small area affected and loss of LTFR through volatilization, adverse effects on flatwoods salamanders due to vegetative changes in both aquatic and terrestrial habitats would be minimal. During the breeding season (late September through December), adults migrate to breeding sites (ephemeral wetlands and ponds) during rains associated with passing cold fronts, where breeding and egg deposition occurs (Means 1972; Palis 1997; Safer, 2001). In the unlikely event that LTFR is directly applied to a breeding pond during the breeding season, the amount of LTFR (2000 pds/ac) would likely smother the eggs and larvae. The temporary ammonia concentration in the wetland would be toxic to larval life stages. In a worst case scenario, one year of reproduction in the breeding pond would be lost.

Conclusions:

Because the flatwoods salamander has not been documented on Alabama National Forests, and the low probability LTFR use on AL National Forests (fire retardant is not used in Alabama (Dagmar Thurmond, pers. comm. 2008), it is unlikely that the proposed action would affect the species in Alabama. After reviewing the current status, location, and likely effects regarding the use of LTFR on the Osceola and Apalachicola NFs in Florida, and the Francis Marion National Forest in South Carolina, the Service concludes: 1) the fossorial nature of flatwoods salamanders during their terrestrial phase reduces the probability of direct physical trauma and/or exposure during LTFR application; 2) the vegetative impacts resulting from the application of LTFR are expected to be limited to relatively small areas and have minimal impacts; 3) there is a low probability of a direct drop of LTFR on an ephemeral wetland during the breeding season because LTFR is rarely used in the National Forests in Florida, and breeding occurs during the rainy season which coincides with low fire risk. Although it has not been used since 2004, aerial application of fire retardant has been used with some frequency on the FMNF in South Carolina (Bill Toomey, Fire Management Officer, FMNF, pers. com. 2008). When used, aerial application of fire retardant has mostly been applied in March or April, with occasional use in May or June (Bill Toomey, pers. com. 2008). The timing of this application coincides with the flatwoods salamander larval stage, when the salamander is more vulnerable to chemicals. In a worst case scenario, direct application of LTFR to a breeding pond during the breeding season would result in the loss of one year of reproduction. However, because the flatwoods

salamander and proposed critical habitat for the salamander is known from 10 distinct areas (proposed critical habitat units) covering 21,728 ac on the Apalachicola NF, and 59 extant populations rangewide, the loss of one ponds' reproduction for one year is not likely to result in population level effects to the flatwoods salamander. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the flatwoods salamander or adversely modify or destroy its proposed critical habitat.

Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*) and Chiricahua leopard frog (*Rana chiricahuensis*)

Effects analysis

The sensitive aquatic habitats occupied by the Chiricahua leopard frog and or Sonora tiger salamander are often very small and may not be recognized as "waterways" or important aquatic sites (e.g. Stock tanks, metal cattle tanks, springs) and may receive direct applications of fire retardants. Stagnant aquatic sites with little or no water flow to dilute the retardant would have a greater adverse effect on the frogs and salamanders, including mortality of individuals due to changes in water quality or loss of prey.

Although research is inconclusive, it is anticipated that there will be some adverse effects on tadpoles and gill-breathing tadpoles, especially in stagnant waters, including direct mortality and loss of prey items as a result of chemicals being more concentrated. Chiricahua leopard frogs and Sonora tiger salamanders inhabiting streams will be less likely to be adversely affected by fire retardant entering those systems due to dilution from the water flows during and after fire suppression actions. Dilution of the fire retardant chemicals by streams will be less likely to affect the aquatic invertebrates that these species rely on for food, and water quality (dissolved oxygen, ph, connectivity, etc.) Should not change to levels considered toxic to aquatic vertebrates (Labat Environmental 2007; Norris, Lorz, and Gregory 1991).

Both of these species are limited in distribution and can be very susceptible to localized applications of fire retardant. Sonora tiger salamanders occur only in stock tanks in the San Rafael Valley in southeast Arizona. On Forest Service lands, these tanks occur on the Coronado National Forest. Several of these stock tanks occur in obstructed waterways and may not be visible to pilots, making them more susceptible to retardant drops; however, close coordination with the Coronado National Forest has resulted in local Forest Service and Fish and Wildlife Service biologists working with fire crews to avoid retardant drops near these tanks, thus reducing the chances of a direct drop on the tanks or drops within close proximity. Chiricahua leopard frogs have a range that includes both Arizona and New Mexico, including genetically distinct populations along the Mogollon Rim in Arizona and New Mexico and in southeastern Arizona (Goldberg *et. Al.* 2004). Within the range of the Chiricahua leopard frog, populations are highly fragmented and declining (USFWS 2007). Direct retardant drops within streams and stock tanks may also occur as several of these areas are not easily visible from the air. Close coordination with local pilots and resource advisors during wildfires has been able to minimize these risks in the past and should continue to minimize them on future wildfires.

Conclusion

After reviewing the current status of the Chiricahua leopard frog and Sonora tiger salamander, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of either species. No critical habitat is designated for these species, thus none will be affected. Our conclusion of “no jeopardy” is based on the following:

- 1) Close coordination with local resource advisors during wildfires will reduce the risk of retardant being dropped directly within and in close proximity to stock tanks and streams containing Chiricahua leopard frogs and Sonora tiger salamanders.
- 2) Following the 300- foot buffer established in the April 2000 *Guidelines for Aerial Application of Fire Retardant and Foams in Aquatic Environments* should prevent fire retardant from entering waterways.
- 3) Runoff of fire retardant into waterways from applications within the 300-foot buffer has been shown to have minimal effects on aquatic species.

Wyoming Toad (*Bufo baxteri*)

Effects Analysis

The proposed action is expected to have minor or no impacts to the Wyoming toad. If fire retardant were to be dropped on individuals of the species, they might be adversely affected. However, no Wyoming toads are located on USFS property. One reintroduction site on private lands is within a few miles of Medicine Bow National Forest and is adjacent to the Little Laramie River downstream of the National Forest. Over the past six years, the Medicine Bow and Routt National Forests combined have had very limited use of fire retardants, averaging only one aerial application of fire retardant per year and no more than two in any given year (USFS unpublished data). In addition, the flow of water to the habitats where the Wyoming toads occur are controlled and these flows are typically of limited duration. In the event a retardant drop occurred in the National Forest that impacted the Little Laramie River, the land manager at the reintroduction site could close off the flow of water to the toad habitats. Only rarely would extreme events during periods of high water levels result in uncontrolled flows from the Little Laramie River to the areas where the reintroduced toads occur. The timing of such events (e.g., early in spring in a high water year) is not likely to occur within the fire season. Other National Forest lands are located 15 to 60 miles from where Wyoming toads occur and no potential connection can be made to use fire retardants to the Wyoming toad.

Conclusion

After reviewing the current status of the Wyoming toad and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Wyoming toad.

Our conclusion is based on the following: (1) no Wyoming toads occur on or adjacent to National Forest lands; and (2) the Wyoming toad population closest to National Forest lands is

very unlikely to be impacted by a retardant drop within the watershed because of timing of water flows to the reintroduction site and fire retardant use are unlikely to coincide; 3) controls are in place that could preclude impacts from a contamination event should it occur; and 4) fire retardants have been used infrequently on the Medicine Bow National Forest in the recent past despite active fire seasons. For all of these reasons, we determine that the use of fire retardant is not likely to jeopardize the existence of the Wyoming toad. No critical habitat has been designated for this species; therefore, none will be affected.

Arroyo Toad (*Bufo californicus*)

Although much of the arroyo toad distribution is on National Forest System lands, the potential for retardant drops in arroyo toad habitat is minimized by the 2000 Guidelines that restrict such applications to at least 300 feet from aquatic habitats. Under certain conditions, a fire retardant drop may be necessary over habitat occupied by arroyo toads. In that case, some mortality may occur; however, the supporting documentation provided by the USFS indicates that the chemicals are of relatively low toxicity to amphibians, although prolonged exposure (unlike what animals in the wild may experience) can have moderate effects on developing amphibian eggs and embryos. Because the arroyo toad is fairly widespread, and because fire retardant drops are supposed to avoid aquatic systems, the species is unlikely to be taken in numbers that would reduce appreciably the likelihood of the species' survival and recovery in the wild. Ground disturbance during fire fighting has proven to be more detrimental.

Red Hills Salamander (*Phaeognathus hubrichti*)

The proposed action is expected to have little to no impact to the Red Hills salamander. The Red Hills salamander is endemic to a narrow belt in south central Alabama known as the Red Hills, approximately 100 km from the nearest Forest Service lands (the Oakmulgee District of the Talladega National Forest). A single specimen found in Wilcox County in 2006 is approximately 80 km to the south of the Oakmulgee Ranger District (Mirarchi, et. al 2004b). While this suggests the salamander may have a wider distribution than was formerly known, there is no indication that the salamander exists on or in proximity to Forest Service lands, and it is highly unlikely that the species will be impacted by the proposed action. Were it to occur on Forest Service lands, fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008).

There is no designated critical habitat for the Red Hills salamander, thus, there will be no effects.

Conclusion

After reviewing the current status of the Red Hills salamander, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Red Hills salamander. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the Red Hills salamander is not found on or in proximity to National Forest lands, US Forest Service fire managers in Alabama have never used

fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Cheat Mountain salamander (*Plethodon nettingi*)

Monongahela National Forest
Effects ANALYSIS

The Cheat Mountain salamander (*Plethodon nettingi*) is a small woodland salamander that is found in high elevation (above 2,980 feet MSL) red spruce and mixed deciduous forests that have relatively high humidity, moist soils, and cool temperatures (USFWS 1991). There are approximately 80 populations spread throughout an estimated 700 square-mile area of West Virginia that includes portions of the Monongahela National Forest (MNF) (Dr. Tom Pauley, Marshall University personal communication).

The proposed action is expected to have minor impacts to the CMS. If fire retardant were to be dropped on individuals of the species, they might be adversely affected. However, the probability that fire retardants would be used in CMS habitats is extremely low. The species occurs in cool, moist, forested habitats with large, emergent rocks or boulder fields of small rocks (USFWS, 1991; Dr. Tom Pauley, Marshall University, personal communication). These areas are not likely to carry a fire which would need fire suppressant.

Furthermore, under current conditions, large-scale forest fires occur infrequently on the MNF. Between 1997 and 2007, approximately 105 wildfires were reported on the MNF. The frequency of fire occurrence has ranged from 3 to 19 being reported in one year. The majority of these fires were estimated to be between 2-10 acres in size. The largest fire to occur within that time period was in 2002 and was approximately 90 acres. (Dan Arling, USFS, personal communication). These fires have affected only a fraction of this 919,000-acre National Forest. The overwhelming majority of these fires occurred in fire dependent ecosystems (oak) found on the MNF. Fires occur less frequently in the northern hardwoods and infrequently in upper elevation northern spruce communities.

Fire return intervals range from 7-15 years on dry oak sites to about 100 years on moister red oak/white pine sites (Schuler & McClain. 2003). The fire return interval for northern hardwoods and spruce is estimated to exceed 200 years, with some information indicating 650 or more years (Lorimer & Allen. 2003). Thus the likelihood of fires occurring in habitats occupied by CMS is extremely low. This probability is lessened even further in that fires in these habitats are typically small and would not require the use of retardant.

When forest fires do occur on the MNF, it is generally not practicable to use fire retardants. The closest fire retardant tanker locations to the MNF are in Knoxville, Tennessee or Asheville, North Carolina. In most cases, this distance makes it unfeasible to access fire retardants within an appropriate response time. Rather, fire control is typically accomplished through the use of local water supply sources, and the construction of fire breaks and other physical barriers. A review of MNF files revealed only one instance in the last 6 years where fire retardants were used. It is believed that this was a situation where the drop did not actually occur on MNF

properties, but where fire control activities were coordinated with the MNF (Dan Arling, USFS, personal communication).

In addition, the MNF has already established measures to ensure that potential impacts to listed species are addressed during fire management activities. Standard FM12 of the 2006 MNF Land and Resource Management Plan (LRMP) states: “A prescribed burning plan must be prepared and approved prior to using prescribed fire as a management tool. The plan shall address protection or maintenance of TEP species and habitat, cultural resources, watershed resources, air quality, private property, and other resources or investments as needed or appropriate.” The Service’s Programmatic Biological Opinion on the LRMP includes a reasonable and prudent measure to ensure that the MNF will coordinate with the Service to develop any appropriate site-specific measures to avoid and minimize impacts associated with fire activities.

Conclusion

After reviewing the current status of the CMS and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the CMS. No critical habitat has been designated for this species; therefore, none will be affected. Our conclusion is based upon the following: 1) CMS occur in habitats that are not likely to carry forest fires; 2) the scope and frequency of fires on the MNF is limited overall; 3) fire retardant use on the MNF is extremely rare; and 4) the MNF and the Service have established procedures to minimize impacts to listed species as a result of fire management activities. As a result of these factors, we determine that the use of fire retardant is not likely to jeopardize the existence of the CMS.

California Red-legged Frog (*Rana aurora draytonii*) (CRF)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDDB) indicated 971 occurrences for this species, with the majority of these in the central coast area and scattered observations in the Sierra Nevada Mountain Range (CNDDDB 2007). Ten occurrences are on Forest Service lands and fifteen occurrences are within 1 mile of Forest service lands.

Direct, Indirect, and Cumulative Effects

While CNDDDB shows 25 CRF occurrences on or near Forest Service lands, there may be occurrences on Forest Service lands that have not been identified, but could be affected by fire retardant. However, given the distribution of the known 25 occurrences and potential habitat that are in or near Forest Service lands, it is highly unlikely that more than a one occurrence would be impacted by fire suppression activities in any given year.

Toxicity of fire retardant has not been determined for CRF. Given the tremendous amount of variability of susceptibility to toxins between anuran species (per. comm. Gary Fellers, USGS Research Herpetologist), it is hard to predict how toxic fire retardant may be for CRF. Without this knowledge, the conservative approach, erring on the side of the species, would lead us to assume that there may be moderate to significant adverse effects to CRF. Data from other anuran species seems to indicate that the tadpole life stage is most sensitive to fire-retardant, with little to no data on effects to eggs, and data suggesting that adults might become ill but would not

likely die (Calfree and Little 2003). CRF typically lay eggs in December to late March, thus eggs are highly unlikely to be exposed to fire retardant. Tadpoles are present from hatching to ~10 weeks later, most populations have completed metamorphosis by late July. Thus, exposure of tadpoles to retardant would be limited. Most CRF populations are in small ponds, thus retardant would be diluted less than it would in a stream. Given the time for retardant to break down, the effects of retardant should not last more than a single breeding season. Therefore, if a retardant drop were to occur on or adjacent to a CRF occupied water body, the retardant has the potential to kill CRF tadpoles and injure frogs, although the likelihood of this occurring is extremely small.

Conclusion

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, and the effects of the proposed action, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of California red-legged frog. The proposed action would not lead to a substantial decline in number of CRF, a substantial reduction in range of CRF and it would not preclude the recovery of CRF. This conclusion is based on the following reasons: (1) the spatial extent of the species outside the proposed action area is large; (2) the 25 occurrences and potential habitat that are in or near Forest Service lands are geographically dispersed; (3) effects of a retardant drop would be short term (single season); and (4) the likelihood of a retardant drop hitting an occupied water body is extremely low.

Mississippi Gopher Frog (*Rana capito sevosa*)

Distribution and Status.

The Mississippi gopher frog was listed in December 2001 as a Distinct Vertebrate Population Segment (DPS). The Mississippi gopher frog DPS was defined as those populations of gopher frogs in the lower coastal plain ranging from the Mississippi River in Louisiana to the Mobile River delta of Alabama (U.S. Fish and Wildlife Service 2001). Historically, the Mississippi gopher frog DPS occurred in at least nine counties or parishes in the States of Alabama, Mississippi, and Louisiana (U.S. Fish and Wildlife Service 2001). Today it is known from only three sites in two counties in Mississippi.

The only breeding site known at the time of listing (Glen's Pond) occurs on the DeSoto National Forest in Harrison County, Mississippi. Subsequent to listing, potential habitat throughout the historic range of the frog (Florida parishes in Louisiana, coastal Mississippi counties, and coastal Alabama west of the Mobile Basin) has been searched extensively for additional breeding populations. In 2004, Mississippi gopher frogs were found at two other ponds sites, named McCoy's Pond and Mike's Pond, in Jackson County, Mississippi.

Habitat destruction and degradation are considered the primary factors in the decline of the Mississippi gopher frog.

Critical habitat. No critical habitat has been designated for this species.

Direct Effects

There are two primary ways that waterways containing the Mississippi gopher frog could be exposed to fire retardants. One is through the intentional application of retardants—a planned release across a waterbody or immediately adjacent—and the other is through the accidental drop or spill during aerial application or during on-the-ground activities. By following the 2000 Guidelines, the USFS may still drop fire retardants into bodies of water, both visible and out of sight. One of the USFS's obligations is to protect resources of value that are found on USFS lands. The Incident Commander uses the WFSAs as a tool to find multiple alternatives for fighting fires in a particular area, taking listed species and their critical habitat into account, along with other important USFS resources. If the Incident Commander, after reviewing the WFSAs alternatives, determines aerial application of fire retardant adjacent to a waterway is necessary, then even with the 2000 Guidelines in place, the USFS could drop fire retardant into and adjacent to waterbodies.

While the 2000 Guidelines are flexible, and allow for the Incident Commander to make exceptions to conduct a drop that would expose a waterbody to retardants, according to the USFS no exceptions have been taken since institution of the Guidelines. Nonetheless, the USFS is unable to assure that fire retardant will stay out of streams.

Furthermore, the 2000 Guidelines only address visible water, so if water were not visible from the airplane at the time of the drop, it would not be reported. We expect that in most instances the frog ponds would be visible.

Fire retardant is designed to perform in several ways: to stay together during the drop from high up so that it all hits in the same general area, to cling to what it hits initially, and in some cases is thinned to drip through branches to the ground. The mix ratios of many formulations are variable so that the retardant can be more or less concentrated so that the appropriate application can be achieved in different environments.

We expect that runoff is particularly problematic and extensive in areas of recently disturbed riparian vegetation, areas without riparian vegetation, and areas of incomplete retardant coverage that burn but leave behind retardant.

Any rain event that happens within three weeks after application to the riparian area poses a risk of introducing lethal levels of ammonia to a waterbody, potentially after any sort of monitoring had been conducted and after the effects to listed aquatic species had been analyzed. The southeastern woodlands experience a fire return frequency of less than 35 years, but the severity is low or mixed. This means that most often, under natural conditions, there are just surface fires. Severe fires are rare in the southeast, and due to the climatic conditions, the use of fire retardant is expected to be extremely rare. If retardant has to be used in southern hardwood forests, the necessary coverage is only two gallons per 100 square feet, but there are no assurances that more retardant would not be used during a large fire.

Fire retardants are nitrogen based and when they hit the water and break down, the retardants eventually become nitrogenous nutrients. Eutrophication can be a significant problem and can impair light penetration, submerged vegetation, and nursery habitat. The application of nutrients into these waters could lead to shifts in phytoplankton composition. Increased nutrients can also impact food resources, such as macroinvertebrate abundance and macroinvertebrate species composition.

Conclusion

The USFS guidelines establish a 300-foot buffer on either side of waterbodies on USFS land, beyond which the USFS assumes long-term retardant application has no effect on listed aquatic species. The Service concurs with that assumption; however, direct application of fire retardant chemicals to Mississippi gopher frog ponds could cause a total loss of the species in that location.

Since specific emergency actions and the scope of USFS' response to those emergencies cannot be predicted, it is not possible to identify specific take that would occur.

After reviewing the current status of the Mississippi gopher frog, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's opinion that the project, as proposed, is not likely to jeopardize the continued existence of this species.

REPTILES

New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*)

The New Mexico ridge-nosed rattlesnake (NMRN) is a small, montane species, one of five ridgenose rattlesnake subspecies known from the southwestern U.S. and western Mexico. The NMRN rattlesnakes currently occur in only three known populations; the Animas Mountains in southwestern New Mexico, Peloncillo Mountains in southwestern New Mexico and southeastern Arizona in part on the Coronado National Forest, and the Sierra San Luis in Sonora and Chihuahua, Mexico. In the U.S., the largest known population occurs in the Animas Mountains. The species was not discovered in the Peloncillo Mountains until 1987; since then, 27 individual snakes have been documented within 13 general areas of the Peloncillo Mountains running from upper Miller Canyon at the southern end of the range to South Skeleton Canyon at the northern end. The Peloncillo Mountains population is the smallest of the three known populations, and is the least dense (USFWS 2001).

New Mexico ridge-nosed rattlesnakes are found in steep, rocky canyons with intermittent streams and on talus slopes at elevations ranging from approximately 5,500 to 8,500 ft (1, to 2,591 m) in the Animas Mountains and 5,000 ft to 6,200 ft (1,525 to 1890 m) in the Peloncillo Mountains. Access to rock shelters with moderate interstitial spaces is probably a key habitat component. At lower elevations in the Peloncillo Mountains, ridge-nosed rattlesnakes probably occur primarily in the bottoms and slopes of steep, heavily wooded canyons (Holycross and

Smith 2001), while at higher elevations they may be found in woodlands, open woodlands, and chaparral on exposed slopes and plateaus (USFWS 2002). In both cases, mature woodlands appear to be an essential habitat element.

Suitable habitat for the rattlesnake also occupies a limited portion of the Peloncillo Mountains. Holycross and Smith (2001) evaluated the physical characteristics of known occurrence sites and from that estimated the existence of 275 core habitat areas. Of those, 232 were ranked as likely to support a rattlesnake population, 13 were not likely to support a rattlesnake population, and 30 had burned in previous wildfires. Additionally, the 2003 Baker prescribed fire had high intensity fire in nine percent of the type 3 and 4 core sites within its boundaries and may have eliminated other core sites in the southwest portion of the range south of the losses from the Maverick Fire. The 232 core habitat areas are scattered across the range and most have never been surveyed for the species, largely due to access issues. Of the 13 sites known to be occupied, one was damaged by the Maverick Fire and may no longer support a population. Eight of the remaining sites are within an aerial mile of each other and are surrounded by other potential sites extending through the mountains.

Threats affecting the New Mexico ridge-nosed rattlesnake and its associated habitat within the action area include illegal collection, wildfires, prescribed fires, and low to moderate levels of recreational activities. Potential threats to the subspecies include fuel wood harvest, mining, improper grazing management, and development (43 FR 34479).

Effects Analysis

Effects of the fire retardants under consideration in this consultation to the NMRN rattlesnake are related to physical effects to individuals that may be hit by a retardant drop and ingestion of chemical residues on prey items.

The period of May through July is the peak fire season in southern Arizona and New Mexico. Rattlesnakes are active on the surface as early as April and as late as October, with a seasonal peak between July and September (USFWS 1985). Individuals are known to be active during daylight and crepuscular periods. During those hours, they may be resting under vegetation (bunch grasses, leaf litter, and downed logs) or rocky cover, thermo-regulating in the open, or hunting. Between June and August, young of the year rattlesnakes are also present on the surface as the live-born young disperse from their birth sites. Individuals may also be in sub-surface dens during these hours, and the percentage of the population vulnerable to retardant drops at any given time is unknown.

The distribution of potential habitat across the Peloncillo Mountains is fairly regular, with core sites in the steep canyons (Holycross and Smith 2001) across the range. The majority of the core sites is in the northern half of the range and has not experienced wildfire in recent years. The topography of the Peloncillo Mountains is such that during a wildfire it is not likely that aerial retardant drops would easily avoid the canyons containing rattlesnake habitat. Few of these

canyons contain any aquatic habitat, so the 300 foot buffer around such areas may not apply to these drainages. However, the denser vegetation in the canyon bottoms may ameliorate the effects of a retardant drop onto the canyon by absorbing the force of the falling retardant before it hits the ground.

Rattlesnakes that are hit by falling retardant may be injured or killed depending on the amount of retardant falling on that location and the amount of protective cover between them and the retardant load. There is limited information on the toxicity of the chemicals in the retardant to reptiles; however, based on toxicity data for other terrestrial species, it is not likely that dermal exposure to the retardant has any significant effect on the individual rattlesnake.

Retardant that does hit the ground may attach as dust onto prey species of the rattlesnake, particularly on small mammals where it may be caught on the fur or lizards where it may be caught between the scales. There may also be an exposure through prey items that have eaten contaminated insects or vegetation that were covered in retardant by the drop. The extent to which retardant reaches the ground in densely vegetated areas is low in comparison to more open areas which are less used by rattlesnakes. In studies done by Labat Environmental (2007), the toxicity of formulated products was slight to very slight for rats and mice although there was an increasing risk of mortality at retardant coverage levels of greater than 2 gallons per 100 square feet. This rate of application was posited as being used in vegetation communities for Arizona (Labat Environmental 2007). Therefore, exposure to retardants may increase the rate of mortality among prey species, or debilitate them to the extent they are more vulnerable to predation by rattlesnakes. Rattlesnakes may also consume freshly dead prey items, and ingest small mammals that died from exposure to the retardants. The extent of this additional risk is uncertain and likely highly variable due to local conditions including the density of rattlesnakes in the area, the extent of the small mammal die-off, and the availability of carcasses to the snakes. There may be a longer-term effect to local rattlesnake populations if the small mammal or lizard populations crash as a result of retardant-related mortality.

Information on the toxicity of retardants and associated chemicals on reptiles are lacking, so effect of eating contaminated prey items is unknown. The risk would be to the individual rattlesnakes in the areas affected by retardant and could range from illness and temporary debilitation to death. In any one year, it would not be expected that extensive areas would be subject to retardant drops. The toxicity of the retardant quickly decays, and the small mammal and lizard populations would rebound quickly after the initial event. It would be unlikely for all rattlesnakes in a core habitat area to be lost due to ingestion of toxic prey items, and it would be expected that populations would recover. The proposed action does not have a defined time period under which the Guidelines would be in place; however, given the number and distribution of NMRN rattlesnake habitats in the Peloncillo Mountains, the use of aerial fire retardant over a period of years is not likely to pose a significant threat to the population.

In summary, there is a risk of injury or death to individual NMRN rattlesnakes from the application of fire retardant on their habitats. The extent of this risk is difficult to quantify; however, we believe it is not significant. It is important to note that NMRN rattlesnakes may be directly killed by fire in their habitats, and that their suitable habitats may be significantly affected by uncontrolled wildfire such that long-term habitat loss is the result. The potential for

habitat loss from uncontrolled wildfires is a greater concern for the species than the potential for loss of individual rattlesnakes due to retardant. The extensive expanse of core habitat areas provides multiple replicates of local populations to re-occupy areas that may be affected by retardants.

Conclusion

Based on the status of the species in the Action Area and the potential effects of the action on the NMRN rattlesnake, it is our biological opinion that the implementation of the use of aerially applied fire retardant on Forest Service lands is not likely to jeopardize the continued existence of the NMRN rattlesnake. Critical habitat is not located on Forest Service lands; therefore it would not be affected by the proposed action.

Our determination is based on the following considerations:

1. Only one of the three populations of the NMRN rattlesnake could be affected by the proposed action. While the population is considered the smallest of the three, the low density of rattlesnakes in the habitat reduces the risk that a significant portion of the population could be affected by retardant drops associated with a particular fire or fires over a span of years.
2. The core habitats of the rattlesnake in the Peloncillo Mountains are distributed across the landscape with no particular concentration. This distribution also reduces the risk of a significant portion of the potentially available habitat for the population being affected by retardant drops associated with a particular fire.
3. Rattlesnakes are surface active during the fire season, however, they prefer wooded habitat in canyons and while on the surface, is often associated with some additional form of ground cover. A retardant drop on vegetation is broken up by the vegetation such that the force hitting the ground is reduced. Additional cover on the ground further protects the rattlesnake from injury.
4. Toxicity of the retardant chemicals to prey species of the rattlesnake is not extreme and long-term contamination of the prey base is not likely to result. While individual rattlesnakes may be affected by the ingestion of contaminated prey items, the status of the overall population would not be impaired.

Eastern Indigo Snake (*Dymarchon corais couperi*)

Effects Analysis:

This section includes an analysis of the direct and indirect effects of the proposed action on the indigo snake within the Apalachicola, Osceola and Ocala National Forests in Florida. The proposed action is expected to have little to no impact to the eastern indigo snake in South Carolina, Alabama or Mississippi National Forests. The eastern indigo is now found naturally only in South Georgia and Florida, with an unknown number occurring on or in proximity to National Forest lands in Florida; the species is likely extirpated from Alabama, Mississippi, and South Carolina (Mirarchi, et. al 2004b). The eastern indigo has not been found on National Forest lands in Georgia.

Because limited location data is available for indigo snakes on Apalachicola, Ocala and Osceola NFs, we assumed all suitable habitat in the action area to be occupied (USFWS 1999). The anticipated effects of the proposed action on indigo snakes are physical trauma (direct impact during aerial release), loss of habitat due to changes in vegetation because of the nitrogen and phosphorus inputs, and direct toxicity. Long term fire retardants (LTFR) are broadcast aerially in long (1-5 mi.), narrow (50 yards) strips on or adjacent to the leading edge of the fire. The relatively small area of habitat receiving applications, along with the fossorial habits and low densities of the species, reduce the probability of direct impacts during aerial application of fire retardants. Concerning LTFR effects on indigo snake habitat, we considered this to be a pulsed effect occurring over a relatively small area of habitat. Short term vegetative changes are likely to occur; however, because of the small area affected and loss of LTFR through volatilization, the adverse effects on indigo snakes due to vegetative changes would be negligible.

The toxic effects of direct exposure to LTFR were assessed using a risk-based approach. First, the estimated amount of prey an indigo snake consumes in a day is 0.02 (g prey/ g BW snake per day) (EPA 1993, p.2-412). Second, 0.02 (g prey/g BW snake per day) was multiplied by 0.000135 (g fire retardant prey/g prey) to give 2.7 (μg fire retardant/g BW indigo snake), which is the average daily dose of fire retardant received by a indigo snake, assuming all prey are equally contaminated. The exposure concentration of 2.7 (μg fire retardant/g BW indigo snake) was divided by 500 (μg fire retardant/g BW rodent) (LD_{50} for rodent; Labat 2007, p. A-3) and resulted in a risk quotient of 0.005, which is less than 0.1, indicating a low probability for acute mortality.

Conclusions:

After reviewing the current status, location, and likely effects regarding the use of LTFR, the Service concludes: 1) low densities, along with the fossorial nature of indigo snakes reduces the probability of direct physical trauma during LTFR application, 2) the adverse effects on indigo snakes due to vegetative changes would be negligible, and 3) the probability of acute mortality due to exposure to LTFR is minimal. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the indigo snake.

Blunt-nosed Leopard Lizard (*Gambelia silus*)

Environmental Baseline

As of 2007, the California Natural Diversity Database (CNDDB) showed 298 occurrences for this species throughout the San Joaquin Valley. The species inhabits open, sparsely vegetated areas of low relief on the valley floor and the surrounding foothills. It also inhabits alkali playa and valley saltbush scrub. In general, it is absent from areas of steep slope or dense vegetation. Of the 298 occurrences, only four are on Forest Service land (Los Padres National Forest). There are three known occurrences adjacent to Forest Service lands.

Direct, Indirect, and Cumulative Effects

Given the general habitat occupied by the blunt-nosed leopard lizard, the use of fire retardant in these areas would be highly successful in the suppression of wildfires and therefore likely to be

applied aerially. However, the distribution of known occurrences of the blunt-nosed leopard lizard on Forest Service lands and the general size and scope of wildfires in California, it is highly unlikely that more than two known occurrences would be impacted by fire suppression activities in a given year.

The direct effects of fire retardant on reptiles have been poorly documented and not thoroughly addressed. Because information is lacking, in order to err on the side of the species, we assume that fire retardant will result in the direct injury and potential mortality of individual blunt-nosed leopard lizards.

Fire retardant has been demonstrated to result in the mortality of insects (Poulton et al. 1997) which constitute the primary food base for the leopard lizard (USFWS 2007). If a retardant drop occurs near an area occupied by the blunt-nosed leopard lizard, we anticipate that the reduced prey base may affect the feeding success of the lizard. Poulton et al. (2007) demonstrated that the ingestion of fire retardant by birds did not result in mortality. Since the distribution of the retardant will be limited, and nearby areas will be available for foraging, we anticipate effects of reduced food availability to be temporary.

Conclusion

After reviewing the current status of the blunt-nosed leopard lizard, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the Aerial Application of Fire Retardant using *Guidelines for Aerial Delivery of Fire Retardant or Foam Near Waterways* (2000) Project, is not likely to jeopardize the continued existence of blunt-nosed leopard lizard. The proposed action would not lead to a substantial decline in number of lizards, a substantial reduction in range of the lizard, and it would not preclude the recovery of the lizard. This conclusion is based on the following reasons: (1) the spatial extent of the anticipated effects is small in comparison to the species' current distribution in the action area; and (2) the spatial extent of the species outside the proposed action area is large.

Desert Tortoise (*Gopherus agassizii*)(Sonora pop.)

This species does not occur on FS lands.

Gopher Tortoise (*Gopherus polyphemus*)

Effects of the Action

The direct and indirect effects of the exposure of gopher tortoises to long-term fire retardants, foams, and water-enhancers when, applied for fire suppression in DeSoto National Forest, is not likely to be biologically significant for several reasons.

First, wildland fire-fighting chemicals are rarely used in DeSoto National Forest, and when applied, the aerial extent has been limited from ground equipment (Jay Boykin 2008, pers. comm.). An air tanker has never been used, and a helicopter has only been used once. These limited applications reflect the structure and condition of forest habitat, which the Forest Service

manages by periodic prescribed fire (2-5 year fire intervals). DeSoto National Forest is part of the longleaf pine ecosystem where frequent and low-intensity ground fire naturally and historically regulated forest structure and composition. Under natural conditions, the longleaf pine forest is open, with a sparse understory of shrubs, and a well developed and species rich grassland. Today, stands with these conditions exist in DeSoto National Forest as a result of management, typically with Condition Class 1 and Fuel Model 2. However, past management practices including infrequent prescribed fire and conversion to off-site pine have created unnatural conditions in some stands, with an encroachment of shrubs and hardwoods in the understory, and heavier fuel loads, typically a Fuel Model 7 (southern rough) in Condition classes 1 – 3.

These departures are not the Forest Service's desired future conditions. Longleaf pine ecosystem restoration and management programs recently have either been initiated or accelerated in DeSoto National Forest, with an objective to restore stands to longleaf, usually with a Fuel Model 2, Condition Class 1 (e.g. U.S. Forest Service, 2005). These objectives are intended to restore and maintain habitat for the gopher tortoise (threatened), red-cockaded woodpecker (endangered), reduce hazards in the urban interface, and accomplish other resource objectives. Desired future conditions for these stands are represented by a Fuel Model 2, Condition Class 1. These conditions will be attained by a program of frequent prescribed fire, thinning, and herbicide treatments to shrubs and hardwoods where ground fuels have become inadequate for a killing fire.

Prescribed fire, as well as wild fire, in the well-managed longleaf pine stands (Fuel Model 2, Condition Class 1) normally has been controlled without fire-fighting chemicals. Similarly, fire in other stands with southern rough conditions (Fuel Model 7), while more intense, remain predominately as ground-fire, and have been effectively managed without retardants, foams, or water enhancers. These agents have only rarely been used in the past, and are expected to be used only rarely in the future under unusually extreme conditions. Following Hurricane Katrina, for example, heavy fuel loads from down timber required a local application during a prescribed fire to reduce hazards.

Secondly, forest habitat conditions where fire-fighting chemicals may be needed under unusual conditions normally are either unsuitable or poor for the gopher tortoise. These forests most likely are closed or nearly closed, with a heavy understory cover of shrubs or hardwoods, and a poorly developed herbaceous plant stratum. Gopher tortoises are rare or absent in this habitat, preferring instead the open pine forests with a well-developed herbaceous plant layer. Thus, the likelihood of using fire-fighting chemicals is very low, and when used the probability of exposing tortoises is very low because of the forest habitat types treated.

Nevertheless, gopher tortoises do in fact reside in poor habitat, especially when more suitable habitat is not available due to past management effects creating departures from desired habitat, fuel, and fire conditions. In these conditions, tortoises will tend to occupy very small, open patches, including open roadsides or other rights-of-way. It is possible that tortoises in these conditions could be exposed to fire-fighting chemicals, although the probability is still low because of the infrequent nature of such applications. Even so, the likelihood of any actual dermal exposure to tortoises is further reduced by the fact that most of the body is covered by an

impervious shell, and tortoises spend the vast majority of time in their underground burrows. In addition to protection from predators, tortoises use their burrows for thermoregulation, avoiding cold as well as hot above ground temperatures. Extreme conditions when the rare use of fire-fighting chemicals would be required would most likely occur during summer drought. At that time, gopher tortoises usually have a short diurnal daily cycle of above-ground feeding activity, if at all, early in the morning and later in the afternoon to avoid daytime heat, for no more than a total of about two hours.

In the unusual event of an actual exposure to fire-fighting chemicals, the primary route most likely would be oral, by the consumption of contaminated herbaceous forage plants. No data is available for a risk assessment specifically for the gopher tortoise and in this habitat, based on chemical application rates of about 6 gallons per 100 ft² in southern rough, deposition rates, residue concentrations of chemicals on herbaceous vegetation, the amount of residue consumed for acute and chronic doses, and the toxicity of the dose. The best available data are limited to other herbivores from the ecological risk assessment for fire-fighting chemicals (Labat Environmental 2007), based on models with deer, deer mouse, rabbit, and cow. The deer mouse models assumed 50 percent of the diet was contaminated, with the total daily dietary intake (kg) equal to about 20 percent of an individual's body weight. This created the greatest dose exposure, per kg of body weight for any of the herbivores modeled. The reference dose for toxicity comparison was an acute oral LD₅₀, when 50 percent of the test animals (mammals) died, for compounds with dose values of less than 500 mg/kg.

The computed hazard quotients (Labat Environmental 2007) for the modeled deer mouse ranged from 0.1 to 0.6 for the salt in 10 fire retardants when applied at 2 – 6 gallons per 100 ft² (gpc), and 0.5 for a reactant at 4 gpc. Thus, modeled doses of exposure were from one-tenth to six-tenths the acute LD₅₀ reference dose. Labat Environmental considered these doses and exposures for sensitive species to represent a toxicological and ecological risk. However, the precise nature of the risk and consequences is uncertain.

We consider the estimated dose to the deer mouse in these models as conservative (high), because the daily diet of the gopher tortoise probably constitutes a much smaller portion of its body weight. The Service during 2003 completed a risk assessment workshop for the use of herbicides in longleaf pine habitat restoration programs designed to benefit the gopher tortoise. The gopher tortoise daily diet was estimated at 5 percent of body weight, which was considered a conservative. Thus, the deer mouse model with a daily dietary intake equal to 20 percent body weight in the Forest Service's risk assessment for fire-fighting chemicals probably overestimates the dose by ingestion by a gopher tortoise. Labat cited the small mammal field studies by Vyas et al. (1997), where there were no detectable effects after an application the retardant Phos-Check G75 at a rate of 3 gpc. It would appear that the fire-fighting models are conservative.

While there is a possibility that exposed could be experience sublethal or even lethal doses, the number of tortoises likely exposed on DeSoto National Forest would be an insignificant number. Estes and Mann (1996) concluded that the total number of gopher tortoises in the federally listed range in Mississippi probably exceeds the upper range of 13,986 tortoises originally estimated from line-distance surveys by Lohofener and Lohmeier (1984). Their conclusion was based on the results of earlier surveys on Camp Shelby and DeSoto National Forest, and the fact that their

survey of Mississippi 16th section lands represented only about three percent of the land in the listed range of the tortoise. Also, the survey and estimates by Lohoefener and Lohmeier (1984) were concentrated on deep, sandy (priority) soils, while later surveys were not limited to habitat with these soil types. From other more recent surveys, a substantial number of tortoises are now known on other non-priority soils (e.g. Wester 1995, 2005; Jones et al. 1995; Estes and Mann 1996; Epperson and Heise, 2001). These major and other surveys indicate at least 20,000 gopher tortoises occur in the listed range. The greater number of tortoises known today, relative to that estimated when federally listed (Lohoefener and Lohmeier, 1984), reflects the completion of more extensive surveys rather than a natural increase in the total population. While gopher tortoises remain relatively abundant and widely distributed in the listed range, individual population segments are small, fragmented, typically non-viable, and exhibit low reproductive success in poor habitat of declining quality that is insufficient to maintain most existing populations (Wester 1995, 2003, 2004; Wester and Haas 1995; Mann 1995; Estes and Mann 1996; Jones et al. 1995; Smith et al. 1997).

In the reasonably foreseeable future, we would conservatively estimate that no more than 100 tortoises would risk any exposure to fire-fighting chemicals on DeSoto National Forest. This is based on the rare application of chemicals, about once per decade, restricted to about 200 acres of poor to unsuitable habitat.

Conclusion

After reviewing the status of the species, the environmental baseline for the action area, the effects of fire-fighting chemicals, and cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the gopher tortoise. Critical habitat has not been designated for this species.

Sand Skink (*Neoseps reynoldsi*)

Effects Analysis:

This section includes an analysis of the direct and indirect effects of the proposed action on the sand skink within the Osceola and Ocala National Forests in Florida. The Osceola National Forest is outside of the range of this species and does not contain sand skinks or habitat suitable for sand skinks (USFWS 1999); therefore, sand skinks will not be affected on Osceola National Forest. The Ocala NF represents the northern extreme of the species range where they are uncommon but do occur at low densities. Because limited location data is available for sand skinks on Ocala NF, we assumed all suitable habitat in the action area to be occupied. The anticipated effects of the proposed action on sand skinks are physical trauma (direct impact during aerial release), loss of habitat due to changes in vegetation because of the nitrogen and phosphorus inputs, and direct toxicity. Long term fire retardants (LTFR) are broadcast aerially in long (1-5 mi.), narrow (50 yards) strips on or adjacent to the leading edge of the fire. The relatively small area of habitat receiving applications, along with the fossorial habits and low densities of the species, reduce the probability of direct impacts during aerial application of fire retardants. Concerning LTFR effects on sand skink habitat, we considered this to be a pulsed effect occurring over a relatively small area of habitat. Short term vegetative changes are likely

to occur, but because of the small area affected and loss of LTFR through volatilization, the adverse effects on sand skinks due to vegetative changes would be minimal.

The toxic effects of direct exposure to LTFR were assessed using a risk-based approach. First, the amount of insects a sand skink consumes in a day was calculated as food ingestion rate for reptile insectivores ($\text{g/d} = 0.013 \text{ Wt}^{0.773} \text{ (g)}$) (EPA 1993, p.3-7). Inserting 1.2 g as the Wt (BW) of a sand skink (Andrews 1994, p.93) in the equation results in a food ingestion rate of 0.015 g/d. Second, 0.015 g/d was divided by 1.2 g BW sand skink to give 0.0125 g insect/g BW sand skink per day. Third, 0.0125 (g insect/g BW/d) was multiplied by 0.000135 (g fire retardant residue/g insect) to give 1.68 (μg fire retardant/g BW sand skink), which is the average daily dose of fire retardant received by a sand skink, assuming all insects are equally contaminated. The exposure concentration of 1.68 (μg fire retardant/g BW sand skink) was divided by 500 (μg fire retardant/g BW rodent) (LD_{50} for rodent; Labat 2007, p. A-3) and resulted in a risk quotient of 0.003, which is less than 0.1, indicating a low probability for acute mortality.

Conclusions:

After reviewing the current status, location, and likely effects regarding the use of LTFR, the Service concludes: 1) the fossorial nature of sand skinks reduces the probability of direct physical trauma during LTFR application, 2) the adverse effects on sand skinks due to vegetative changes would be limited to relatively small areas, and 3) the probability of acute mortality due to exposure to LTFR is minimal. Based on these conclusions, the Service's biological opinion is that the proposed action is not likely to jeopardize the continued existence of the sand skink.

Shenandoah salamander (*Plethodon shenandoah*)

There will be no effect to the Shenandoah salamander, which is found only within the Shenandoah National Park in Virginia and not on any Forest Service lands.

Flattened Musk Turtle (*Sternotherus depressus*)

The proposed action is expected to have little to no impact to the flattened musk turtle. The flattened musk turtle is endemic to the Black Warrior River system in Alabama and is found within the boundaries of Bankhead National Forest as well as other streams outside of the Forest. It prefers rocky pools of clean, mid-to large-sized streams but has also been found in backwater areas of reservoirs (Mirarchi, et. al 2004b). A direct application of fire retardant to the streams where adult and young turtles are found may have some direct toxic effects, but is more likely to temporarily impact invertebrate prey items such as clams and snails. Fire retardants have never been used on National Forest lands in Alabama, and US Forest Service management does not intend to use retardants in the future (Dagmar Thurmond, USFS biologist, pers. comm. 2008). Because the flattened musk turtle spends nearly all of its time in deeper pools, significant dilution of fire retardant may be expected were it ever to be used near the turtle.

There is no designated critical habitat for the flattened musk turtle; therefore, there will be no effects.

Conclusion

After reviewing the current status of the flattened musk turtle, and the likely effects of the use of fire retardant on National Forest lands, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the flattened musk turtle. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based upon the following: the flattened musk turtle is found in multiple locations within the Bankhead National Forest in deepwater habitats, as well as in several drainages outside of the Forest; also US Forest Service fire managers in Alabama have never used fire retardants in the manner described by the proposed action, and have no plans to do so in the future.

Giant Garter Snake (*Thamnophis gigas*)

The proposed project is outside the known range of the giant garter snake. Because there are no known occurrences of this listed species on or adjacent to U.S. Forest Service lands and the project is outside the range of this species, the Service has determined that the proposed project is not likely to adversely affect the giant garter snake.

MAMMALS

Mexican gray wolf (*Canis lupus baileyi*)

Population that currently occurs in R2 is an experimental non-essential population.

San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*)

Based on the general effects of the action above, there is a low likelihood of toxicological effects to San Bernardino kangaroo rats. Indirect effects such as the promotion of non-native species can adversely affect habitat for the San Bernardino kangaroo rat, but there is limited habitat for this species on Forest Service lands. Only about 3 percent (957 acres) of designated critical habitat occurs on Forest Service lands. Much of this habitat does not contain the primary constituent elements necessary for the San Bernardino kangaroo rat (72 FR 33808). Using refined mapping techniques, only 89 acres on Forest Service lands were determined to have the primary constituent elements for this species and were proposed as critical habitat (72 FR 33808). Although there may be negative effects to critical habitat, these effects are minimal, are not significant and will not destroy or adversely modify critical habitat.

Fresno Kangaroo Rat (*Dipodomys nitratoides exilis*)

The proposed project is outside the known range of the Fresno kangaroo rat. Because there are no known occurrences of this listed species on or adjacent to U.S. Forest Service lands and the project is outside the range of this species, the Service has determined that the proposed project is not likely to adversely affect the Fresno kangaroo rat.

Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*)

While the proposed project is within range of this species, there are no known occurrences of the Tipton kangaroo rat on, or adjacent to, U.S. Forest Service lands. During wildfires, burrowing mammals tend to take refuge underground, thus are not likely to be directly exposed to a fire retardant drop (Smith 2000). Rodents ingesting seeds coated by retardant have not been adversely affected (Labat-Anderson 1994). The application of fire retardant causes an increase in nutrient levels in the soil, leading to increased plant growth (Hopmans and Bickford 2003) which may result in increased seed production (Barbour et al. 1999), the primary food for this species (USFWS 1998). The result of these potential effects is considered insignificant to this species, and therefore, the Service has determined that the proposed project is not likely to adversely affect this species.

Sierra Nevada Bighorn Sheep (*Ovis canadensis*) (SNBS)

The likelihood that the SNBS would be in an area where a fire retardant drop would occur is low. They typically inhabit steep, open terrain, where fire retardant would be of little use. SNBS may be in lowland areas in winter; however, fires are unlikely during that time of year. According to the supporting information provided by the USFS, the fire retardant chemicals may be toxic to ruminants. Therefore, if the chemicals were accidentally dropped on an area where SNBS were located, some individual SNBS could be affected. However, the effect of retardant chemicals on ruminants is related to length and quantity of exposure. We do not anticipate that even if a retardant drop were to occur in SNBS habitat, that the individual animals would experience the quantity and duration of exposure necessary to elicit a toxicological effect.

Woodland Caribou (*Rangifer tarandus caribou*)

Management Framework

The Selkirk Mountains Woodland Caribou Recovery Plan (USDI, 1994), the Colville National Forest Land and Resource Management Plan (USDA, 1988), the Idaho Panhandle National Forest Land and Resource Management Plan (USDA, 1990) (hereinafter referred to as the Forest Plans), and the amended biological opinions for the continued implementation of the Forest Plans (USDI, 2001) all provide direction for caribou management. The Selkirk Mountains Woodland Caribou Recovery Area generally lies above 4,000 feet in elevation in extreme northeastern Washington and northern Idaho. More than half of the recovery area is located in southern British Columbia. There is no direction for managing habitats for caribou outside of the recovery area, although animals that occur there are protected.

The Forest Plans describe seasonal habitats important to caribou and provide prescriptions for managing these habitats in the recovery area. With respect to fire suppression, the management objective is to control all fires that might threaten essential habitats for the caribou. A term and condition in the amended biological opinions for the Forest Plans requires the Forest Service to develop a Fire Action Management Plan that would be incorporated into the revised Forest Plans. An objective in the caribou recovery plan is to “develop fire management prescriptions that emphasize restricting fires to small areas that will not restrict caribou movement or habitat use.” Presently, there is no management direction specifically related to the use of retardant to fight fires in caribou habitat.

Effects Analysis

The potential direct impacts to caribou resulting from retardant drops include: (1) the disturbance associated with low-flying aircraft that could stress animals, disrupt calving, or displace animals to areas of less suitable habitat; and (2) direct hits on animals that could cause injury or death due to the force of impact of the retardant load.

In recent years, large fires that removed or adversely modified suitable caribou habitat within the recovery area included: Hughes 32 (2006), Mankato Mountain (1994), Pass Creek Pass (1994), Ace Creek (1986), Sundance (1967), and Trapper Peak (1967). Aerial retardant drops were used on each of these fires. Aerial fire suppression is a proven, effective method of limiting fire spread. This is particularly true in mountainous terrain where road or trail access for ground-based fire fighting resources is limited. Such terrain is typical throughout the recovery area. Individual caribou in the immediate vicinity of a fire could be disturbed by suppression activities whether retardants are used or not. If retardants were not available for use, incident commanders would likely request water drops from available helicopters or fixed winged aircraft. Water drops are oftentimes not as effective as retardants. The aircraft used for water drops are usually rated for lighter loads than retardant planes. Water is also less effective at smothering flames and reducing the flammability of ground fuels, than retardants. Thus, an incident commander is likely to request a greater number of drops by aircraft carrying water; resulting in a greater potential for disturbance to caribou.

Pregnant female caribou move onto their high-elevation calving ranges in early June. These areas typically contain open stands of subalpine fir (*Abies lasiocarpa*) and spruce (*Picea engelmannii*) with high lichen densities (USDI, 1994). During the calving period, there is likely to be considerable snow cover remaining in these areas and forest fuels are likely to be quite moist. Thus, the risk of fire starts in this habitat during the calving period is slight.

Pilots dropping retardants on a fire initially make a “dry run” in order to size up the fire and determine the best flight path to deliver their payload (personal omm.. With C. Eighme). Caribou in the immediate area may have fled in response to the initial pass, reducing the potential for an animal to suffer a direct hit by a retardant drop. As air operations and other fire fighting activities continue, it would become increasingly more likely that caribou would have moved out of the area. In addition, only 44 caribou were counted during the last survey of the ecosystem in 2007. Currently, the risk of a direct hit by a retardant load on animals at such low densities is quite small.

Potential indirect effects to caribou resulting from retardant drops include: (1) adverse health effects from the ingestion of vegetation or water that has been affected by the retardant; and (2) the beneficial effect of protecting essential habitats that might have been lost to fire.

Environmental risk assessments carried out for seven North American ecoregions indicate that fire retardant chemicals pose minimal toxicological risks to vertebrate species. Only two bird species (the blue jay and wild turkey) and one mammal species (a species of rabbit) appeared to be adversely affected (Labat-Anderson 1996). The fire retardants approved for use with this

proposal are considered by some to be capable of killing livestock by nitrate poisoning. Dodge (1970) stated that drops of ammonium-based fire retardant at rates of 1,000 to 1,200 pounds per acre would cover relatively small areas and would not be capable of causing nitrate poisoning until they move through the soil and into plants. Only special climatic conditions can cause rapid accumulation of nitrates in plants. These include low light levels and high temperatures, or when drought occurs late in the growth cycle. Dodge (1970) concluded that “The possibility of injury to livestock (and other ruminants) from fire retardant materials is very slight – much less than that from a range or pasture fertilization program.”

Habitat for caribou is generally described as mature cedar (*Thuja plicata*)/hemlock (*Tsuga heterophylla*) and spruce/fir forests (USDI, 1994). The fire regime in such wet forest types is characterized as low frequency (100 to 200-year return interval), and high intensity (stand replacing). Dry forests with a high frequency, low intensity fire regime exist in minor amounts in the recovery area. Dry forest stands do not provide essential habitat for the caribou.

Over the past 30 years, large fires removed caribou cover and winter food over portions of the recovery area. These habitat losses were cumulative to those resulting from timber harvest prior to the active management of caribou habitat. Thus, there is now “additional pressure on unaffected habitat to support caribou recovery and other multiple use needs” (USDI, 1994). The retention of suitable timber stands for caribou is a recovery objective for the Selkirk Mountains herd. Given the propensity for these stand types to experience hot crown fires, the application of aerial retardant is one of the best tools available for protecting the stands from fire.

Conclusion

After reviewing the potential direct and indirect effects of the proposed action on woodland caribou, it is the Service’s biological opinion that the continued use of aerial ammonium-based fire retardants, as proposed, is not likely to jeopardize the continued existence of the species or result in destruction or modification of critical habitat (none has been designated). The basis for this finding is that ammonium-based retardant applications are an effective tool for preventing the loss of suitable habitat to fires. Wholesale loss of habitat poses a much greater risk to the species than any potential adverse effects associated with the use of retardants, including disturbance and displacement of animals, direct hits on animals, and toxicity issues. The potential for caribou to experience adverse effects from the proposed action is small and further reduced by operational standards and the completion of a Wildland Fire Situation Analysis by Forest staff that considers ways to avoid and minimize the effects of fire suppression activities on listed species.

Northern Idaho Ground Squirrel (*Spermophilus brunneus brunneus*)

Management Framework

The Boise, Payette, and Sawtooth National Forests (NFs) share common forest-wide direction for managing habitat for the northern Idaho ground squirrel (NIDGS) (Chapter III, Payette NF Land and Resource Management Plan 2003). The probable historical distribution of the species includes the Boise and Payette NFs, with the majority of known occupied habitat occurring on the Payette NF. The Boise NF contains substantial potential habitat for this species based on

habitat modeling, and the Final Recovery Plan for the NIDGS identifies these areas as important for recovery as well (R. Vizgirdas, USFWS, pers com.).

After the initial attack on a fire, a Wildland Fire Situation Analysis (WFSA) is completed by Forest staff that considers ways to avoid and minimize the effects of fire suppression activities on listed species, such as the NIDGS. In this case, a WFSA would likely include a provision to locate all incident bases, heli-bases, staging areas, and other centers for incident activities outside of known NIDGS-occupied habitat. Exceptions to this direction would be made when the line officer or designee determines that the only suitable location for these activities would be within occupied NIDGS habitat, or when locating these activities within occupied habitat is necessary to protect human safety or structures. The Payette NF has site-specific management direction for the NIDGS in Forest Plan Management Areas (Mas) 2 and 3. This direction includes the following two significant standards:

Standard 0248 – The NIDGS will receive priority consideration for all management activities that occur within their known occupied habitat. The intent of this standard is not to exclude all other activities within this habitat, but rather to reduce or minimize potential impacts to this species while emphasizing habitat improvement within and adjacent to known sites.

Standard 0276 – Once a WFSA is approved, avoid delivery of chemical retardant, foam, or additives to all surfaces within occupied NIDGS habitat unless:

- a. the line officer or designee determines that imminent safety to human life or protection of structures is an issue; OR
- b. the incident resource advisor determines and documents an escaped fire would cause more degradation to occupied NIDGS habitat, than would be caused by chemical, foam, or additive delivery to the habitat.

In no case will the decision to avoid delivery to chemical retardant, foam or additives to occupied NIDGS habitat be delayed when the line officer or designee determines safety or loss of human life or protection of structures is at imminent risk.

In addition, the Payette NF has a map of *potential* NIDGS habitat polygons that is available to all ranger district fire crews, the fire staff in the Forest Supervisor's Office, the regional smokejumper base, and any heli-base established on a fire. After the initial attack phase of a fire, Forest Service personnel familiar with the species (e.g., biologists) would perform a cursory survey for ground squirrels where potential habitat has been identified. Except in an emergency, and as per discussion/agreement between the Resource Advisor and the Incident Commander, subsequent retardant drops would avoid any newly discovered NIDGS population centers.

Effects Analysis (Direct and Indirect Effects)

Direct Effects – Immediate effects of the action on the species or its habitat.

The potential direct impacts to NIDGS resulting from use of fire retardant (drops) include:

1. Individuals or an colony may be disturbed or startled as a result of low flying aircraft;
2. Individuals or an entire colony could be injured or killed due to the application of the retardant.

Northern Idaho ground squirrels emerge from their burrows in late March or early April and adults are active above ground until July, whereas young of the year may be active late into August (Yensen, 1997, R. Vizgirdas, pers omm..). Thus, these animals could be above ground over roughly the first half of the fire season, then estivating before entering hibernation in below ground chambers until the following spring. During the time that NIDGS enter hibernation until spring, it is unlikely that any adverse effects from aerial retardant drops would occur to this species. Active animals (most likely young) during the August to October time period could be affected by air operations occurring near colony sites, but are likely to respond by simply moving into their underground burrows or other available cover. This behavior would likely reduce the potential for an animal to suffer a direct hit by a load of retardant.

After the period of initial attack on a new fire start on either the Payette or Boise NFs where NIDGS is known to occur, a WFSA would be completed by the Forest staff. The WFSA would confine the subsequent delivery of retardants to areas outside known occupied habitat, except under the special circumstances noted earlier. Areas of potential habitat would be surveyed for the NIDGS by Forest Service personnel. Subsequent retardant drops would avoid any newly discovered NIDGS population centers, except in an emergency. These actions are likely to reduce the potential for retardant to be dropped on occupied NIDGS habitats.

Indirect Effects – Caused by or result from the proposed action, are later in time, and are reasonably certain to occur; may occur outside of the area directly affected by the action.

Potential indirect effects to NIDGS resulting from retardant drops may include:

1. Individuals or colonies of squirrels may be adversely affected after ingesting retardant that may be coating vegetation or from grooming retardant off their fur.
2. There may be loss of important forage plants and/or hiding cover due to the retardant's toxicity to plants.

Animals may come into contact with wet retardant slurry covering the ground surface, or slogged into burrow entrances. In this event, they may ingest retardant chemicals as they attempt to clean their fur. They may also ingest retardant that is coating forage plants such as grasses and forbs. However, terrestrial field studies documented no measurable effects from ammonium-based fire retardants on small mammal populations in both the mixed grass prairie and the Great Basin ecosystems (Poulton et al. 1997). These authors reported “For all test species (two fish, two aquatic invertebrates, an algae, three birds, a mammal, and a terrestrial invertebrate), the LD₅₀ exceeded the limit criteria for significant acute toxicity, suggesting that no mortality should result from direct chemical application or from dietary exposure to fire chemicals.”

As already mentioned, the WFSA would confine the delivery of retardants to areas outside known occupied NIDGS habitat, except under special conditions. Potential NIDGS habitats would be surveyed after the period of initial attack on the fire. If the resource advisor determines

that allowing a fire to burn through NIDGS habitat would do more harm to the habitat than retardant application, he can approve the delivery of retardant to occupied habitat. This might occur in the case of a very intense burn, where sterilization of soils is a concern.

Conclusion

Based on the above analysis, the Service concludes that the proposed action is not likely to jeopardize the continued existence of the northern Idaho ground squirrel because: (1) the proposed action is not likely to reduce the reproduction, status, or distribution of affected NIDGS; (2) the Payette and Boise NFs have forest-wide and management area direction specifically addressing fire management that excludes the use of fire retardant from June through July in areas occupied by the NIDGS (with the possible exception during initial attack of a fire and other unforeseen emergencies); and (3) it is anticipated that during the latter part of the fire season (August to October), the majority of the squirrels on any given site will have entered into aestivation and subsequently hibernation and not be affected by the use of fire retardant.

Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*)

Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*) (MGRS) was listed as endangered without critical habitat on June 3, 1987 (52 FR 20994). Critical habitat was later designated on January 5, 1990 (55 FR 425). The rule concluded that MGRS was endangered because its range and habitat have been reduced and its habitat has been threatened by a number of factors, including the proposed construction of an astrophysical observatory, occurrences of annual forest fires, proposed road construction and improvement, and recreational development at high elevations. The rule also concluded that the MGRS might also suffer due to resource competition with the introduced Abert's (tassel-eared) squirrel (*Sciurus aberti*). MGRS inhabits only the Pinaleno Mountains, which is the southernmost portion of the range of the red squirrel. MGRS originally resided predominantly in upper elevation, mature to old-growth associations of mixed conifer, ecotone, and spruce-fir above approximately 8,000 feet. The spruce-fir vegetation association, which has been considered as the most important forest community for the MGRS (Service 1993), is now limited in distribution due to large-scale, stand-replacing, catastrophic wildfires (Clark Peak in 1996 and Nuttall-Gibson Complex in 2004) and a four-insect epidemic that devastated the spruce-fir ecosystem on the mountain (1996 to present). Most MGRS are now located at lower elevation in the mixed-conifer associations. Rangewide multi-agency MGRS surveys, based on a sample of middens throughout the range of the MGRS, have been conducted since 1986. The estimate dropped to a 15-year low of approximately 199 MGRS in Spring 2006 census (conservative estimate), but has since increased to 299 MGRS during the Fall 2007 census (conservative estimate). Designated critical habitat includes three areas: the area above 10,000 feet surrounding Hawk and Plain View peaks and a portion of the area above 9,800 feet; the north-facing slopes of Heliograph Peak above 9,200 feet; and the east-facing slope of Webb Peak above 9,700 feet. The main attribute of these areas was dense stands of mature spruce-fir forest. However, much of the high elevation spruce-fir forest, particularly the parts that contain critical habitat, has been lost to widespread insect outbreak and past wildfires.

Effects Analysis

Given the programmatic nature of this consultation, and the fact that we do not have a sense of when or where the project will hit the ground, the specific effects resulting from the proposed action which may adversely affect MGRS and its critical habitat cannot be described. Instead, we offer the following general discussion.

In general, fire suppression chemicals do not harm terrestrial wildlife, vegetation, and soils. The ammonium compounds used are considered to have minimal toxicological or ecological effects to terrestrial ecosystems; however, most research has been limited to effects on aquatic species. Several authors have reported on the toxicity of the active ammonium salts found in most fire retardants (Pramanik and Sarkar 1987, Sheehan and Lewis 1987, Ram and Sathyanesan 1986, Singh et al. 1985). The retardant salt was associated with risks to terrestrial species due to its low lethal dosage and high proportion in many products formulated by current chemical retardant manufacturers (Labat Environmental 2007). However, subacute toxicity testing with white-footed mice (*Peromyscus leucopus*), the closest test species to MGRS, was conducted using Phos-Chek D-75F. The median lethal dose (active ingredient) to 50 percent of the population was found to be greater than 2000 mg/kg body mass. Furthermore, no mortalities were observed for this test species (Poulon et al. 1997).

It is also possible that MGRS could be affected directly by being hit by aerial applications of long-term retardant or if nest trees are occupied, and could be affected indirectly if middens are subjected to direct hits from long-term retardant aerial applications. However, after suppression activities commenced for the June 26, 2004 Nuttall-Gibson Fire, no dead or injured MGRS were observed during Service site visits in July 2004. Similarly, Koprowski et al. (2006) did not observe any dead or injured MGRS. Furthermore, Labat-Anderson, Inc. (1994) believes the likelihood of physical injury to individual terrestrial species from applications of long-term retardants is unlikely, since large animals leave the area of a fire and small mammals seek shelter in burrows.

Additionally, a potential risk exists if a sufficient portion of MGRS diet or water sources contaminated; however, the entire population is not likely to be affected. If contamination of MGRS food base occurs, it may cause avoidance of certain areas. This may have a short-term negative effect on some MGRS, but is unlikely to adversely affect the entire population over the long-term (Labat-Anderson 1994).

Overall, risks to terrestrial species, including MGRS, are expected to be minor; these risks are small in scale and are not likely to affect more than a few individuals at a time, and the use of long-term retardants is not likely to have a lasting effect on the species.

Critical Habitat

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the analysis with respect to critical habitat. Section 3 of the Act defines “critical habitat” as specific areas within the geographical area occupied by the

species on which are found those physical or biological features essential to the conservation of the species.

Essential habitat features for the MGRS include areas with dense stands of mature spruce-fir forest. Because the proposed action may occur within critical habitat, it could have a negative effect on these features. It is possible that retardant drops could adversely affect MGRS critical habitat either with a direct hit or by breaking vegetation for nesting, foraging, or perching. However, the use of fire suppression chemicals is not likely to have a lasting effect on terrestrial ecosystems (Labat-Anderson, Inc. 1994). One study conducted in an Australian eucalyptus forest, which was sprayed with an ammonium sulfate compound showed phytotoxic short-term effects to vegetation (i.e., leaf death in tree, shrub, and ground cover species). However, the effect was poorly documented and thus, did not appear to be a major issue (Bradstock et al. 1987). The lack of further references documenting phytotoxic effects suggests it is not a major concern. Additionally, long-term retardants may benefit wildlife due to increased tree, plant, and grass growth, since these chemicals are composed mostly of fertilizers (Kalabokidis 2000).

Conclusion

After reviewing the current status of the MGRS and its critical habitat, the environmental baseline for the action area, the effects of the action, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of MGRS.

Our findings are based on the following:

- MGRS midden census data indicate that the MGRS population has been relatively stable since the Fall of 2001, despite the Nuttall-Gibson Complex Fire and tree death associated with insect damage, which together are much more important than the effects of long-term retardant use.
- Direct effects from the use of long-term retardants on MGRS are expected to be minor, in that effects would be small in scale and should only affect a few individuals at a time, as opposed to the entire MGRS population.
- Indirect effects of long-term retardant use on the food and water resources of MGRS are likely short-term and localized, whereas the effects of uncontrolled wildfire potentially could have long-term adverse effects on the food and water resources of the entire population.
- Direct and indirect impacts to MGRS from the proposed action are not expected to impede the long-term recovery of the species or the conservation value of its critical habitat.

Additionally, implementation of the proposed action would allow essential features of critical habitat to remain functional. The Service believes this because long-term retardants are not likely to have lasting effects on terrestrial ecosystems. Additionally, the proposed action will prevent wildfires from becoming potentially much larger and consuming most or all of the critical habitat on the Pinaleno Mountains.

Louisiana black bear (*Ursus americanus luteolus*)

Factors to be considered

The USFS has proposed to continue aerial application of fire retardants on NFS lands using chemicals that are less toxic than those previously applied during fire suppression activities, and to permanently adopt the “Guidelines for Aerial Delivery of Retardant or Foam near Waterways” that were established in 2000. That new fire retardant compound would consist of approximately 85 percent water, with the remainder consisting primarily of ammonia (i.e., vegetation fertilizer). The above-referenced guidelines establish the procedures for applying fire retardants near waterways, and would be permanently adopted by the Forest Service under the current proposal.

According to the EA for this proposal, the innate response of terrestrial wildlife is to avoid wildfires which, in turn, minimizes their risk (especially the more highly mobile species) of direct contact with fire retardants. Ingestion of retardant-coated food, following fire suppression activities, carries a low risk of toxicity for wildlife. In fact, according to the EA, because the primary components of the currently proposed fire retardant are agricultural fertilizer and water, it may beneficially affect treated vegetation (through increases in biomass and nutrition) upon which many wildlife species depend (including the Louisiana black bear).

Analyses for effects of the action

Effects of the proposed action on the Louisiana black bear could occur from direct contact with applied fire retardant chemicals. Such contact is not anticipated to occur for two reasons: (1) the Louisiana black bear is a relatively intelligent and highly mobile species, and would likely flee the vicinity of a wildland fire thus avoiding the possibility of direct contact with fire retardant chemicals, and (2) there is no known resident population of Louisiana black bears occurring on NFS lands in Louisiana or Mississippi. Nonetheless, should contact with fire retardant chemicals

occur, the risk to the Louisiana black bear remains minimal because, according to the EA, those chemicals carry a low risk of toxicity even when ingested.

Indirect effects of the proposed action on the Louisiana black bear could occur from fire retardant impacts to the natural vegetation upon which the Louisiana black bear depends for its existence (i.e., for foraging, bedding, denning, reproducing, rearing young, and escaping threats). According to the EA, use of the currently proposed fire retardant would likely have a positive impact on the area vegetation by suppressing wildfires that would temporarily destroy such habitat, and because those retardants (with water and ammonia as the primary ingredients) would likely function as vegetation fertilizers.

Species' response to a proposed action

According to the Louisiana Black Bear Recovery Plan (USFWS 1995), the range of the Louisiana black bear at the time of listing (i.e., 1992) did not include any NFS lands. Since its listing in 1992, the Louisiana black bear has been studied extensively by numerous researchers with various affiliations, and a substantial amount of new data now exists for all populations of the Louisiana black bear. Those studies and resultant data verify that there are currently no reproducing populations of Louisiana black bear on NFS lands in Louisiana (Anderson 1997, Beausoleil 1999, Marchinton 1995, Wagner 1995, and Weaver 1999). In fact, the closest distance from recognized Louisiana black bear occupied habitat to NFS lands is approximately 24 miles. Occasional bear sightings that occur on NFS lands are considered transient bears, therefore, and consist primarily of young, dispersing males. Such sightings occur intermittently throughout much of the State, but are not considered evidence of populations because, consistent with the definition of occupied habitat presented in the Black Bear Restoration Plan (BBCC 1997), those areas lack documented evidence of reproduction. Similarly, Louisiana black bears have been sighted in the DeSoto National Forest and Delta National Forest areas, though currently no occupied habitat (i.e., breeding population or resident females) exists on or next to these lands.

Based on reported sightings, it is apparent that transient Louisiana black bears traverse NFS lands on an infrequent basis. It is, therefore, highly unlikely that a bear would coincidentally occur on those lands during a wildfire during which fire retardants would be utilized. In the unlikely event that a Louisiana black bear would encounter those retardants, the health risk to that animal would be minimal because, and according to the EA, those retardant chemicals carry a low risk of toxicity even when ingested. Due to the low probability of direct affects, coupled with the potential positive indirect affects of fire-retardant use (i.e., suppressing habitat-damaging wildfires and applying a water/ammonia-based fertilizer to area vegetation), we anticipate that this proposed action will have no impact on the Louisiana black bear from exposure to fire retardant chemicals applied on NFS lands.

CONCLUSION

After reviewing the current status of the Louisiana black bear, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that continuation of the aerial application of fire retardants on USFS lands in accordance with the Guidelines for Aerial Delivery of Retardant or Foam near Waterways (established in 2000), as proposed, is not likely to jeopardize the continued existence of the Louisiana black bear. No critical habitat has been designated for this species (though we are in the process of proposing such a designation); therefore, none will be affected.