United States Department of the Interior

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Memorandum

To: Cicely Muldoon, Acting Superintendent, Yosemite National Park, National Park Service, Yosemite, California

From: Jennifer Norris, Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Formal Consultation on Wilderness Pack Stock Use in Yosemite National Park, California

This memorandum is in response to the National Park Service's February 18, 2020, request for initiation of consultation with the U.S. Fish and Wildlife Service (Service) on Wilderness Pack Stock Use in Yosemite National Park, California. At issue are the potential effects on the federally endangered Sierra Nevada yellow-legged frog (*Rana sierrae*), the federally threatened Yosemite toad (*Anaxyrus canorus*), and designated critical habitat for both species. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

The federal action on which we are consulting is the use of pack stock in wilderness areas within Yosemite National Park. Pursuant to 50 CFR 402.12(j), you submitted a Biological Assessment for our review and requested concurrence with the findings presented therein. These findings conclude that the proposed project (1) *may affect, and is likely to adversely affect* the Sierra Nevada yellow-legged frog and the Yosemite toad; and, (2) *may affect, is likely to adversely affect* critical habitat for Sierra Nevada yellow-legged frog and the Yosemite toad.

In considering your request, we based our evaluation on the following: (1) the letter from the National Park Service to the Service requesting initiation of consultation on the proposed project, dated February, 18, 2020; (2) the *Biological Assessment, Wilderness Pack Stock Use in Yosemite National Park* (Biological Assessment), dated February 7, 2020; (3) conversations between National Park Service and Service biologists; and (4) other information available to the Service.

Consultation History

January 23, 2020: Colleen Kamoroff (Yosemite National Park Wildlife Biologist) met with Stephanie Eyes and Rick Kuyper of the Service to discuss pack stock use in Yosemite National Park wilderness areas.

February 18, 2020: The Service received a request from Yosemite National Park for consultation on pack stock use in Yosemite wilderness areas, along with the final Biological Assessment.

BIOLOGICAL OPINION

Description of the Action

Saddle and pack stock use in Yosemite National Park pre-dates the designation of Yosemite as a National Park. Pack stock use was a critical component of the development and protection of the Yosemite landscape and its wilderness, and continues to be used for administrative, commercial, and private packing purposes, as well as recreational riding (Kuhn et al. 2018).

Administrative stock users are employed or contracted by the National Park Service. Stock is used in the administrative capacity to assist with park duties, including mounted wilderness patrol, trail construction and maintenance, backcountry utilities, search and rescue, fire management, and monitoring/research project support. The locations and magnitude of administrative stock use vary based on the needs of park management (Kuhn et al. 2018).

Commercial pack stock use provides "for-hire" riding and packing services, as well as spot and dunnage trips. Like other businesses that operate within the Park, commercial outfitters are required to have a Commercial Use Authorization (CUA) permit and obtain wilderness permits. Commercial outfitters must use formal trails and designated stock camping/grazing sites approved by the National Park Service. CUA permits and requirements specified in the Superintendent's Compendium are issued annually and reviewed each year by Park staff. Commercial use may also be authorized through a concession contract. In Yosemite, the concessioner offers stock for hire and provides supplies to the High Sierra Camps they manage.

Private users are typically small, non-commercial groups that use pack stock for recreational purposes within Yosemite's Wilderness. Private stock users are required to possess a valid wilderness permit and can camp within ¼ mile of NPS trails, including backpacker campsites. Patterns of use are sporadic and based on user preferences. Private use has been primarily comprised of small groups (i.e., typically fewer than 6 head of stock) and limited grazing (in 2019, private use for the entire wilderness was 12 stock use nights). Private stock use is tracked after the fact, via database entry and synthesis of wilderness permits issued for that year (Kuhn et al. 2018). The Park Service is not requesting consultation for private stock use.

Conservation Measures

Commercial, private, and administrative pack stock users must adhere to all pack stock requirements outlined in the Yosemite National Park Superintendent's Compendium and the Code of Federal Regulations. Additional requirements for commercial users are outlined in the Management Tools and Framework for Pack Stock Use and Meadow Monitoring in Yosemite Wilderness and the annual CUA. All requirements and recommendations are in place to protect natural and cultural resources as well as wilderness character. They are updated to incorporate management strategies based on the best science available. A current summary of requirements and recommendations is listed in Appendix A of the Biological Assessment.

In addition to requirements dictated by the aforementioned documents, grazing restriction will be put in place to protect Yosemite toad and Sierra Nevada yellow-legged frogs (See appendix B of the Biological Assessment for all CUA sites with grazing restrictions). The following use limits apply to all meadows containing occupied Yosemite Toad and/or Sierra Nevada yellow-legged frog breeding habitats.

- All stock traffic will be confined to the NPS trail system through closed meadow areas
- Grazing is prohibited in areas where Yosemite Toad and Sierra Nevada yellow-legged frog are breeding. These areas include specified pools, ponds or flooded habitats within commercial stock grazing destinations (maps will be made available in the annual Yosemite National Park Superintendent's Compendium).
- Approved methods to prevent grazing in closed areas include hobbling, high lining, electric fence, hand grazing, carrying feed and any combination thereof.
    - Electric fences will be placed 100 feet from all avoidance areas
    - To avoid overgrazing, electric fences should not be placed in areas that have been previously used by earlier season stock parties
- Stock use is limited to designated access routes and stock holding areas when not grazing
- Stock use is limited to ¼ mile from trails or backpackers campgrounds

The NPS will close additional stock camps or lessen current restrictions based on the best survey data available. The Park retains the ability to close meadows or portions of meadows for grazing in the event that restrictions are not being followed and or impacts to breeding/occupied habitat is observed.

Sites with the highest pack stock use will be monitored to ensure mitigation measures are followed and effects to amphibian populations are minimized. High stock use sites include: Upper Kerrick Meadow, Hook Lake, Miller Lake and/or Isberg Lake. Monitoring entails surveying sites on a yearly rotation basis (i.e. a subset of sites will be surveyed every year).

Analytical Framework for the Jeopardy Analysis

The following analysis relies on four components to support the jeopardy determination for the Yosemite toad, Sierra Nevada yellow-legged frog, and Northern Distinct Population Segment of the mountain yellow frog: (1) the **Status of the Species**, which evaluates the species' range wide condition, the factors responsible for that condition, and their survival and recovery needs; (2) the **Environmental Baseline**, which evaluates the condition of these species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the **Effects of the Action**, which determines the direct and indirect effects of the proposed programmatic Federal action and the effects of any interrelated or interdependent activities on these species; and (4) **Cumulative Effects**, which evaluates the effects of future, non-Federal activities in the action area on these three species.

In accordance with the implementing regulations for Section 7 and Service policy, the jeopardy determination is made in the following manner: The effects of the proposed programmatic Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the current status of the Yosemite toad and Sierra Nevada yellow-legged frog. Additionally, for non-Federal activities in the action area, we will evaluate those actions likely to affect these species in the future, to determine if implementation of the proposed programmatic action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of them in the wild.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the Yosemite toad and Sierra Nevada yellow-legged frog, and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed programmatic Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Analytical Framework for Adverse Modification

Section 7(a)(2) of the ESA requires that Federal agencies insure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification" (DAM) was published on February 11, 2016 (81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states:

> "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features".

The DAM analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat*, which describes the range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, primary constituent elements, or physical and biological features) that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and (4) *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

For purposes of making the DAM determination, the Service evaluates if the effects of the proposed Federal action, taken together with cumulative effects, are likely to impair or preclude the capacity of critical habitat in the action area to serve its intended conservation function to an extent that appreciably diminishes the rangewide value of critical habitat for the conservation of the listed species. The key to making that finding is understanding the value (i.e., the role) of the critical habitat in the action area for the conservation/recovery of the listed species based on the *Environmental Baseline* analysis.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." For this Federal Action, the action area encompasses all stock campsites, grazing sites, trails and cross country routes within Yosemite National Park wilderness areas. Stock use is limited to ¼ mile from trails or backpackers campgrounds except limited routes and locations specified annually in the Superintendent's Compendium (see appendix A of the Biological Assessment).

Status of the Sierra Nevada Yellow-legged Frog

Listing Status

The Sierra Nevada yellow-legged frog was listed as an endangered species on April 29, 2014, under the Endangered Species Act of 1973 (Service 2014). Critical habitat was designated for the species on August 26, 2016 (Service 2016).

Description

The Sierra Nevada yellow-legged frog was previously known as the mountain yellow-legged frog (*Rana muscosa*). Based on mitochondrial DNA, morphological information, and acoustic studies, Vredenburg *et al.* (2007) concluded the mountain yellow-legged frog in the Sierra Nevada consists of two distinct species – *R. muscosa* and *R. sierrae*. Due to their similar appearance, habitat requirements, and ecology, these closely related species are often discussed together as the mountain yellow-legged frog complex.

The Sierra Nevada yellow-legged frog is moderate-sized, ranging from 1.5 to 3.25 inches in length (Wright and Wright 1949, Zweifel 1955). Adult coloration is highly variable, with a dorsal pattern of dark spots of various sizes among a background mixture of primarily brown and yellow, but also gray, red, or green-brown. Dorsolateral folds are present, but not prominent. The abdomen and hind legs are yellow, sometimes tinged with orange in larger females. Although lacking vocal sacs, they can still vocalize in or out of water with a flat clicking sound (Zweifel 1955, Stebbins 2003). The adults may also produce a distinctive mink or garlic-like odor when disturbed (Wright and Wright 1949, Stebbins 2003).

Sierra Nevada yellow-legged frogs tend to have smoother skin, with heavier spotting and mottling dorsally, darker toe tips (Zweifel 1955), and more opaque ventral coloration than their conspecific foothill yellow-legged frog (*R. boylii*) (Stebbins 2003). Larvae (tadpoles) exhibit a flattened body shape with a low dorsal fin, can reach up to 2.8 inches in length, and are mottled brown on the dorsal side with a faintly yellow underside (Zweifel 1955, Stebbins 2003, Vredenburg *et al.* 2005).

Current Range and Distribution

The Sierra Nevada yellow-legged frog is endemic to the northern and central Sierra Nevada, ranging from north of the Feather River including the Plumas and southern edge of the Lassen National Forests, south to the Monarch Divide on the west side of the Sierra Nevada crest in the Sierra National Forest, and near Independence Creek on the east side of the Sierra Nevada crest in the Inyo National Forest. The current distribution of the species is primarily restricted to high elevation publicly managed lands within National Forests and National Parks.

Habitat and Life History

Sierra Nevada yellow-legged frogs predominantly inhabit lakes, ponds, tarns, marshes, meadows, and streams at high elevations usually above 4,500 feet (Zweifel 1955, California Department of Fish and Wildlife 2014a, b), but may occur as low as 3,500 feet in northern portions of their range (USFS 2014). Recent genetic testing, however, suggests that frogs below 4,500 ft. in Plumas National Forest are primarily foothill yellow-legged frogs (*R. boylii*) rather than Sierra Nevada yellow-legged frogs (C. Dillingham, USFS, personal communication, 2017). These frogs are highly aquatic (Stebbins 1951, Mullally and Cunningham 1956, Bradford *et al.* 1993), with adults typically found sitting on rocks along shorelines with little or no vegetation (Mullally and Cunningham 1956). Though most abundant in high-elevation lakes and slow-moving portions of meadow streams (Zweifel 1955, Mullally and Cunningham 1956, Lannoo 2005, Vredenburg *et al.* 2005), habitat use varies with availability. For example, at lower elevations throughout their range, they are associated with rocky streambeds and wet meadows surrounded by coniferous forest (Zweifel 1955, Zeiner *et al.* 1988, Vredenburg *et al.* 2005). These frogs tend to be absent from the smallest creeks, possibly due to insufficient depth for adequate refuge and overwintering habitat (Jennings and Hayes 1994).

Breeding habitat can be diverse, but most often includes permanent, deep lakes (Zweifel 1955, Knapp and Matthews 2000a). In Yosemite National Park, for example, Sierra Nevada yellow-legged frog occupancy tended to be associated with deep water, meadow vegetation on shorelines, and absence of introduced fish (Knapp 2005). When frogs do co-occur with introduced fish, they often use different microclimates, such as shallower waters (Brown *et al.* 2019). Breeding has been observed in both shallow pools and inlet streams (Vredenburg *et al.* 2005). Timing varies with elevation, occurring earlier (April-May) at lower elevations and later (June-July) in higher locations (Zweifel 1955). Females deposit 15-350 eggs underwater in clusters, attached to rocks, gravel, vegetation, or under banks, and hatch after 15-20 days as the temperature warms (Wright and Wright 1949, Stebbins 1951, Zweifel 1955, Pope 1999).

Hatching success tends to be high (Vredenburg 2004), but because tadpoles can require 2 to 4 years to mature, successful recruitment requires water bodies that hold water for this duration, even if only a small amount (Bradford 1983, Bradford *et al.* 1993, Knapp and Matthews 2000b, Vredenburg *et al.* 2005, Lacan *et al.* 2008). Another 3 to 4 years post-metamorphosis is required to reach reproductive maturity; thus it may take 5 to 8 years for an individual to begin reproducing (Zweifel 1955, Vredenburg *et al.* 2005). Adults are long lived, up to 14-16 years (Vredenburg *et al.* 2005, Fellers *et al.* 2013), and under normal circumstances adult survivorship from year to year is very high (Pope 1999). High environmental variation, however, such as severe winters and drought years, can lead to massive mortality (Bradford 1983). Tadpoles are particularly vulnerable in their first winter, with those reared in shallow sites more prone to desiccation (Lacan *et al.* 2008). A study in Yosemite National Park found that population size varied annually, and was positively correlated with precipitation (Fellers *et al.* 2013).

Both adults and juveniles will overwinter in aquatic habitats under ice (Mullally and Cunningham 1956, Pope and Matthews 2001), often at the bottom of lakes >1.7 meters deep (Bradford 1982). However, frogs can also overwinter in bedrock crevices, allowing them to survive in shallower water bodies that freeze to the bottom (Mathews and Pope 1999). Stream-dwelling frogs have also been found overwintering in rock crevices, undercut banks, and seeps within mud holes (MGW Biological 2008). At spring thaw or snowmelt, adults disperse into various sites during the summer months for feeding (Wengert 2008, Pope and Matthews 2001, Matthews and Preisler 2010). In the summer, frogs are found basking in open areas near cover and water (Grinnell and Storer 1924, Storer 1925, Mullally and Cunningham 1956). Individuals display strong site fidelity and may return to the same overwintering and summer habitats from year to year (Pope 1999). Adult frogs also make local movements during the active season – in aquatic habitats of high mountain lakes, adults typically move only a few hundred meters (Pope 1999, Pope and Matthews 2001), though distances over 1 km have been recorded that included overland travel (Vredenburg *et al.* 2005).

Though few diet studies exist, invertebrates are primary prey for this species. Adult frogs have also been observed consuming Yosemite toad and Pacific treefrog larvae (Mullally 1953, Zeiner *et al.* 1988, Pope 1999). As is typical of ranids, tadpoles graze on algae and diatoms along the rocky bottoms (Zeiner *et al.* 1988).

Status and Threats Overall

Once thought to be abundant throughout aquatic habitat in the high Sierra Nevada (Grinnell and Storer 1924), the Sierra Nevada yellow-legged frog and mountain yellow-legged frog have declined since the 1970s (Bradford 1991). Beginning in the 1980s, researchers reported the frogs had disappeared from a significant portion of their range (Hayes and Jennings 1986). Davidson *et al.* (2002) reviewed 255 previously documented locations throughout the historical ranges of mountain yellow-legged frog and Sierra Nevada yellow-legged frog, based on Jennings and Hayes (1994), and they concluded that 83 percent of these sites no longer supported extant populations. Vredenburg *et al.* (2007) further compared recent surveys from 1995 to 2004 with museum records of specimens collected between 1899 and 1994 and found that 93 percent of locations with historic records of the Sierra Nevada yellow-legged frog sites were extirpated. Most recently from 2002-2009, watersheds containing over 2,900 meadows, lakes, ponds or stream reaches were surveyed for both species: breeding was found in 4 percent of watersheds that had frog records from 1990-2001, and only 2 percent of watersheds that had frog records prior to 1990 (Brown *et al.* 2014).

Overall, recent surveys estimate 65-95 percent disappearance from their historical range (Knapp and Matthews 2000a, Vredenburg *et al.* 2007, California Department of Fish and Wildlife 2014 a, b). Furthermore, extant populations are much smaller than historical populations (57 percent of watersheds surveyed had <10 adults/subadults and <10 tadpoles, Foote *et al.* 2013, Brown *et al.* 2014). Populations in the northern range of the Sierra Nevada yellow-legged frog are particularly vulnerable to stochastic environmental events and loss of genetic variation due to their small size and isolation from other populations (Service 2014).

The Sierra Nevada yellow-legged frog is imperiled by a variety of factors, particularly invasive predators and disease (Bradford 1989, Bradford *et al.* 1998, Knapp and Matthews 2000a, Fellers *et al.* 2001). Because the species has a short active season, they must overwinter in aquatic habitats for much of the year, and they require perennial water for reproduction (Zweifel 1955, Bradford 1983, Matthews and Pope 1999, Knapp and Matthews 2000a, Brown *et al.* 2014), it is especially vulnerable to such threats. The introduction of trout to historically fish-free lakes in the Sierra Nevada reduced the distribution and abundance of the Sierra Nevada yellow-legged frog (Bradford 1989, Knapp and Matthews 2000a, Knapp 2005). Prior to the mid-19th century, almost all lakes and associated streams in the Sierra Nevada above 6,000 feet were fishless, but as a result of 150 years of fish stocking throughout the region, all watersheds now contain as many as five non-native trout species (Moyle *et al.* 1996, USFS 2013). Besides direct predation, trout can also further fragment small populations by disrupting dispersal and recolonization routes (Bradford *et al.* 1993). In addition, introduced bullfrogs co-occur with native ranid species at lower elevation sites (generally below 6,000 feet), and may also increase predation and competition, though their exact contribution to the decline remains unknown (Casper and Hendricks 2005).

Diseases also pose a significant threat – especially chytrid fungus (*Batrachochytrium dendrobatidis*, or Bd), documented as a primary factor in widespread declines in Sierra Nevada yellow-legged frogs across the Sierra Nevada over the past several decades (Rachowicz *et al.* 2006, Vredenburg *et al.* 2010). Their highly aquatic life history appears to make these frogs particularly susceptible to this fungus (Fellers *et al.* 2001). Human activities can also facilitate the spread of disease by encouraging further introduction of non-native carriers and even acting as carriers themselves.

Finally, though the Sierra Nevada yellow-legged frog might not be losing much habitat *per se* by human development, additional activities such as water development, mining, and roads are increasingly fragmenting these populations. As the majority of remaining frog populations are small and isolated, they are vulnerable to stochastic events, increased inbreeding, and loss of genetic diversity (Bradford *et al.* 1993, Knapp *et al.* 2007, Brown *et al.* 2011). Furthermore, climate change will reduce snow pack and increase evapotranspiration that may result in desiccation of some breeding ponds which in turn would reduce breeding success (Lacan *et al.* 2008) and affect survivorship (Blaustein *et al.* 2010; Walls *et al.* 2013).

Status of Sierra Nevada Yellow-legged frog Critical Habitat

Approximately 1,082,147 acres of critical habitat has been designated for the Sierra Nevada yellow-legged frog in Plumas, Lassen, Sierra, Nevada, Placer, El Dorado, Amador, Calaveras, Alpine, Mariposa, Mono, Madera, Tuolumne, Fresno, and Inyo Counties, California (Service 2016). Critical habitat for this species was designated as three units encompassing 24 subunits. The critical habitat units and subunits constitute the Service's current best assessment of areas that meet the definition of critical habitat for the Sierra Nevada yellow-legged frog. The 24 sub-units were known to be occupied when critical habitat was designated and the Service assumes these sub-units are currently occupied.

The Service (2016) determined that the Sierra Nevada yellow-legged frog requires the following physical or biological features: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; (5) habitats protected from disturbance or representative of the historical, geographic, and ecological distributions of the species.

Based on our current knowledge of the physical or biological features and habitat characteristics required to sustain the species' life-history processes, the Service (2016) determined that the primary constituent elements specific to the Sierra Nevada yellow-legged frog are:

(1) Aquatic habitat for breeding and rearing. Habitat that consists of permanent water bodies, or those that are either hydrologically connected with, or close to, permanent water bodies, including, but not limited to, lakes, streams, rivers, tarns, perennial creeks (or permanent plunge pools within intermittent creeks), pools (such as a body of impounded water contained above a natural dam), and other forms of aquatic habitat. This habitat must:

    (a) For lakes, be of sufficient depth not to freeze solid (to the bottom) during the winter 5.6 feet, but generally greater than 8.2 feet, and optimally 16.4 feet or deeper (unless some other refuge from freezing is available).
    (b) Maintain a natural flow pattern, including periodic flooding, and have functional community dynamics in order to provide sufficient productivity and a prey base to support the growth and development of rearing tadpoles and metamorphs.
    (c) Be free of introduced predators.
    (d) Maintain water during the entire tadpole growth phase (a minimum of 2 years). During periods of drought, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but they may still be considered essential breeding habitat if they provide sufficient habitat in most years to foster recruitment within the reproductive lifespan of individual adult frogs.
    (e) Contain:
        (i) Bank and pool substrates consisting of varying percentages of soil or silt, sand, gravel, cobble, rock, and boulders (for basking and cover);
        (ii) Shallower microhabitat with solar exposure to warm lake areas and to foster primary productivity of the food web;

(iii) Open gravel banks and rocks or other structures projecting above or just beneath the surface of the water for adult sunning posts;
(iv) Aquatic refugia, including pools with bank overhangs, downfall logs or branches, or rocks and vegetation to provide cover from predators; and
(v) Sufficient food resources to provide for tadpole growth and development.

(2) Aquatic nonbreeding habitat (including overwintering habitat). This habitat may contain the same characteristics as aquatic breeding and rearing habitat (often at the same locale), and may include lakes, ponds, tarns, streams, rivers, creeks, plunge pools within intermittent creeks, seeps, and springs that may not hold water long enough for the species to complete its aquatic life cycle. This habitat provides for shelter, foraging, predator avoidance, and aquatic dispersal of juvenile and adult mountain yellow-legged frogs. Aquatic nonbreeding habitat contains:
(a) Bank and pool substrates consisting of varying percentages of soil or silt, sand, gravel, cobble, rock, and boulders (for basking and cover);
(b) Open gravel banks and rocks projecting above or just beneath the surface of the water for adult sunning posts;
(c) Aquatic refugia, including pools with bank overhangs, downfall logs or branches, or rocks and vegetation to provide cover from predators;
(d) Sufficient food resources to support juvenile and adult foraging;
(e) Overwintering refugia, where thermal properties of the microhabitat protect hibernating life stages from winter freezing, such as crevices or holes within bedrock, in and near shore; and/or
(f) Streams, stream reaches, or wet meadow habitats that can function as corridors for movement between aquatic habitats used as breeding or foraging sites.

(3) Upland areas.
(a) Upland areas adjacent to or surrounding breeding and nonbreeding aquatic habitat that provide area for feeding and movement by mountain yellow-legged frogs:
(i) For stream habitats, this area extends 82 feet from the bank or shoreline;
(ii) In areas that contain riparian habitat and upland vegetation (for example, mixed conifer, ponderosa pine, montane conifer, and montane riparian woodlands), the canopy overstory should be sufficiently thin (generally not to exceed 85 percent) to allow sunlight to reach the aquatic habitat and thereby provide basking areas for the species;
(iii) For areas between proximate (within 984 feet) of water bodies (typical of some high mountain lake habitats), the upland area extends from the bank or shoreline between such water bodies; and
(iv) Within mesic habitats such as lake and meadow systems, the entire area of physically contiguous or proximate habitat is suitable for dispersal and foraging.
(b) Upland areas (catchments) adjacent to and surrounding both breeding and nonbreeding aquatic habitat that provide for the natural hydrologic regime (water quantity) of aquatic habitats. These upland areas should also allow for the maintenance of sufficient water quality to provide for the various life stages of the frog and its prey base.

Environmental Baseline of the Sierra Nevada Yellow-legged Frog

Sierra Nevada yellow-legged frog was a historically common inhabitant of Yosemite National Park's lakes, ponds, and streams (Grinnell and Storer 1924; Mullally and Cunningham 1956). Sierra Nevada yellow-legged frog also occupy meadows and marshy areas in Yosemite National Park, especially at lower elevations. Although Sierra Nevada yellow-legged frogs can occupy stream habitats, this species is more commonly found in lakes, ponds, meadows, and marshy areas in Yosemite National Park. There are nearly 400 historic and extant Sierra Nevada yellow-legged frog observations in

Yosemite National Park. Many of historic records include observations before the 1980's or museum specimens. Although there are no current observations at many these historic localities, habitat is still likely suitable for the species, absent other stressors (e.g. fish, disease, etc.).

The introduction of non-native trout has resulted in considerable alteration of Yosemite's herpetofauna, especially the Sierra Nevada yellow-legged frog (Knapp 2005). Nearly all streams and rivers within and surrounding the action area were naturally fishless; however, the majority now contain one or more species of non-native trout. Most high montane lakes in Yosemite National Park have been stocked with non-native trout for recreational angling (Bahls 1992). In Yosemite National Park, there are at least 245 lakes (Knapp 2003) and at least 704 miles of streams and rivers (Knapp unpublished data) that have self-sustaining non-native trout populations. Stocking records indicate that between 1877 and 1990 (the last year of stocking in Yosemite National Park), 202 water bodies were stocked with over 33 million non-native fish. In locations where there were no fish barriers, non-native fish were able to migrate and populate new water bodies, expanding their distribution.

Knapp (2005) conducted comprehensive surveys of all lakes and ponds in Yosemite National Park (2,655 water bodies) and detected population declines in the Park. For example, in surveys conducted in 2000-2002, Sierra Nevada yellow-legged frogs were recorded at 10.6 percent (282) of the total sites (Knapp 2005). Knapp (2005) found that populations were generally very small; more than 10 adults were only observed at eight percent of the sites.

More recently, a landscape scale analysis conducted using frog abundance data collected from 1993–2012 showed Sierra Nevada yellow-legged frog populations in Yosemite National Park have been able to reverse their declining trends and are now increasing, in part due to cessation of fish stocking (Knapp *et al.* 2016). The NPS has implemented various recovery efforts that include the removal of non-native trout; frog translocations; reintroductions and augmentations; egg and tadpole salvage; and anti-fungal treatments and bioaugmentations. All recovery efforts are coupled with long-term surveying in order to assess Sierra Nevada yellow-legged frog population size and management success. Surveys continued during the drought through 2015 and surveyors identified successful breeding at high elevation sites, but low breeding success at lower elevation sites (< 7,000 feet; R. Grasso, NPS, personal communication 2017). During the 2016–2017 severe winter, high mortality was observed at several sites, but overall a number of subadults and tadpoles were detected at other sites that could help the population rebound (Knapp 2019). Despite the harsh winter, most translocated populations continue to persist, and other populations are beginning to expand following trout eradication (Knapp 2019). Given this information, Yosemite National Park plays a vital role in re-establishing a viable range-wide population of the species since removal of some of the stressors is beginning to contribute to small gains in the recovery of the species.

Environmental Baseline for Sierra Nevada Yellow-legged Frog Critical Habitat

The Action Area contains the following critical habitat units: 2I (Emigrant Yosemite), 2J (Spiller Lake), 2K (Virginia Canyon), 2L (Register Creek), 2M (White Mountain), 2N (Unicorn Peak), 3A (Yosemite Central), and 3B (Cathedral).

Critical Habitat Units 2 represents a significant fraction of the Sierra Nevada yellow-legged frog's range, and it reflects unique ecological features within the range by comprising populations that are both stream- and lake-based. Sierra Nevada yellow-legged frog populations within Critical Habitat Unit 2 are at very low to intermediate abundance and face significant threats from habitat fragmentation resulting from the introduction of fish (Service 2016). Critical Habitat Unit 3 represents a significant portion of the species' range, and it reflects a core conservation area comprising the most robust remaining populations at higher densities (closer proximity) across the species' range. Special management considerations or protections to reduce the following threats may be required: The persistence of introduced trout populations in essential habitat; the risks related to the spread of pathogens; the effects from water withdrawals and diversions; impacts associated with timber harvest and fuels reduction activities; impacts associated with inappropriate livestock grazing; and intensive use by recreationists, including packstock camping and grazing (Service 2016).

The PCEs within Yosemite National Park are primarily found in wilderness areas and have been historically impacted by grazing activities. The introduction of fish species has converted much of the available breeding habitat to non-breeding habitat (i.e., converted PCE 1 to PCE 2). Fragmentation is much less of an issue since very few roads or other human-made features are present within the Action Area. Recreation activities such as backpacking and hiking also occur within these critical habitat units; however, these activities are managed by the Park to minimize impacts to suitable aquatic breeding and non-breeding habitat (e.g., backpackers are required to camp a minimal distance from water bodies, not allowed to camp in meadows, and wilderness permits are required for backpackers and pack stock users that limit the number of individuals staying overnight within the Park wilderness).

Status of the Yosemite Toad

Listing Status:

The Yosemite toad was listed as a threatened species on April 29, 2014, under the Endangered Species Act of 1973 (Service 2014). Critical habitat was designated for this species on August 26, 2016 (Service 2016).

Description:

The Yosemite toad was originally described as *Bufo canorus* by Camp (1916). Frost *et al.* (2006) divided the paraphyletic genus *Bufo* into three genera, assigning the North American toads, including the Yosemite toad, to the genus *Anaxyrus*. The Yosemite toad is a moderately sized amphibian ranging in size from 1.2 to 2.8 inches (Karlstrom 1962, Lannoo 2005, Dodd 2013). Juveniles have a thin mid-dorsal stripe that disappears or is reduced with age, a process which occurs more quickly in males (Lannoo 2005, Dodd 2013). The toad's iris is dark brown with gold iridophores (Dodd 2013), and it has large paratoid glands that are rounded to slightly oval in shape.

Male Yosemite toads are smaller than females, with less conspicuous warts (Stebbins 1951, Stebbins 2003, Lannoo 2005, Stebbins and McGinnis 2012, Dodd 2013, Green *et al.* 2014). Males have a nearly uniform dorsal coloration of yellow-green, olive drab or darker greenish brown, whereas females have black spots or blotches edged with white or cream set against a grey, tan, or brown background color (Jennings and Hayes 1994, Lannoo 2005, Dodd 2013, Green *et al.* 2014). Tadpoles are uniformly black with a snout that is blunt in profile and rounded from above. They are 10 to 37 millimeters long with a transparent dorsal fin (Stebbins 1951, Karlstrom and Livezey 1955).

Current Range and Distribution:

The Yosemite toad is endemic to the high elevation Sierra Nevada in California, ranging from the Blue Lakes region north of Ebbetts Pass in Alpine County to just south of Kaiser Pass in the Evolution Lake/Darwin Canyon area in Fresno County (Jennings and Hayes 1994, Lannoo 2005, Liang *et al.* 2010, Liang and Stohlgren 2011, Stebbins and McGinnis 2012, Dodd 2013, Green *et al.* 2014). Most of the Yosemite toad's range occurs on lands managed by the Forest Service (72 percent, USFS 2014) or National Parks.

Habitat and Life History:

Yosemite toads typically inhabit high elevation wet meadows and lakeshores surrounded by forests or shrublands (Camp 1916, Lannoo 2005, Stebbins and McGinnis 2012, Wang 2012, Dodd 2013). The toad is capable of successfully utilizing both large and small patches of potential habitat, but prefers sites with less variation in mean annual temperature (Liang 2010).

Breeding and rearing takes place after snowmelt (generally May-June) in shallow warm waters of primarily wet meadows, but also small permanent and ephemeral ponds, lake edges, and slow-moving streams (Karlstrom and Livezey 1955, Kagarise Sherman and Morton 1993, Martin 2008). Males emerge first from overwintering sites and form breeding choruses (Kagarise Sherman 1980, Kagarise Sherman and Morton 1984). Breeding occurs over a few days to a few weeks, with females leaving breeding sites before males (Kagarise Sherman 1980, Sadinski 2004, Brown *et al.* 2012). Females lay a large clutch, sometimes 1-2,000 eggs in a single season, and may either split their clutches or lay them communally with other toads (Karlstrom 1962, Kagarise Sherman 1980, USFS *et al.* 2009). Clutches are laid in shallow water (1.5 to 3 inches), along the edges of small pools or flooded meadows (Kagarise Sherman 1980, Sadinski 2004, Roche *et al.* 2012). Eggs hatch in four to 15 days; tadpoles metamorphose in 40 to 50 days, and do not overwinter (Jennings and Hayes 1994, Brown *et al.* 2014).

The Yosemite toad is a late maturing and long-lived species, known to live up to 18 years (Kagarise Sherman and Morton 1984). Females first breed when they are four to six years (Kagarise Sherman 1980). Most adult males appear to breed annually, whereas females may skip years between breeding (Kagarise Sherman 1980; Brown *et al.* 2012). Only about one-third of breeding sites are consistently occupied each year, but unoccupied sites remain important because they are often reoccupied in later years (Brown *et al.* 2012). Periodic years of high recruitment and high survival rates of adults may be important for the long-term persistence of populations (Biek *et al.* 2002, Brown *et al.* 2012).

Adults are difficult to find outside of the breeding season, so less is known about non-breeding habitat, where they spend the majority of their lives. One study conducted in subalpine forest in the Stanislaus National Forest found that toads dispersed upslope, generally along ephemeral streams, seeps, or springs with lush vegetation (Martin 2008). Another study conducted in a drier habitat in the Sierra National Forest demonstrated that toads extensively used upland habitats and were found most often in burrows, both shallow and underground, but also under logs, rocks, and tree stumps (Liang 2010). Martin (2008) reported the mean total home range for the toad in the Stanislaus National Forest study area was 8,457.93 square meters.

In the Sierra National Forest, toads moved up to 1,260 meters from their breeding pools, with a mean distance of 270 meters (Liang 2013). Morton (1981) reported several female toads at a distance of 750 meters from the nearest breeding pools. On the Stanislaus National Forest, Martin (2008) reported maximum dispersal distances for Yosemite toad at 657.44 meters from breeding pools to upland foraging habitat, however the majority of toads observed travelled less than 250 meters. Martin (2008) found that this species conducts much of its post-reproductive activity at night and that many of the long range migrations took place nocturnally. Most of the longer distance movements occur in the two months after the breeding season. Additionally, there appear to be some sex-specific differences in non-breeding habitat use and movement. Generally, females tend to range further than males (Martin 2008, Liang 2010, Morton and Pereyra 2010). Morton and Pereyra (2010) found that during late July and August at Tioga Pass, females were more likely to move farther upland to rocky hillside habitats and males stayed in lowland meadow habitats near breeding ponds. Adult females appear to spend much of the active season in upland habitats except for the few days spent breeding every two to three years (Kagarise Sherman 1980).

To overwinter, toads may use rodent burrows, crevices under rocks and stumps, and root tangles at the base of willows (Davidson and Fellers 2005, Kagarise Sherman 1980, Martin 2008). Some metamorphs appear to overwinter their first year in the terrestrial meadow habitat adjacent to their rearing site, but move to more distant terrestrial habitat during mid-summer of their second year (Kagarise Sherman and Morton 1993, Morton and Pereyra 2010). Individual Yosemite toads show high fidelity to both breeding meadows and terrestrial habitats (Brown *et al.* 2012, Kagarise Sherman and Morton 1984, Liang 2010).

Detecting Yosemite toads is difficult because of short suitable survey periods for each life stage. Adult males are most easily detected during the short breeding window at snowmelt (1-2 weeks). As tadpoles are present for a longer period of time (6-8 weeks), they could be easier to find, but again, surveys must be carefully timed. Furthermore, even the breeding meadows and breeding areas within the meadows can be highly variable according to snowpack and management activities. Toads are rarely seen once they disperse into their upland habitats, and thus determining presence or absence is challenging (Brown *et al.* 2012).

Diet has not been well-characterized, but the toads are thought to be largely ambush predators and consume primarily terrestrial invertebrates during the non-breeding active season (Mullally 1953, Wood 1977). Martin (2008) observed that much of the foraging activity in terrestrial habitats for this species appears to occur at night. Tadpoles are grazers and highly opportunistic (Grinnell and Storer 1924).

Status and Threats Overall:

The species historically inhabited elevations ranging from 4,790 to 11,910 feet (Stephens 2001, Stebbins 2003), and was most abundant above 8,000 feet below permanent snow and ice. Occupancy studies indicate a decline of greater than 50 percent of former sites range-wide (Stebbins and Cohen 1995, Drost and Fellers 1996). Current populations are thought to be very small (< 20 adult males) (Brown *et al.* 2011). The only long-term, site-specific population study of the Yosemite toad at Tioga Pass Meadow from 1971-1991 found a dramatic decline from 258 males entering breeding pools, down to 28 in the early 1980s, with only one found in 1991 (Kagarise Sherman *et al.* 1993). Within its current range on National Forest lands, breeding is currently found in only 22 percent of watersheds (Brown *et al.* 2012).

The Yosemite toad is imperiled by a variety of factors, especially damage and loss of habitat, livestock grazing, chytrid fungus, and global climate change (Lannoo 2005, Davidson and Fellers 2005, Martin 2008, Brown *et al.* 2011, Green *et al.* 2014). High meadow habitat quality in the western United States, and specifically the Sierra Nevada, has been degraded by a variety of stressors over the last century (Ratliff 1985, Vale 1987). Because Yosemite toads rely on shallow, ephemeral water, they may be particularly sensitive to even minor impacts on their habitat. Drying of meadow systems is one of the more significant changes, primarily as a result of widespread historic livestock overgrazing (Ratliff 1985, Menke *et al.* 1996, Lind *et al.* 2011, Weixelman *et al.* 2011, McIlroy *et al.* 2013). Timber harvest, road construction, and an altered fire regime has introduced additional distrubance pressures to meadows, including tree encroachment.

Approximately 33 percent of the toad's current range is within active Forest Service grazing allotments. Besides degradation of meadow habitat, livestock, as well as recreation including hikers, pack animals, and vehicles, can directly impact individual toads through trampling, collapse of rodent burrows, and harassment (Karlstrom 1962). Breeding toads and metamorphs are particularly vulnerable to such trampling (Martin 2008).

Although effects of road and trail fragmentation on Yosemite toad populations is unknown, there is evidence that roads and trails reduce Yosemite toad connectivity (Maier 2018). Also, recent monitoring efforts on the Sierra National Forest documented vehicle related mortality along commonly used roadways (Barnes 2017a, 2017b, and 2018). In response to the roadside mortality, the USDA Forest Service, Sierra National Forest, and the US Geological Survey San Diego Field Station Research Center installed an elevated road segment in suitable Yosemite toad habitat to decrease vehicle related mortality. Prelminary observations confirmed Yosemite toad crossing under the elevated road segment (Barnes 2018).

Diseases, especially chytrid fungus, also play an important role in Yosemite toad population dynamics. Although individuals appear less prone to epidemic outbreaks than mountain yellow-legged frogs (Green and Kagarise Sherman 2001, USFS *et al.* 2009), pathogen prevalence appeared to coincide with recent declines (Fellers *et al.* 2007, Service 2013). From 2006-2011, Dodge and Vredenburg (2012 in Service 2013) found infection intensities between 17 and 26 percent, and that juvenile toads were more likely to be infected. In an experimental study, 100 percent of juvenile toads exposed to chytrid fungus became infected and died within 25 days (Lindauer 2018).

Yosemite toads are expected to be vulnerable to a warming climate, but recent genetic research illustrated that the genetic diversity of Yosemite toads in Yosemite National Park may allow for local adaptation to climate change. Maier (2018) identified four main lineages of Yosemite toad in Yosemite National Park and patterns of tadpole development differed between lineages. For example, tadpoles developed faster in one lineage, which may prove advantageous if meadows dry at a faster rate in a warming climate.

As the majority of remaining populations are likely small and isolated, they are vulnerable to stochastic environmental events and loss of genetic diversity (Service 2014). Additionally, the Yosemite toad's high fidelity to breeding and non-breeding sites can increase the vulnerability of small populations when individuals return to habitats that are no longer suitable.

Status of Yosemite Toad Critical Habitat

Approximately 750,926 acres of critical habitat have been designated for the Yosemite toad in Alpine, Tuolumne, Mono, Mariposa, Madera, Fresno, and Inyo Counties, California (Service 2016). Critical habitat was divided into 16 separate units. The critical habitat units constitute the Service's current best assessment of areas that meet the definition of critical habitat for the Yosemite toad. The 16 units were known to be occupied when critical habitat was designated and the Service assumes these sub-units are currently occupied.

The Service (2016) determined that the Yosemite toad requires the following physical or biological features: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; and (5) habitats protected from disturbance or representative of the historical, geographic, and ecological distributions of the species.

Based on our current knowledge of the physical or biological features and habitat characteristics required to sustain the species' life-history processes, the Service (2016) determined that the primary constituent elements specific to the Yosemite toad are:
(1) Aquatic breeding habitat.
    (a) This habitat consists of bodies of fresh water, including wet meadows, slow-moving streams, shallow ponds, spring systems, and shallow areas of lakes, that:

(i) Are typically (or become) inundated during snowmelt;
(ii) Hold water for a minimum of 5 weeks, but more typically 7 to 8 weeks; and
(iii) Contain sufficient food for tadpole development.
(b) During periods of drought or less than average rainfall, these breeding sites may not hold surface water long enough for individual Yosemite toads to complete metamorphosis, but they are still considered essential breeding habitat because they provide habitat in most years.
(2) Upland areas.
(a) This habitat consists of areas adjacent to or surrounding breeding habitat up to a distance of 0.78 miles in most cases (that is, depending on surrounding landscape and dispersal barriers), including seeps, springheads, talus and boulders, and areas that provide:
(i) Sufficient cover (including rodent burrows, logs, rocks, and other surface objects) to provide summer refugia,
(ii) Foraging habitat,
(iii) Adequate prey resources,
(iv) Physical structure for predator avoidance,
(v) Overwintering refugia for juvenile and adult Yosemite toads,
(vi) Dispersal corridors between aquatic breeding habitats,
(vii) Dispersal corridors between breeding habitats and areas of suitable summer and winter refugia and foraging habitat, and/or
(viii) The natural hydrologic regime of aquatic habitats (the catchment).
(b) These upland areas should also maintain sufficient water quality to provide for the various life stages of the Yosemite toad and its prey base.

With the designation of critical habitat, the Service intends to conserve the geographic areas containing the physical and biological features that are essential to the conservation of species through the identification of the appropriate quantity and spatial arrangement of the PCEs that are sufficient to support the life-history functions of the species. Because not all life-history functions require all of the PCEs, not all areas designated as critical habitat will contain all of the PCEs.

Environmental Baseline of the Yosemite Toad

Yosemite National Park contains approximately 2,500 meadow parcels in the range of the Yosemite toad, but not all meadow parcels meet the habitat requirements of the Yosemite toad due to meadow wetness levels, conifer encroachment, size, distance to other meadows (occupied and unoccupied meadows), etc. Previous modeling work estimated that approximately 562 of these meadow parcels represent potential breeding meadows, but suggest that number is likely higher due to the difficulty of detecting Yosemite toads (Berlow *et al.* 2013). Yosemite toads also use upland habitat surrounding meadows consisting of conifers, talus, or boulders, and given many of Yosemite National Park's meadows are located in wilderness, it is likely they also contain suitable upland non-breeding habitat. Therefore, Yosemite toads can use portions of the action area for breeding, non-breeding activities, and dispersal between breeding meadows.

Yosemite National Park biologists and other researchers have not surveyed all suitable Yosemite toad meadow parcels, but through their survey efforts beginning in 1992 they located Yosemite toads at 221 meadow parcels. Overall Yosemite toad populations in Yosemite National Park are small. Although abundance of Yosemite toads may have shifted over time causing population declines, Yosemite toad distribution may not have changed in Yosemite National Park (Ostoja *et al.*, in prep. – cited in the Biological Assessment). Most extensive Park-wide surveys occurred prior to 2013, with other surveys being conducted opportunistically. Further, most surveys occurred prior to the onset of a considerable drought period in California (~2011 to 2017) so current occupancy post drought at many of these meadows is unknown. Surveys during the drought years primarily detected successful breeding attempts at high elevation meadows with lower success rates in low elevation meadows (< 7,000 feet; R. Grasso, NPS, personal communication 2017). Thorough surveys were not completed in 2017 or 2018, but Yosemite toad tadpoles were observed at meadows visited to achieve other research and monitoring objectives (Grasso 2017 and 2018), and some sites in southern Yosemite experienced an increase in breeding compared to previous years (R. Grasso, NPS, personal communication 2017). Given Yosemite toads were observed opportunistically in recent years, it is likely that many of the previously occupied meadows may still harbor at least small populations of toads.

Environmental Baseline of Yosemite Toad Critical Habitat

Yosemite National Park contains the following critical habitat units: 3 (Rogers Meadow); 4 (Hoover Lakes); 5 (Tuolumne Meadows/Cathedral); 6 (McSwain Meadows); 7 (Porcupine Flat); 8 (Westfall Meadows); 9 (Triple Peak); 10 (Chilnualna).

Units 3 through 10 are an essential component of the entirety of this critical habitat designation because these units provide a continuity of habitat between adjacent units, provide for the maintenance of genetic variation, and provide habitat types necessary to sustain Yosemite toad populations under various climate regimes. Within these critical habitat units, special management considerations or protections may be necessary to reduce the following threats: Impacts associated with timber harvest and fuels reduction activity; impacts associated with inappropriate livestock grazing; the spread of pathogens; and intensive use by recreationists, including pack stock camping and grazing (Service 2016).

The PCEs within Yosemite National Park are primarily found in wilderness areas and have historically been impacted by grazing activities. The introduction of fish species has converted much of the available breeding habitat to non-breeding habitat (i.e., converted PCE 1 to PCE 2). Fragmentation is much less of an issue since very few roads or other human-made features are present within the Action Area. Recreation activities such as backpacking and hiking also occur within these critical habitat units; however, these activities are managed by the Park to minimize impacts to suitable aquatic breeding and non-breeding habitat (e.g., backpackers are required to camp a minimal distance from water bodies, not allowed to camp in meadows, and wilderness permits are required for backpackers and pack stock users that limit the number of individuals staying overnight within the Park wilderness).

Effects of the Action

The effects of stock use on meadows may have direct and indirect impacts on Yosemite toads and Sierra Nevada yellow-legged frogs. Yosemite toads use shallow snowmelt pools in meadows for breeding, and Sierra Nevada yellow-legged frogs live in perennial waterbodies, including meadow habitats. Pack stock use may negatively influence toad and frog population persistence when pack stock use overlaps these meadow habitats. The Yosemite toad and Sierra Nevada yellow-legged frog spend all or part of their life in aquatic and meadow systems that also are preferred by livestock (Vredenburg et al. 2005). Similar to cattle, horses and mules may significantly overgraze, trample, or pollute riparian and aquatic habitat if too many are concentrated in riparian areas too often or for too long (Service 2014). Habitat changes due to pack stock grazing may pose a risk to some remnant populations of frogs and toads, and, in certain circumstances, a hindrance to recovery of populations in heavily used areas (Service 2014). But overall, the Service (2014) determined that pack stock use is a low-level threat for these two species.

Potential effects of pack stock on listed amphibians are poorly documented and not well understood. A negative relationship between stock use and Sierra Nevada yellow-legged frog and Yosemite toad breeding or occupancy has not been established. Matchett et al. (2015) investigated patterns between Yosemite toad occurrence and stock use, and did not detect a negative relationship between pack stock grazing and Yosemite toad breeding occupancy in Yosemite National Park meadows. Similarly, a research project on the relationship of cattle grazing and potential impacts to Yosemite toad habitat conducted by the USDA Forest Service Pacific Southwest Research Station and the University of California found that breeding and non-breeding meadow pool conditions did not differ in relation to livestock grazing or fencing treatment over time (Brown et al. 2015). Lastly, Tate et al. (2010) found that Yosemite toad occupancy was more related to meadow wetness than to livestock (cattle grazing) use.

While no evidence suggests it is a major risk factor for Yosemite toad or Sierra Nevada yellow-legged frog, there could be direct impacts to individual frogs or toads related to pack stock use. Mortality of adult Sierra Nevada yellow-legged frogs has been observed on USFS lands from trampling by cattle (Brown et al. 2014), and similarly mortality of Yosemite toad tadpoles in Yosemite has been observed due to pack stock animal trampling (USDI NPS, Thompson and Grasso, unpublished data). Yosemite toads may be exposed to livestock effects in their upland habitats if pack stock step on burrows occupied by the toads, where they would be crushed or entombed. The frequency of such incidents and their potential effect on Yosemite toad and Sierra Nevada yellow-legged frog population dynamics are poorly understood (Brown et al. 2014; Brown et al. 2015).

Direct injury and mortality of the Yosemite toad and Sierra Nevada yellow-legged frog are expected to be uncommon. Pack stock use in Yosemite wilderness is expected to be localized and for short-term durations. Concentrated pack stock use occurs in extremely limited areas throughout Yosemite National Park. In addition, Yosemite National Park implements resource protection measures to further minimize potential adverse effects to listed amphibian species resulting from pack stock use. For example, grazing is prohibited in areas where Yosemite Toad and Sierra Nevada yellow-legged frog are breeding, which decreases the chances that egg masses or tadpoles will be directly affected. Others resource protection measures include a requirement for wilderness permits for pack stock users that limit the number of individual pack stock staying overnight within the Park wilderness and serves to disperse use throughout the Park. Pack stock are required to use only designated camping areas and NPS trail systems. All of these measures will decrease overlap between the Yosemite toad and Sierra Nevada yellow-legged frog, which will minimize potential for direct mortality or injury to occur.

In addition to direct effects, indirect effects from pack stock use may also occur. Over grazing may negatively affect riparian habitat by decreasing vegetation cover, reduce food resources for amphibians, and increase exposure to predators. Livestock tend to concentrate along streams and wet areas where there is water and herbaceous vegetation; grazing impacts are, therefore, most pronounced in these habitats (Meehan and Platts 1978; Fleischner 1994; Menke *et al.*1996). Streambank erosion from trampling and hoof slide causes streambanks to collapse (Meehan and Platts 1978). This streambank collapse and erosion resulting from pack stock use may impact successful Sierra Nevada yellow-legged frog reproduction in future years because the species will have less available habitat for attaching egg masses. Stream banks and herbaceous vegetation also provide cover for frog larvae. Kuhn et al. (2015) found increased streambank stability at sites with lower levels of pack stock use in the previous year. Additionally, trampling associated with streambank erosion may increase sedimentation and result in altered stream morphology (Duff 1997, Kauffman et al. 1983, Bohn and Buckhouse 1985), which can lower meadow water tables and reduce the extent of permanent water bodies, such as shallow wetlands, needed by Yosemite toad for successful reproduction (Brown et al. 2014; Kuhn et al. 2018).

Effects to Critical Habitat

Effects to PCEs for the Sierra Nevada yellow-legged frog and Yosemite toad are similar to the indirect effects to amphibian habitat described above. Pack stock use, especially in concentrated areas, could degrade aquatic breeding habitat (PCE 1) and upland habitat (PCE 2) for the Yosemite toad and aquatic breeding habitat (PCE 1), aquatic non-breeding habitat (PCE 2), and upland habitat (PCE 3) for the Sierra Nevada yellow-legged frog. Although some small aquatic and upland areas may receive higher levels of disturbance due to repetitive use by pack stock animals, these areas make up a relatively small area compared to the overall size of the critical habitat units and habitat available to the listed amphibians. Additionally, due to the conservation measures implemented by Yosemite National Park, it is unlikely that use will occur in high enough concentrations to adversely impact these PCEs to a level that will preclude these critical habitat units from providing functional habitat for these species. For example, pack stock users will not use areas previously disturbed by pack stock users, pack stock will use NPS trail systems only, and grazing is prohibited in areas where Yosemite Toad and Sierra Nevada yellow-legged frog are breeding.

Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Yosemite has exclusive jurisdiction over its lands, there are no state, tribal, or local actions that are expected to occur in the action area. The only private or commercial actions that are reasonably certain to occur in the action area are visitor uses in the form of hiking, camping, fishing and pack stock travel or grazing. There are three primary means by which Sierra Nevada yellow-legged frog or Yosemite toad may be adversely affected by hikers, campers, anglers and pack stock: (1) disturbance during encounters with people and stock; (2) injury or mortality due to trampling by people and stock; and (3) degradation of habitat due to trails and/or stock use.

Conclusion

After reviewing the current status of the Sierra Nevada yellow-legged frog, Yosemite toad, and critical habitat for these two 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 wilderness stock use in Yosemite National Park wilderness areas is not likely to jeopardize the continued existence of the Sierra Nevada yellow-legged frog and Yosemite toad. The Service reached this conclusion because the project-related effects to the species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the species based on the following: (1) direct mortality of Sierra Nevada yellow-legged frog and Yosemite toad is expected to be uncommon; (2) most pack stock use will result in minor, localized, and predominantly short-term effects to suitable habitat; (3) highly concentrated pack stock use occurs in limited areas throughout Yosemite National Park and highly concentrated areas make up only a small portion of the wilderness areas within the Park; and (4) Yosemite National Park implements resource protection measures to further minimize potential adverse effects to listed amphibian species resulting from pack stock use.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by Service regulations at 50 CFR 17.3 as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the same regulations as an act which actually kills or injures wildlife. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Forest Service so that they become binding conditions of any grant or permit issued to the Plumas Corp, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest Service (1) fails to assume and implement the terms and conditions or (2) fails to require Plumas Corp to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest Service must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take

Sierra Nevada yellow-legged frog

The Service anticipates that incidental take of the Sierra Nevada yellow-legged frog will be difficult to detect due to their life history and ecology. We cannot measure the number of frogs taken as a result of the proposed project, because frogs are difficult to observe due to their size, cryptic coloring, and complexity of their habitat. Frogs can also quickly decay and/or be scavenged before their carcasses are detected. In addition, tadpoles are frequently hidden in submerged vegetation and cannot be counted precisely. Losses of Sierra Nevada yellow-legged frogs also may be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in water regime at their breeding ponds, or additional environmental disturbances. We will use detection of 3 dead or injured subadult or adult Sierra Nevada yellow-legged frogs (directly attributable to pack stock use) within the Action Area per year to determine when take is exceeded (i.e., if 4 dead or injured frogs are detected within one year then take is exceeded). We believe that the detection of 3 dead or injured individual Sierra Nevada yellow-legged frogs indicates the likelihood that more individuals have been injured or killed and that further resource protection measures may be warranted.

Yosemite Toad

The Service anticipates that incidental take of the Yosemite toad will be difficult to detect due to their life history and ecology. We cannot measure the number of Yosemite toad taken as a result of the Event, because Yosemite toad are difficult to observe due to their size, cryptic coloring, and complexity of their habitat. Toads can also quickly decay and/or be scavenged before their carcasses are detected. In addition, tadpoles are frequently hidden in submerged vegetation and cannot be counted precisely. Losses of Yosemite toad also may be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in water regime at their breeding ponds, or additional environmental disturbances. We will use detection of 3 dead or injured subadult or adult Yosemite toads (directly attributable to pack stock use) within the Action Area per year to determine when take is exceeded (i.e., if 4 dead or injured Yosemite toad are detected then take is exceeded). We believe that the detection of 3 dead or injured individual of Yosemite toad indicates the likelihood that more individuals have been injured or killed and that further resource protection measures may be warranted.

Effect of the Take

In the accompanying Biological Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. While pack stock use in wilderness areas within the Park may result in adverse effects to the frog and toad populations, the amount of incidental take will not prevent the species as a whole from recovering to pre-take levels. The Service believes that the project-specific conservation measures, as well as the terms and conditions detailed below, will be effective in minimizing the amount and extent of incidental take from the proposed action.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of the Sierra Nevada yellow-legged frog and Yosemite toad:

1. All Conservation Measures, as described in the Project Description section of this Biological Opinion, shall be fully implemented and adhered to. Further, this reasonable and prudent measure shall be supplemented by the Terms and Conditions below.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the National Park Service shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

The following Terms and Conditions implement the Reasonable and Prudent Measures:

1) The National Park Service shall implement the avoidance, minimization, survey, monitoring, and reporting measures described in the *Conservation Measures* section of the Biological Opinion.

2) The National Park Service shall monitor a sufficient number of pack stock use areas to ensure that pack stock use does not result in adverse effects beyond those analyzed in this biological opinion and levels of authorized Take are not exceeded. Results of this monitoring will be shared with the Service annually.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. Yosemite National Park should continue to implement and support projects that aid in the recovery of listed species such as the Sierra Nevada yellow-legged frog, including conservation actions identified in the *Interagency Conservation Strategy for Mountain Yellow-legged Frogs (Rana sierrae and Rana muscosa) in the Sierra Nevada* (MYLF ITT 2018).

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION—CLOSING STATEMENT

This concludes formal consultation on the proposed Wilderness Pack Stock Use in Yosemite National Park. As provided in 50 CFR §402.16, reinitiation of formal consultation is required and shall be requested by the federal agency or by the Service where discretionary federal agency involvement or control over the action has been retained or is authorized by law, and:

(a) If the amount or extent of taking specified in the incidental take statement is exceeded;

(b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the Biological Opinion; or

(d) If a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions regarding this Biological Opinion, please contact Rick Kuyper, Sierra/Cascades Division Chief (richard_kuyper@fws.gov), at the letterhead address or at (916) 414-6621.

Sincerely,

Jennifer M. Norris, Ph.D.
Field Supervisor

ec:
Rachel Mazur, Lisa Acree, Rob Grasso, and Colleen Kamoroff, Yosemite National Park, California

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Personal Communications

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