U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Bufo canorus*

COMMON NAME: Yosemite toad

LEAD REGION: Region 8

INFORMATION CURRENT AS OF: April 14, 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
X_ Continuing candidate
    ___ Non-petitioned
    X_ Petitioned - Date petition received: April 3, 2000
        X 90-day positive - FR date: October 12, 2000
        X 12-month warranted but precluded - FR date: December 10, 2002

        _ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

___ Listing priority change
    Former LP: ___
    New LP: ___
Date when the species first became a Candidate (as currently defined): December 10, 2002
___ Candidate removal: Former LPN: ___

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
____U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: *Amphibian, Bufonidae* (true toad)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: California

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: California

LAND OWNERSHIP: The vast majority of land within the range of the Yosemite toad is federally managed, with 919,011 ha (2,270,918 ac) (99 percent of the range) on USFS, NPS, and BLM lands. Much of this land is within designated wilderness. The remaining land within the species' range is a mix of State, local government, and private lands.

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BIOLOGICAL INFORMATION

Species Description

The Yosemite toad is moderately sized, with a snout-urostyle length (measured from the tip of the snout to the posterior edge of the urostyle, a bony structure at the posterior end of the spinal column) of 30-71 millimeters (mm) (1.2-2.8 inches (in)) with rounded to slightly oval paratoid glands (a pair of glands, one on each side of the head, that produce toxins) (Karlstrom 1962, pp. 21-23). The paratoid glands are less than the width of a gland a part (Stebbins 1985, pp. 71-72). A thin mid-dorsal (on the middle of the back) stripe is present in juveniles of both sexes. The stripe disappears or is reduced with age, and more quickly in males (Jennings and Hayes 1994, pp. 50-53). The iris of the eye is dark brown with gold iridophores (reflective pigment cells) (Jennings and Hayes 1994, pp. 50-53). Males are smaller than females, with less conspicuous warts (Stebbins 1951, p. 246). Differences in coloration between males and females are more pronounced in the Yosemite toad than in any other North American frog or toad (Stebbins 1951, p. 246). Females have black spots or blotches edged with white or cream that are set against a grey, tan or brown background color (Jennings and Hayes 1994, pp. 50-53). Males have a nearly uniform dorsal coloration of yellow-green to olive drab to darker greenish brown (Jennings and Hayes 1994, pp. 50-53). Karlstrom (1962, pp. 80-81) suggested that differences in coloration between the sexes evolved because they provide the Yosemite toad with protective coloration. The uniform coloration of the adult male matches and blends with the silt and grasses that they frequent during the breeding season, whereas the young and females with disruptive coloration tend to use a wider range of habitats with broken backgrounds; thus coloration may help conceal individual toads from predators.

Photo U.S. Fish and Wildlife Service

Taxonomy

The Yosemite toad (*Bufo canorus*) was originally described by Camp (1916, pp. 59-62), and given the common name Yosemite Park toad. Subsequent detections of this species indicated that its range extends beyond the boundaries of Yosemite National Park; and Grinnell and Storer (1924, pp. 657-660) referred to this species as the Yosemite toad. The word "canorus" means "tuneful" in Latin, referring to the male's sustained, melodious trill, which attracts mates during the early-spring breeding season.

Similarities in appearance of the Yosemite toad and the western toad (*Bufo boreas*) were noted by Camp (1916, pp. 59-62). Based on general appearance and structure and on distribution, it appears that these two species are closely related (Myers 1942, p. 10; Stebbins 1951, pp. 245-248; Mullally 1956, pp. 133-135; Savage 1958, pp. 251-253). The close relationship between *B. boreas* and *B. canorus* is also supported by studies of bone structure (Tihen 1962, pp. 1-50; and 1962b, pp. 1-50) and by the survivorship of hybrid toads produced by artificially crossing the two species (Blair 1959, pp. 427-453; 1963, pp. 1-16; and 1964, pp. 181-192).

Camp (1916, pp. 59-62), using characteristics of the skull, concluded that *B. boreas*, *B. canorus*, and *B. nestor* (extinct) are more closely related to each other than to other North American toads, and that these species comprise the most primitive group of *Bufo* in North America. Blair (1972, pp. 93-95) grouped *B. borea*s, *B. canorus*, black toads (*B. exsul*), and Amargosa toads (*B. nelsoni*) together taxonomically as the "boreas group."

Feder (1977, pp. 43-55) found *B. canorus* to be genetically distinctive based on samples from a limited geographic range. However, Yosemite toads are thought to hybridize with western toads in the northern part of their range (Karlstrom 1962, p. 84; Morton and Sokolski 1978, pp. 52-55). A genetic analysis on a segment of mitochondrial DNA from Yosemite toads was performed by Shaffer *et al.* (2000, pp. 245-257) from 372 toads from Yosemite and Kings Canyon National Parks. Their data showed significant genetic differences in Yosemite toads between the two parks. They also found significant genetic variability within Yosemite National Park between drainages and within both Parks between breeding sites. Their data also indicated that black toads are a subgroup within Yosemite toads rather than a separate species.

Stephens (2001. pp. 1-62) examined mitochondrial DNA from eight Yosemite toads (selected from the samples examined by Shaffer *et al.* (2000, pp. 245-257) to represent the range of variability found in that study) and 173 western toads. Stephens' data indicate that *Bufo* in the Sierra Nevada occur in northern and southern evolutionary groups, each of which include both Yosemite and western toads (i.e., toads of both species are more closely related to each other within a group than they are to members of their own species in the other group). While further genetic analysis of Yosemite toads sampled from throughout their range, and from other toad species surrounding their range, is needed to fully understand the evolutionary history and appropriate taxonomic status of the Yosemite toad (Stephens 2001. pp. 1-62), we have carefully reviewed the available literature and have concluded the Yosemite toad is a valid species.

Habitat/Life History

Yosemite toads use meadow habitats surrounded by lodgepole (*Pinus contorta*) or whitebark (*P. albicaula*) pines (Camp 1916, pp. 59-62). They are most likely to be found in areas with thick meadow vegetation or patches of low willows (*Salix* spp.) (Mullally 1953, pp. 182-183). They are most often seen near water, but only occasionally in water (Mullally and Cunningham 1956, pp. 57-67), and use rodent burrows for overwintering and probably for temporary refuge during the summer (Jennings and Hayes 1994, pp. 50-53). They also use spaces under surface objects, including logs and rocks, for temporary refuge (Stebbins 1951, pp. 245-248; Karlstrom 1962, pp. 9-10). Breeding habitat includes the edges of wet meadows and slow flowing streams (Jennings and Hayes 1994, pp. 50-53). Tadpoles have also been observed in shallow ponds and shallow areas of lakes (Mullally 1953, pp. 182-183). Moist upland areas such as seeps and springheads are important summer non-breeding habitats for adult toads (Martin 2002, pp. 1-3).

Historical Range/Distribution

The historic range of the Yosemite toad in the Sierra Nevada occurs from the Blue Lakes region north of Ebbetts Pass (Alpine County) to 5 kilometers (km) (3.1 miles (mi)) south of Kaiser Pass in the Evolution Lake/Darwin Canyon area (Fresno County) (Jennings and Hayes 1994, pp. 50-53). The historic elevational range of Yosemite toads is 1,460 to 3,630 m (4,790 to 11,910 ft) (Stebbins 1985, pp. 72; Stephens 2001, p. 12).

Current Range/Distribution

The historic and current acreage of Yosemite toad habitat (wet meadows, shallow breeding waters, and moist uplands) within the historic range of Yosemite toad is unknown. These habitats have been degraded and may be decreasing in area as a result of conifer encroachment and livestock grazing (see Factor A below). The vast majority of land within the range of the Yosemite toad is federally managed, with 919,011 hectares (ha) (2,270,918 acre (ac)) (99 percent of the range) on U.S. Forest Service (USFS), National Park Service (NPS), and Bureau of Land Management (BLM) lands. Much of this land is within designated wilderness. The remaining land within the species' range is a mix of State, local government, and private lands (9,190 ha (22,709 ac)).

The following known-site discussion is based on the California Wildlife Habitat Relations range map, obtained as a geographic information system data from the California Department of Fish and Game (CDFG). This map includes large areas of unsuitable habitat, but represents the best available range map for the species. The species has been detected in a few locations outside the range map boundaries, primarily at the southern end of the range. These site specific discussions are based on localized studies and thus do not represent a comprehensive range-wide assessments of the species status.

(1) The Yosemite toad is known from three sites in the southeast corner of the El Dorado National Forest where it borders with the Toiyabe and Stanislaus National Forests. Two of these three sites have been confirmed as occupied since 1990.

(2) The Yosemite toad is known from 25 locations along the west side of the Toiyabe National Forest, 15 of which have been confirmed as occupied since 1990.

(3) Yosemite toads are known from 28 sites on the Stanislaus National Forest, 22 of which have been confirmed as occupied since 1990. These sites occur primarily in two groups, one on the northern edge of the forest, where it borders with the El Dorado and Toiyabe National Forests, and the other in a band extending west across the Stanislaus National Forest, from its southeast border with Yosemite National Park and the Toiyabe National Forest. More recent surveys have found Yosemite toad present at approximately 80 meadows within the forest (Holdeman 2005, p. 1).

(4) The Yosemite toad is known from 49 sites along the west side of Inyo National Forest, 35 of which have been confirmed as occupied since 1990.

(5) The Yosemite toad was historically known from 91 locations throughout Sierra National Forest, of which 84 have been confirmed as occupied since 1990. From 2002 to 2004 surveyors visited 2227 sites in Sierra National Forest and Yosemite toads were detected at 313 sites (Sanders 2005, p. 1).

(6) The Yosemite toad was historically known from 78 sites scattered throughout Yosemite National Park, 57 of which have been confirmed occupied since 1990. Knapp (2005, p. 1) detected Yosemite toads at 74 of 2655 lakes and ponds surveyed in 2000, 2001, or 2002.

(7) The Yosemite toad is known from 18 sites throughout the northern half of Kings Canyon National Park, 14 of which have been confirmed as occupied since 1990.

It is impossible to fully determine the extent to which Yosemite toad populations have declined, because baseline data on the number and size of historic populations are few. The following studies, which reassess the current status of historically documented populations, give the most insight into the species' decline.

Grinnell and Storer (1924, pp. 657-660) surveyed for vertebrates at 40 sites along a 143-km (89-mi) west-to-east transect across the Sierra Nevada, through Yosemite National Park, in 1915 and 1919. Drost and Fellers (1996, pp. 414-425) conducted more thorough surveys, specifically for amphibians, at 38 of those sites in 1992. They found that Yosemite toads were absent from 6 of 13 sites in which they had been found in the original survey. At sites where Drost and Fellers (1996, pp. 414-425) found Yosemite toads, the toads occurred in low numbers (only 15 total adult and juvenile toads at all sites), with documented declines in relative abundance in three of the Grinnell and Storer (1924, pp. 657-660) sites, as based on their generalized abundance categories such as rare, common, and abundant. Therefore, the species was undetectable or had declined in numbers at 9 of 13 (69 percent) of the Grinnell and Storer (1924, pp. 657-660) sites.

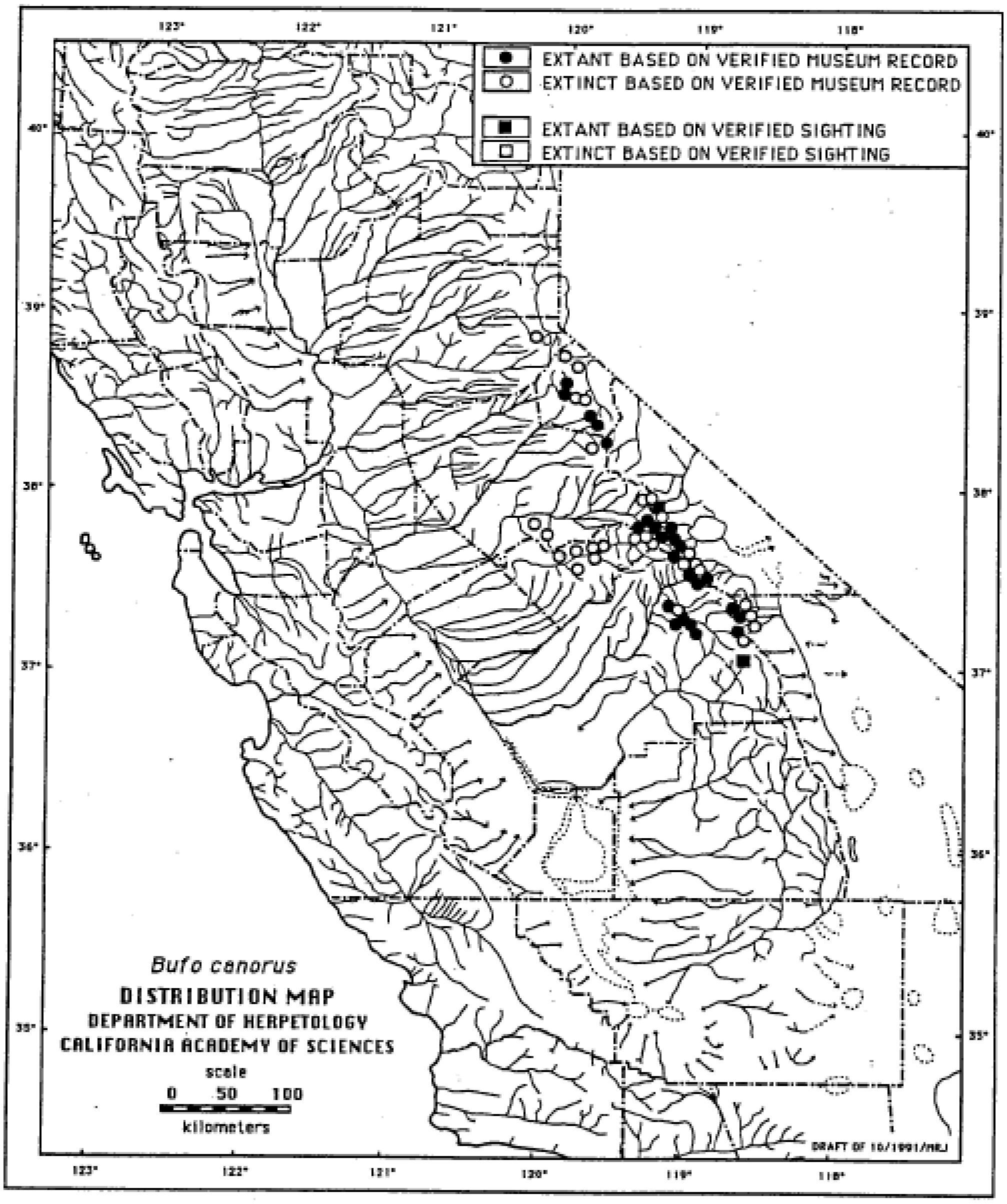
In 1990, David Martin surveyed 75 sites throughout the range of the Yosemite toad for which there are historic records of the species' presence, and found that 47 percent of those sites showed no evidence of any life stage of the species (Stebbins and Cohen 1997, pp. 213-215), suggesting a decline of about 53 percent.

Jennings and Hayes (1994, pp. 50-53) reviewed the current status of Yosemite toads using museum records of historic and recent sightings, published data, and unpublished data and field notes from biologists working with the species. They mapped 55 historically documented general localities throughout the range of the species where the toad had been present (based on 144 specific sites), and found that as of the writing of that report Yosemite toads were absent from 29 of those localities, a decline of over 50 percent.

An ongoing effort by the U.S. Forest Service is monitoring amphibians in 94 basins encompassing the ranges of both the Yosemite toad and the Sierra Nevada mountain yellow-legged frog. In surveys conducted in 2002, 2003, and 2004, Yosemite toads were detected in 75-85 percent of the basins where this species has been observed since 1990. In 16 basins sampled in more than one of these years, 10 basins had toads detected in all years, 4 basins had toads detected in some years, and 2 had no toads detected (Brown 2005, p. 1). While no new information on the status and change of the Yosemite toad has not been summarized as of yet, monitoring has been conducted throughout 2005 and 2006 and is ongoing (Brown 2007, pp.1-2)

The only long-term study on the size of a population of the Yosemite toad documents a dramatic decline. Kagarise Sherman and Morton (1993, pp. 186-198) studied Yosemite toads at Tioga Pass Meadow (Mono County, California) intensively from 1971 to 1982, and made less systematic observations from 1983 to 1991. To estimate the adult population size, they captured and marked toads entering breeding pools. From 1974 to 1978, an average of 258 males entered the breeding pools. In 1979, the number of male toads began to decline, and by 1982, the number of males had dropped to 28. During the same time period, the number of females varied between 45 and 100, but there was no obvious trend in number observed. In periodic surveys between 1983 and 1991, it appeared that both males and females continued to decline, and breeding activity became sporadic. In 1990, the researchers were only able to locate one female, two males, and four to six egg masses. In 1991, they found only one male and two egg masses. The researchers also surveyed non-breeding habitat in the same area and found similar population declines. To date, the population at Tioga Pass Meadow has not recovered (Knapp 2002, p. 1).

Kagarise Sherman and Morton (1993, pp. 186-198) also conducted occasional surveys of six other populations in the eastern Sierra Nevada. Five of these populations showed serious, apparently long-term, declines between 1978 and 1981, while the sixth population held relatively steady until the final survey in 1990, at which time it dropped precipitously. In 1991, E.L. Karlstrom revisited the site where he had studied a breeding population of Yosemite toads from 1954 to 1958, just south of Tioga Pass Meadow within Yosemite National Park (Tuolumne County, California), and found no evidence of toads or signs of breeding (Kagarise Sherman and Morton 1993, pp. 186-198).



From Jennings and Hayes 1994, p. 51

<u>Population Estimates/Status</u> No estimate of the number of Yosemite toad present within the range or even for localized populations is available. Adults of this species spend only brief periods of time at breeding ponds, making census of populations difficult. We can however make an estimate of the number of populations as indicated by occupied sites. Using this approach the available data suggest that the Yosemite toad occurs in at least 475 different sites within its range.

THREATS

A. <u>The present or threatened destruction, modification, or curtailment of its habitat or range</u>.

Grazing. Grazing by cattle and horses is not a natural situation in Yosemite toad habitats, and these habitats are vulnerable to degradation. Because Yosemite toad breeding habitat is shallow, that habitat is very vulnerable to changes in hydrology caused by grazing (Martin 2002, pp. 1-3; Knapp 2002, p. 1).

Direct and indirect mortality of Yosemite toads have occurred as a result of livestock grazing. Cattle have been observed to trample Yosemite toad eggs and disturb eggs such that they fall into hoof prints, or other deeper water, and die. Metamorph Yosemite toads have been observed to have died after falling into cattle hoof prints or being defecated upon by cattle. Adult Yosemite toads trampled to death by cattle have also been observed (Martin 2002, pp. 1-3). Preliminary research data indicate that Yosemite toad tadpoles in grazed areas take longer to metamorphose and produce smaller metamorphs than those in areas being rested from grazing, potentially due to high bacterial and nutrient levels in the grazed areas (Martin 2002, pp. 1-3).

Grazing also removes vegetative cover, and before/after surveys have shown reductions in the number of Yosemite toads using an area after the herbaceous cover was grazed (Martin 2002, pp. 1-3). Grazing can cause erosion by disturbing the ground, removing vegetation, and destroying peat layers in meadows, which lowers the groundwater table and summer flows (Armour *et al.* 1994, pp. 9-12; Martin 2002, pp. 1-3). Consequently, this may increase the stranding and mortality of tadpoles, or make these areas completely unsuitable for Yosemite toads (Martin 2002, pp. 1-3). Grazing can also degrade or destroy moist upland areas used as non-breeding habitat by Yosemite toad (Martin 2002, pp. 1-3), especially when nearby meadow and riparian areas have been fenced to exclude livestock. Livestock may also collapse rodent burrows used by Yosemite toad as cover and hibernation sites, or disturb toads and disrupt their behavior.

The potential impacts of grazing on habitat can be inferred by observing the recovery of vegetation, ground stability, and water flow that occurs when riparian areas are fenced to exclude livestock (Kattelmann and Embury 1996, Ch. 5 pp. 16-18). A study of fish habitat on Silver King and Coyote Valley Creeks (tributaries of the Carson River, Alpine County, California), showed that in stream reaches fenced to exclude cattle, over time, bank stability increased and stream channels became deeper and narrower as compared to unfenced reaches. This indicated that streambank sloughing had been reduced and vegetation was stabilizing soils and reducing erosion (Overton *et al.* 1994, pp. 1-27; Kattelmann and Embury 1996, Ch. 5 pp. 16-18).

Livestock grazing in the Sierra Nevada has been so widespread for so long that, in most places, no ungrazed areas are available to illustrate the natural condition of the habitat (Kattelmann and Embury 1996, Ch. 5 pp. 16-18). Due to the long, and historically unregulated history (Menke *et al.* 1996, Ch. 22 pp. 1-52) of livestock and packstock grazing in the Sierra Nevada, and the lack of historic Yosemite toad population size estimates, it is difficult to establish a quantitative link between grazing and reductions in Yosemite toad populations. However, because of the documented negative effects of livestock on Yosemite toad habitat, and documented direct mortality of the species caused by livestock, the decline of some populations of Yosemite toad has been attributed to the effects of livestock grazing (Jennings and Hayes 1994, pp. 50-53; Jennings 1996, pp. 921-944). The U.S. Forest Service has developed an adaptive management study plan for determining the effects of livestock grazing on Yosemite toads and their habitat (Allen-Diaz *et al*. 2007, pp. 1-45).

Roads and Timber Harvest. Any activity that severely alters the terrestrial environment, such as road construction and timber harvest, is likely to result in the reduction and occasional extirpation of amphibian populations in the Sierra Nevada (Jennings 1996, pp. 921-944). By creating gaps in the natural vegetation, roads and harvested areas may act as dispersal barriers and contribute to the fragmentation of Yosemite toad habitat and populations. Habitat fragmentation has been shown to have a negative effect on amphibian species richness (Lehtinen *et al*. 1999, pp. 1-12). Timber harvest removes vegetation and causes ground disturbance and soil compaction, which makes that ground more susceptible to erosion (Helms and Tappeiner 1996, pp. 439-476). Much of the erosion caused by timber harvests is from logging roads (Helms and Tappeiner 1996, pp. 439-476). This erosion could damage Yosemite toad breeding habitat by lowering the water table, and drying out riparian habitats used by the species.

Prior to the formation of National Parks and National Forests, timber harvest was widespread and unregulated, but most cutting occurred below the elevational range of the Yosemite toad on the west slope of the Sierra Nevada (University of California (UC) 1996, pp. 17-45). Between 1900 and 1950, the majority of timber harvest was of old growth forests on private land (UC 1996, pp. 17-45). The majority of roads in National Forests of the Sierra Nevada were built between 1950 and 1990 to allow access to the forests for timber harvest (USDA 2001a, p. 445). Between 1950 and the early 1990s, the USFS allowed major increases in timber harvest on National Forests and at higher elevations, and the majority of impacts on Yosemite toads probably took place during this period.

Roads may cause direct mortality of amphibians through roadkill (DeMaynadier and Hunter 2000, pp. 56-65), and the possible introduction of contaminants such as petroleum products, herbicides, and pesticides. The levels of timber harvest and road construction have declined substantially since implementation of the California Spotted Owl Sierran Province Interim Guidelines in 1993, and some existing roads have been, or are scheduled for, decommissioning (USDA 2001a, p. 445). Therefore, the risks posed by new roads and timber harvests have declined, but those already existing still pose risks to the species and its habitat through erosion, roadkill, and contaminant introduction.

Vegetation and Fire Management Activities. Vegetation management includes the removal of small trees and brush to reduce fuels, and to reduce competition which allows faster growth of desired tree species (Helms and Tappeiner 1996, pp. 439-476). These activities may disturb the ground and increase erosion, which could cause damage to Yosemite toad habitat through siltation and lowering of groundwater levels. Brush removal sometimes includes the use of herbicides, which may run off into Yosemite toad habitat, causing lethal or sublethal effects on individuals (see Factor D and E below).

Long-term fire suppression has influenced changes in forest structure and dynamics in the Sierra Nevada. In general, the fire return interval is now much longer than it was historically, and live and dead fuels are more abundant and continuous (USDA 2001a, p. 35). Fire is thought to be important in maintaining open aquatic and riparian habitats for amphibians in some systems (Russel *et al.* 1999, pp. 374-384).

Fire suppression, and changes in fire frequency and hydrology, has probably contributed to the decline of the Yosemite toad through habitat loss caused by conifer encroachment on meadows (Chang 1996, pp. 1071-1099; NPS 2002, p. 1). Under natural conditions, conifers are excluded from meadows by fire and by soils too saturated for their survival. But in the absence of regular fire conifers may encroach upon meadow habitat, their root systems reducing soil moisture. In some areas vegetation treatment may be needed to maintain or restore Yosemite toad habitat.

Increases in fuel abundance have created the potential for catastrophic fires which could cause direct mortality of Yosemite toads; however, data on the direct effects of fire on Yosemite toads are lacking. Fire and mechanical fire suppression activities (such as cutting fire lines) could cause erosion and siltation that could negatively impact Yosemite toad habitat. However, amphibians in general are thought to retreat to moist or subterranean refuges and thereby suffer low mortality during natural fires (Russel *et al*. 1999, pp. 374-384).

Fire retardant chemicals contain nitrogen compounds or surfactants (soaps). Laboratory tests of these chemicals have shown that they cause mortality in fish and aquatic invertebrates (Hamilton *et al.* 1996, pp. 132-144), and likely have similar effects on amphibians. Therefore, if fire retardant chemicals were dropped in or near Yosemite toad habitat, they could have negative effects on individual toads. The majority of vegetation and fire management activities take place at lower elevations, but they do pose a threat to Yosemite toads when they take place in occupied habitat.

<u>Recreation</u>. Recreational activities take place throughout the Sierra Nevada and can have significant negative impacts on wildlife and their habitats (USDA 2001a, p. 221 and pp. 453-500). Recreation is the fastest growing use of National Forests (USDA 2001a, pp. 453-500). Heavy foot traffic in riparian areas tramples vegetation, compacts soils, and can physically damage streambanks. Trails (foot, horse, bicycle, or off-highway motor vehicle) compact soil in riparian habitat, which increases erosion, displaces vegetation, and can lower the water table (Kondolph *et al.* 1996, pp. 1009-1026). Trampling or the collapsing of rodent burrows by recreationists, pets, and vehicles could lead to direct mortality of all life stages of the Yosemite toad. Recreational activity may also disturb toads and disrupt their behavior (Karlstrom 1962, pp. 3-34).

<u>Dams and Water Diversion</u>. Several artificial lakes are located in or above Yosemite toad habitat, most notably Edison, Florence, Huntington, Courtright, and Wishon Reservoirs. By altering the timing and magnitude of water flows, these reservoirs have caused changes in hydrology that may have negatively altered Yosemite toad habitat. Changes in water flows have caused increased water levels upstream of the reservoirs, which may have reduced the suitability of shallow water habitats necessary for egg laying, or allowed the invasion of predatory fish into those habitats. Water flow changes may have contributed to the mortality of eggs and tadpoles

either by stranding during low water or inundation during high water. The reservoirs themselves probably cover what was once Yosemite toad habitat. Most native Sierra Nevada amphibians cannot live in or move through reservoirs (Jennings 1996, pp. 921-944). Therefore, reservoirs represent both a loss of habitat and a barrier to dispersal and gene flow. These factors have probably contributed to the decline of Yosemite toad and continue to pose a risk to the species.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

There is no known commercial market for Yosemite toad. There is also no documented recreational or educational use for Yosemite toad.

Scientific research may cause some stress to Yosemite toad through disturbance and disruption of behavior, handling, and injuries associated with marking individuals. Scientific research has resulted in the death of a few individuals through accidental trampling (Green and Kagarise Sherman 2001, pp. 92-103), irradiation where Karlstrom (1957, pp. 187-195) collected data on Yosemite toad movements by implanting them with radioactive tags, and collection for museum specimens (Jennings and Hayes 1994, pp. 50-53). Given the current reduced size and number of populations (Jennings and Hayes 1994, pp. 50-53), further unregulated collection could pose a serious threat to Yosemite toad populations.

C. Disease or predation.

Prior to the stocking of high Sierra Nevada lakes with salmonid fishes, which began over a century ago, fish were entirely absent from most of this region (Bradford 1989, pp. 775-778). Introduced fish, such as rainbow and golden trout (*Oncorhynchus mykiss* ssp.), brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*), have been shown to have a negative impact, primarily through predation, on native populations of Sierra Nevada amphibians, including the mountain yellow-legged frog (Bradford 1989, pp. 775-778; Knapp and Matthews 2000, pp. 428-438) and Pacific chorus frog (Matthews *et al.* 2001, pp. 1130-1137).

Data on the effects of introduced fish on the Yosemite toad is less clear, although re-surveys of historic Yosemite toad sites have shown that the species had disappeared from several lakes where they formally bred and which are now occupied by fish (Stebbins and Cohen 1997, pp. 213-215; Martin 2002, p. 1). Drost and Fellers (1994, pp. 414-425) state that Yosemite toads are less vulnerable to fish predation than frogs because they breed primarily in ephemeral waters that do not support fish. Jennings and Hayes (1994, pp. 50-53) stated that the palatability of Yosemite toad tadpoles to fish predators was unknown, but is often assumed to be low based on the unpalatability of western toads (Drost and Fellers 1994, pp. 414-425; Kiesecker *et al.* 1996, pp. 1237-1245), to which Yosemite toads are closely related. Brook trout have been observed to prey on Yosemite toad tadpoles and to "pick at" Yosemite toad eggs, which later became infected with fungus (Martin 2002, p. 1). Grasso et al. (2005, p. 1) conducted a study and observed brook trout swim near, but ignore, Yosemite toad tadpoles, suggesting that tadpoles are unpalatable. The study also found that metamorph Yosemite toads were not consumed by brook trout (Grasso et al. 2005, p.1); however, the the sublethal effects from trout "sampling" or mouthing and ejecting tadpoles, which was observed during trials and the palatability of metamorphs to other trout species is unknown. In addition metamorph western toads have been observed in golden trout stomach contents (Knapp 2002, p. 1).

Because Yosemite toads primarily breed in ephemeral waters, fish are probably less of an impact on them than on amphibians that breed primarily in perennial lakes and streams. However, the observed predation of Yosemite toad tadpoles by trout (Martin 1992, p.1) indicate that introduced fish may pose a risk to the species in some situations, which may be accentuated during drought years.

At a site where Yosemite toads normally breed in small meadow ponds, they have been observed to successfully switch breeding activities to stream habitat containing fish during years of low water (Strand 2002, p. 1). Thus, drought conditions can increase the toads' exposure to predatory fish. Also, although the number of lake breeding sites used by Yosemite toads is small relative to the number of ephemeral sites, lake sites may be especially important because they are more likely to be useable during years with low water (Knapp 2002, p. 1).

Various diseases have been confirmed in dead Yosemite toad (Green and Kagarise Sherman 2001, pp. 92-103). Those diseases, in concert with other factors, are likely to have contributed to the decline of the Yosemite toad and continue to pose a risk to the species. Mass die-offs of amphibians have been attributed to: chytrid fungal infections of metamorphs and adults (Carey *et al.* 1999, pp. 1-14); *Saprolegnia* fungal infections of eggs (Blaustein *et al*. 1994, pp. 251-254); iridovirus infection of larvae, metamorphs, or adults; and bacterial infections (Carey *et al*. 1999, pp. 1-14). Humans, pets, livestock, packstock, vehicles, and wild animals may all act as disease vectors. Although it has not been observed in the Sierra Nevada, introduced fish may also serve as disease vectors to amphibians. Infection of both fish and amphibians by the same pathogen has been documented with viral (Mao *et al.* 1999, pp. 45-52) and fungal (Blaustein *et al.* 1994, pp. 251-254) pathogens.

Tissue samples, from dead or dying adults and from healthy tadpoles, were collected during a die-off of adult Yosemite toads at Tioga Pass Meadow and Saddlebag Lake and analyzed for disease (Green and Kagarise Sherman 2001, pp. 92-103). Several infections were found in the adults, including: chytridiomycosis (chytrid fungal infection), bacillary bacterial septicemia (red-leg disease), *Dermosporidium* (a fungal infection), myxozoan infection (a parasitic cnidarian (relatives of jellyfish)), *Rhabdias* spp. (a parasitic roundworm) infection, and several species of trematode (parasitic flatworm) infection. However, no single infectious disease was found in more than 25 percent of individuals, and some dead toads showed no infection that would explain their death. No evidence of infection was found in tadpoles. The authors concluded that the die-off was caused by suppression of the immune system caused by an undiagnosed viral infection or chemical contamination that made the toads susceptible to the variety of diagnosed infections.

Carey (1993, pp. 355-361) developed a model to explain the disappearance of boreal toads (*Bufo boreas boreas*) in the Rocky Mountains. In that model, she hypothesized that the toads were stressed by some unknown environmental factor. This stress caused a physiological response that suppressed the immune system, which was further hindered by cold temperatures typical of the toads' high-elevation environment. The toads then died of infection by pathogens normally found in their environment. This model may fit Yosemite toad die-offs, given the close relationship between the two toads and their occupation of similar habitats.

Saprolegnia ferax is a species of water mold that commonly infects fish. This mold has been documented to cause massive lethal infection of eggs of western toads in Oregon (Blaustein *et al*. 1994, pp. 251-254). However, it is unclear whether the infection was caused by the introduction of the fungal pathogen via fish stocking, or if the fungus was already present and the eggs' ability to resist infection was inhibited by some unknown environmental factor. Subsequent laboratory experiments, showed that the fungus could be passed from hatchery fish to western toads (Kiesecker *et al.* 2001, 1064-1070). Fungal growth on Yosemite toad eggs was observed by Kagarise Sherman (1980, p. 46), but the fungal species was not determined, and it was unclear whether the fungus killed the eggs or grew on them after they died of some other cause. Field studies conducted in Yosemite National Park found that an undetermined species of water mold infected only the egg masses that contained dead embryos. The researchers also observed that the water mold became established on egg masses only after embryo death, and subsequently spread, causing the mortality of additional embryos (Sadinski 2004, pp. 33-34).

Sadinski (2004, p. 35) discovered that additional mortality of Yosemite toad embryos may be attributed to an unidentified species of a free-living flatworm, *Turbellaria* spp. During the study of the toad population in Yosemite National Park, these worms were observed to penetrate the Yosemite toad egg masses and feed directly on the embryos. In some locations, the *Turbellaria* spp. reached such large densities that they consumed all embryos within an egg mass. The predation of the toad egg masses also facilitated the colonization and spread of water mold on the egg masses leading to further embryo mortality. Further studies will be needed to determine which species of *Turbellaria* feeds on Yosemite toad eggs and the extent of the impact this predation has on the Yosemite toad.

D. <u>The inadequacy of existing regulatory mechanisms</u>.

The Yosemite toad occurs on Federal, State, and private lands. Existing regulatory mechanisms do not fully protect this species or its habitat on these lands. Federal, State, and local laws have been insufficient to prevent past and ongoing losses of the limited habitat of the Yosemite toad.

The National Park service Organic Act of 1916 established the National Park Service for the preservation, conservation, and management of the scenic, natural (including wildlife), and historic objects of the United States for the enjoyment of current and future generations. As a result, Yosemite toads may not be taken or possessed within a National Park without a special permit from the National Park Service (NPS 2001, pp. 1-3). In addition, cattle grazing, stocking of fish, and most timber harvest are prohibited within National Park boundaries without special permits or authorization (NPS 2001, pp. 1-3, NPS 2008, pp. 1-2). Despite these restrictions, the Yosemite toad has continued to decline within the National Parks where the species occurs. This may be, in part, due to the Parks allowing such activities as packstock grazing and recreation in

Yosemite toad habitat, as well as chemical contamination of the species and its habitat from sources outside the Parks.

The Wilderness Act of 1964 calls for designated wilderness land "to be protected and managed so as to preserve its natural conditions." Timber harvest and the use of motor vehicles are generally prohibited within wilderness areas, but cattle grazing and invasive fish stocking are permitted within National Forest wilderness lands and pose a threat to the species and its habitat. The species has declined sharply (Jennings and Hayes 1994, pp. 50-53) regardless of wilderness designation in large portions of its range.

The Yosemite toad is considered a sensitive species by the U.S. Forest Service. Each National Forest is required to complete a Land and Resource Management Plan (LRMP) by the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (NFMA). Those acts require that the LRMPs provide for multiple use and sustained yield of the products and services obtained from the National Forests, including wildlife.

In 2001, a record of decision (ROD) was signed by the U.S. Forest Service finalizing the Sierra Nevada Forest Plan Amendment (SNFPA), based on the final environmental impact statement (FEIS) for the SNFPA effort and prepared under the1982 NFMA planning regulations (USDA 2001a, pp. 1-55). The ROD amends the USFS Pacific Southwest Regional Guide, the Intermountain Regional Guide, and the LRMPs for national forests in the Sierra Nevada and Modoc Plateau. This document affects land management on national forests within the range of the Yosemite toad. The SNFPA addresses and gives management direction on issues pertaining to old forest ecosystems; aquatic, riparian, and meadow ecosystems; fire and fuels; noxious weeds; and lower westside hardwood ecosystems of the Sierra Nevada.

In January 2004, the USFS amended the SNFPA, based on the final supplemental environmental impact statement (FSEIS), following a review of specific areas of the SNFPA: fire and fuels treatments, compatibility with the National Fire Plan, compatibility with the Herger-Feinstein Quincy Library Group Forest Recovery Pilot Project, and effects of the SNFPA on grazing, recreation, and local communities (USDA 2004a, pp. 1-55).

Relevant to the Yosemite toad, the FSEIS ROD for the SNFPA aims to protect and restore aquatic, riparian, and meadow ecosystems, and to provide for the viability of their associated native species via an aquatic management strategy. The aquatic management strategy is a general framework with broad policy direction. Implementation of this strategy is intended to take place at the landscape and project levels. There are nine goals associated with the aquatic management strategy. They include: (1) the maintenance and restoration of water quality to comply with the Clean Water Act (CWA) and the Safe Drinking Water Act; (2) the maintenance and restoration of habitat to support viable populations of native and desired non-native riparian-dependent species and to reduce negative impacts of non-native species on native populations; (3) the maintenance and restoration of species diversity in riparian areas, wetlands, and meadows to provide desired habitats and ecological functions; (4) the maintenance and restoration of the distribution and function of biotic communities and biological diversity in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and marshes); (5) the maintenance and restoration of spatial and temporal connectivity for aquatic and riparian species within and between watersheds to provide physically, chemically, and biologically unobstructed movement for their survival, migration, and reproduction; (6) the maintenance and restoration of hydrologic connectivity between floodplains, channels, and water tables to distribute flood flows and to sustain diverse habitats; (7) the maintenance and restoration of watershed conditions as measured by favorable infiltration characteristics of soils and diverse vegetation cover to absorb and filter precipitation, and to sustain favorable conditions of stream flows; (8) the maintenance and restoration of instream flows sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and to keep sediment regimes within the natural range of variability; and (9) the maintenance and restoration of the physical structure and condition of stream banks and shorelines to minimize erosion and sustain desired habitat diversity. If these goals are pursued and met, the Yosemite toad and its habitat could benefit. These goals, if met, would restore Yosemite toad aquatic habitats that have been degraded by a history of livestock use.

To help meet these goals, the aquatic management strategy proposes a broad initial action to address the Yosemite toad in a conservation plan developed by the USFS with other State and Federal agencies; an effort by the USFS to do this is underway. Where known locations of Yosemite toads occur on the national forests, critical aquatic refuges will be designated. A primary management goal for the critical aquatic refuges is to contribute to the viability and recovery of sensitive species (including the Yosemite toad) through habitat preservation, enhancement, restoration, or connectivity. Within the aquatic management strategy, critical aquatic refuges are given highest priority for evaluating how existing and proposed activities are consistent with the goals of the strategy. The aquatic management strategy directs existing and proposed activities within critical aquatic refuges to be consistent with the goals of the critical aquatic refuges. This evaluation will be made using the riparian conservation objectives and associated standards and guidelines, as defined in the FSEIS ROD for the SNFPA. One such standard and guideline specific to the Yosemite toad includes the avoidance of pesticide applications from within 152 m (500 ft) of sites known to be occupied by the species.

Management standards and guidelines in the SNFPA FSEIS ROD for the Yosemite toad may have an impact on the species. These standards and guidelines exclude livestock from standing water and saturated soils in wet meadows and associated streams and springs occupied by Yosemite toads during the breeding and rearing season, but can be waived if a site specific management plan including a rigorous monitoring component is developed. However, monitoring plans have not been developed. Additionally, grazing restrictions do not apply to packstock or saddlestock and may still impact Yosemite toads (USDA 2004b, pp. pp. 161-162).

The SNFPA includes requirements for monitoring to determine how well the aquatic management strategy goals and the riparian conservation objectives have been met, and how closely management standards and guidelines have been applied. However, monitoring plans have not been developed.

Our review of the SNFPA FEIS and ROD indicate that full implementation of the SNFPA FSEIS could have both positive and negative effects on the Yosemite toad and its habitat. National forests affected by the SNFPA are responsible for implementing it; however, implementation is subject to funding. Therefore, the extent to which it may benefit the Yosemite toad and its habitat is uncertain. The Forest Service is in the process of developing forest management regulations after the previous regulations enacted in 2005 (USDA 2005, pp. 1022-1023) were removed by the court.

The State of California considers the Yosemite toad a species of special concern, but it is not State listed as a threatened or endangered species under the California Endangered Species Act. California Sport Fishing Regulations include the Yosemite toad as a protected species that may not be taken or possessed at any time except under special permit from the CDFG. This gives the Yosemite toad some legal protection from collecting, but does not protect it from other causes of mortality or alterations to its habitat.

The California Environmental Quality Act (CEQA) requires review of any project that is undertaken, funded, or permitted by a State or local governmental agency. If a project with potential impacts on Yosemite toad were reviewed, CDFG personnel could determine that, although not listed, the toad is a *de facto* endangered, threatened, or rare species under section 15380 of CEQA. Once significant effects are identified, the lead agency has the option of requiring mitigation for effects through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA Sec. 21002). In the latter case, projects may be approved that cause significant environmental damage, such as destruction of listed endangered species or their habitat. Protection of listed species through CEQA is, therefore, dependent upon the discretion of the agency involved.

The California Forest Practice rules set guidelines for the design of timber harvests on private land to reduce impacts on non-listed species. However, these rules have little application to the protection of Yosemite toad because approximately 99 percent of the species' range is on Federal land.

The California Department of Pesticide Regulation has authority to restrict the use of pesticides. Their Toxic Air Contaminant (TAC) Program includes assessment of the risks posed by airborne pesticides by collecting air samples near sites of pesticide application and in communities near those sites. If air samples indicate that reductions in exposure are needed, mitigation measures are developed to bring about those reductions (California Department of Pesticide Regulation 2001, pp. 32-34). However, the TAC program is intended primarily to protect human health, and air samples are not taken at far distant locations from application sites, like those inhabited by Yosemite toads.

E. <u>Other natural or manmade factors affecting its continued existence</u>.

The Yosemite toad is likely exposed to a variety of pesticides and other chemicals throughout its range. Environmental contaminants could negatively affect the species by causing direct mortality; suppressing the immune system; disrupting breeding behavior, fertilization, growth or development of young; and disrupting the ability to avoid predation (Carey and Bryant 1995, pp. 13-17). Hydrocarbon and other contamination from oil production and road runoff; the application of numerous chemicals for agricultural production; roadside maintenance; and rodent and vector control programs may all have negative effects on Yosemite toad populations. Also, the airborne transport of pesticides as a result of drift from agricultural applications, including chlorothalonil, malathion, diazinon, and chlorpyrifos, from the Central Valley of California to the Sierra Nevada, has been documented (Aston and Seiber 1997, pp. 1483-1482; McConnell *et al.* 1998, pp. 1906-1911) in samples of air, rain, snow, lake water, and pine needles.

Cholinesterase is an enzyme that functions in the nervous system and is disrupted by organophosphorus pesticides, including malathion, chlorpyrifos, and diazinon (Sparling *et al.* 2001, pp. 1591-1595). Reduced cholinesterase activity and pesticide residues have been found in Pacific chorus frog larvae collected in the Sierra Nevada downwind of the Central Valley (Sparling *et al.* 2001, pp. 1591-1595). Cholinesterase activity was significantly lower in samples from the Sierra Nevada than from samples taken from coastal California, upwind of the Central Valley. No samples were taken above approximately 1,500 m (4,900 ft) elevation (Sparling *et al.* 2001, pp. 1591-1595), which barely overlaps the 1,460 to 3,630 m (4,790 to 11,910 ft) elevational range (Stebbins 1985, pp. 71-72) of Yosemite toad. However, significant amounts of pesticide residues have been documented as high as 1,920 m (6,300 ft) in Sequoia National Park, south of Yosemite and Kings Canyon National Parks (Aston and Seiber 1997, pp. 1483-1482; McConnell *et al.* 1998, pp. 1906-1911). In addition to interfering with nerve function, contaminants may act as estrogen mimics (Jennings 1996, pp. 921-944), or may otherwise disrupt endocrine function (Carey and Bryant 1995, pp. 13-17), and may have a negative effect on amphibian populations.

Dichlorodiphenyltrichloroethane (DDT) and its residues were found in frogs throughout the Sierra Nevada during the late 1960s (Corey *et al.* 1970, pp. 205-211), and those residues still appear in Pacific chorus frog larvae collected in the late 1990s (Sparling *et al.* 2001, pp. 1591-1595), over 25 years after DDT was banned for use in the United States.

Spatial analysis of Yosemite toad populations shows a trend towards greater decline in populations downwind of areas of the Central Valley with more agriculture, where there is presumably more pesticide use; however this trend is not statistically significant (Davidson 2002, pp. 14-16).

Snow core samples from the Sierra Nevada contain a variety of contaminants from industrial and automotive sources including: hydrogen ions (indicative of acidic precipitation), nitrogen and sulfur compounds (NH_4, NO_3, SO_2, and SO_4), and heavy metals (Pb, Fe, Mn, Cu, and Cd) (Laird *et al.*1986, pp. 275-290). The pattern of recent frog extinctions in the southern Sierra Nevada corresponds with the pattern of highest concentration of air pollutants from automotive exhaust, possibly due to increases in nitrification (or other changes), caused by those pollutants (Jennings 1996, pp. 921-944).

The effects of contaminants on amphibians needs further research (Hall and Henry 1992, pp. 65-71), and there are few, if any, studies on the direct effect of contaminants on Yosemite toads. However, we know of one study which shows that there are significant levels of contaminants that have been deposited in the Sierra Nevada, and the correlative evidence between areas of contamination in the Sierra Nevada and areas of amphibian decline (Jennings 1996, pp. 921-944; Sparling *et al.* 2001, pp. 1591-1595; Davidson 2002, pp. 14-16), and the significant evidence of an adverse physiologic effect of pesticides on Sierra Nevada amphibians in the field (Sparling *et al.* 2001, pp. 1591-1595), indicate that contaminants may pose a risk to the Yosemite toad and may have contributed to the species' decline.

The last century has also included some of the most variable climate reversals, at both the annual (extremes and high frequency of El Nino and La Nina events) and near decadal scales (periods of 5- to 8-year drought and wet periods) that has been documented (USDA 2001a, p. 33). These events may have negative effects on Yosemite toads. Severe winters (El Nino) would force longer hibernation times, and could stress the toads by reducing the time available for them to feed and breed. Severe winters may also depress reproductive effort. Morton (1981, pp. 234-238) theorized that fluctuations in energy storage from year to year may explain why many female Yosemite toads do not breed on a yearly basis. Alternately, during mild winters (La Nina), precipitation is reduced. This reduction in precipitation could lead to stranding and death of Yosemite toad eggs and tadpoles, a major documented source of mortality (Zeiner *et al.* 1988, pp. 66-67; Kagarise Sherman and Morton 1993, pp. 186-198; Jennings and Hayes 1994, pp. 50-53), or to increased exposure to predatory fish.

Changes in climate that occur faster than the ability of endangered species to adapt could cause local extinctions (U.S. Environmental Protection Agency (EPA) 1989, p. xxxv and pp. 148-154). Analysis of the Antarctic Vostok ice core has shown that over the past 160,000 years, temperatures have varied with the concentrations of greenhouse gasses such as carbon dioxide and methane (Harte 1996, pp. 1069-1083). Since the pre-industrial era, atmospheric concentrations of carbon dioxide have increased nearly 30 percent, methane concentrations have more than doubled, and nitrous oxide (another greenhouse gas) levels have risen approximately 15 percent (EPA 1997, pp. 1-4). The burning of fossil fuels is the primary source of these increases (EPA 1997, pp. 1-4). Global mean surface temperatures have increased 0.3 to 0.7 Celsius (0.6-1.2 Fahrenheit) since the late 19th century (EPA 1997, pp. 1-4). Climate modeling indicates that the overall effects of global warming on California will include higher average temperatures in all seasons, higher total annual precipitation, and decreased spring and summer runoff due to decreases in snowpacks (EPA 1989, pp. 247-279; EPA 1997, pp. 1-4). Decreases in spring and summer runoff could lead to the loss of breeding habitat for Yosemite toads and an increase in stranding mortality of eggs and tadpoles.

Changes in temperature may also affect virulence of pathogens to a different degree than the immune systems of amphibians (Carey *et al*. 1999), and may make the Yosemite toad more susceptible to disease. An experimental increase in stream water temperature was shown to decrease density and biomass in invertebrates (Hogg and Williams 1996, pp. 395-408), thus global warming might have a negative impact on the Yosemite toad prey base.

Drought has contributed to the decline of the Yosemite toad (Jennings and Hayes 1994, pp. 50-53), and the effects of climate change may also have contributed to that decline. These effects pose an ongoing, range-wide risk to the species.

Acid precipitation has been hypothesized as a cause of amphibian declines in the Sierra Nevada, because waters there are extremely low in acid neutralizing capacity, and therefore susceptible to changes in water chemistry due to acidic deposition (Bradford *et al.* 1994, pp. 155-161). Precipitation acidity in the Sierra Nevada has been documented to have significantly increased at a collection station at approximately 2,100 m (6,900 ft) elevation near Lake Tahoe (Byron *et al.* 1991). In addition to raising the acidity of water, acidic deposition may also cause increases in dissolved aluminum, because aluminum is more soluble at higher acidity. These increases in dissolved aluminum may be toxic to amphibians (Bradford *et al.* 1992, 271-275). In laboratory experiments (Bradford *et al.* 1992, pp. 369-377; Bradford and Gordon 1992, pp. 75-76), high acidity and high aluminum concentrations did not have significant effects on survival of Yosemite toad embryos or newly hatched tadpoles. However, at pH 5.0 (pH represents acidity on a negative scale, with 7 being neutral and lower numbers being more acidic) and at high aluminum concentrations, Yosemite toad embryos hatched earlier and the tadpoles showed a reduction in body size. In a complementary field study of 235 randomly selected potential amphibian breeding sites (Bradford *et al.* 1994, pp. 155-161), no significant difference was found in pH between sites occupied and unoccupied by Yosemite toads. These data indicate that acid precipitation is an unlikely cause of decline in Yosemite toad populations (Bradford *et al.* 1994, pp. 155-161). Therefore, acid deposition is considered a low risk to the species at this time, but should still be considered in conservation efforts because of the possibility of sublethal effects, of its interaction with other factors, and the potential for more severe acidic deposition in the future (Bradford *et al.* 1992, p. 375).

Ambient ultraviolet-b (UV-B) radiation (280 to 320 nanometers (11.0 to 12.6 micro-inches)) has increased at north temperate latitudes in the past two decades (Adams *et al.* 2001, pp. 519-525). Ambient levels of UV-B were demonstrated to cause significant decreases in survival of western toad eggs in field experiments (Blaustein 1994, pp. 32-39). In a laboratory experiment (Kats *et al.* 2000, pp. 921-931), metamorph western toads exposed to levels of UV-B below those found in ambient sunlight showed a lower alarm response to chemical cues of injured toads than metamorphs that were completely shielded from UV-B. This indicates that ambient levels of UV-B may cause sublethal effects on toad behavior that may increase their vulnerability to predation. In a field experiment (Kiesecker and Blaustein 1995, pp. 11049-11052), the synergistic effects of exposure to ambient levels of UV-B radiation, and exposure to a pathogenic fungus (*Saprolegnia*), were shown to cause significantly higher mortality of western toad embryos than either factor alone.
Sadinski *et al.* (1997, pp. 1-8) observed a high percentage of embryo mortality in Yosemite toads at six breeding sites in Yosemite National Park, but in a subsequent field experiment this

mortality did not appear to be related to UV-B (Sadinski 2004, p. 37). In spatial statistical analysis of extant and extinct populations, higher elevation was shown to have a positive effect on the likelihood that populations of Yosemite toads were extant. This is counter to what would be expected if UV-B were the primary cause of decline (Davidson 2002, p. 15), as sites at higher elevations would be expected to receive more solar radiation due to the thinner atmosphere. The increase in UV-B at high elevations in the Sierra Nevada has not been more than 5 percent in the past several decades (Jennings 1996, pp. 921-944). These data further indicate that UV-B has probably not contributed significantly to the decline of Yosemite toads and is probably currently a low risk to the species. However, as with acid precipitation, UV-B should still be considered as a risk to the species because of the potential for sublethal effects, synergistic effects with other factors, and the potential for further increases in UV-B radiation in the future.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED: The Forest Service has conducted extensive surveys of national forest lands to document the current distribution of the Yosemite toad. The FSEIS ROD for the SNFPA contains guidance for the conservation of the Yosemite toad including excluding grazing from occupied breeding habitats and wet meadows through the breeding and rearing season, and designing pesticide application within 500 feet of occupied habitat so that it does not adversely affect individuals or habitat. In 2005 the Forest Service began a long-term experimental study to assess the effects of grazing on Yosemite toads. As of 2007, no data has been analyzed, but additional experiments and studies on the effects of grazing are planned. The Service has also assisted in funding a recently completed habitat model for Yosemite Toad in the Sierra National Forest that will assist in predicting appropriate habitat for the species (Laing et al. 2010, pp. 1-24).

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate) The factors responsible for the decline of the Yosemite toad remain poorly understood. The available evidence suggests that degradation of aquatic breeding habitats and meadows has contributed to the decline of the Yosemite toad. Historic livestock grazing throughout the range of the Yosemite toad was intense and appears to have negatively impacted its habitat. Adverse affects to toads from recent grazing activities have also been documented. Historic timber harvest and road building within the national forests likely resulted in adverse effects on its breeding habitats. Persistent fire suppression throughout the range of the Yosemite toad may have reduced breeding and upland habitat quality for this species. Additional factors, which have been implicated as threatening Yosemite toads include, the presence of the pathogenic chytrid fungus throughout the species range, possible contamination of their environment by anthropogenic chemicals, changing climate, and dams and water diversion. We find that the Yosemite toad is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:
____Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

Current conservation efforts include monitoring and implementation of potential reintroduction efforts for the Yosemite toad. The Service is currently funding studies and working with the U.S. Forest Service and National Park Service to determine appropriate conservation strategies.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	**11***
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: The magnitude of threats to the Yosemite toad was determined to be moderate. Yosemite toads face multiple ongoing threats that cause direct mortality and degradation of habitat, and the species has declined accordingly. The magnitude of threats was determined to be moderate, rather than high, because almost all of the species' range occurs on Federal land, which protects the species from private development and facilitates management of the species by Federal agencies.

Imminence: The imminence of threats to the Yosemite toad was determined to be non-imminent; no major imminent change in threats is expected in the near future.

Rationale for Change in Listing Priority Number (insert if appropriate)

_X_ Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? After reviewing the current status and distribution of the Yosemite toad and the threats associated with the species, we have determined that an emergency listing of the species is not warranted at this time. Numerous stable and intact metapopulations of Yosemite toad occur throughout its current range. Approximately 75 percent of known locations surveyed in 1990 continue to support Yosemite toad from the El Dorado National Forest to Kings Canyon National Park. Nearly 99 percent of the species range occurs on Federal land with some of this area being designated as wilderness area and not subject to development pressures. The federal agencies (Forest Service, National Park Service, and Bureau of Land Management) managing the areas where Yosemite toads occur are continuing to monitor the species and its habitat.

DESCRIPTION OF MONITORING: The Service attends the Declining Amphibian Task Force California-Nevada Working Group meetings to learn from species experts about the latest research and monitoring that is occurring. We also coordinate with species experts with the Forest Service and National Park Service regularly and are coordinating with the U.S. Forest Service on a Conservation Assessment and Strategy as required by the Sierra Nevada Forest Plan Amendment of 2004.

Monitoring of the Yosemite toad includes reviewing the current scientific literature, and contacting species experts and State agencies regarding Yosemite toad status and threats. These efforts are on-going and occur as information becomes available or on a 6 month basis. Due to the limited range of the species and its distribution within areas managed by primarily by Federal agencies (e.g. USFS, NPS, BLM), it is our opinion that such a level of monitoring is appropriate to update the status of the species, given the biology of the species and the threats it faces.

COORDINATION WITH STATES
Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: California

Indicate which State(s) did not provide any information or comments: None

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: ______________________________ 6-7-2010
Regional Director, Fish and Wildlife Service Date

Concur: ______________________________ Date: October 22, 2010
ACTING
Director, Fish and Wildlife Service

Do not concur: ______________________________
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: April 14, 2010
Conducted by: Arnold Roessler

FY 2010, R8 CNOR: Yosemite toad