A.16 WESTERN SPADEFOOT TOAD (*SPEA HAMMONDII*)


photo courtesy BCAG

A.16.1 Legal and Other Status

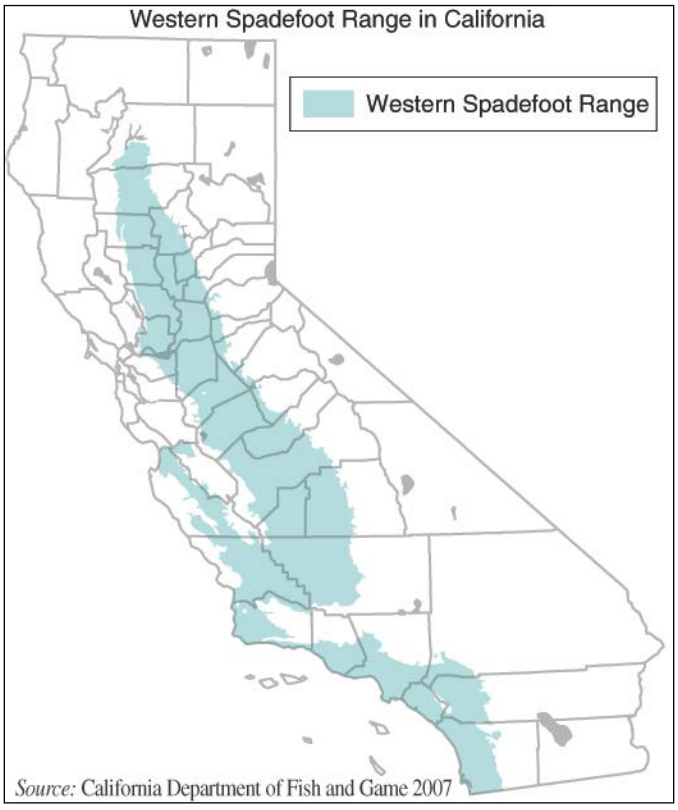
The western spadefoot toad is a California designated Species of Special Concern. This species currently does not have any federal listing status.

Although this species is not federally listed, it is addressed in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005).

A.16.2 Species Distribution and Status

A.16.2.1 Range and Status

The western spadefoot toad historically ranged from Redding in Shasta County, California, to northwestern Baja California, Mexico (Stebbins 1985). This species was known to occur throughout the Central Valley and the Coast Ranges and along the coastal lowlands from San Francisco Bay to Mexico (Jennings and Hayes 1994).



The western spadefoot toad has been extirpated throughout most southern California lowlands (Stebbins 1985) and from many historical locations within the Central Valley (Jennings and Hayes 1994, Fisher and Shaffer 1996). It has severely declined in the Sacramento Valley, and their density has been reduced in eastern San Joaquin Valley (Fisher and Shaffer 1996). While the species has declined in the Coast Range, they appear healthier and more resilient than those in the valleys. The population status and trends of the western spadefoot toad outside of California (i.e., Baja California, Mexico) are not well known.

This species occurs mostly below 900 meters (3,000 feet) in elevation (Stebbins 1985). The average elevation of sites where the species still occurs is

significantly higher than the average elevation for historical sites, suggesting that declines have been more pronounced in lowlands (USFWS 2005).

A.16.2.2 Distribution and Status in the Plan Area

CNDDB (2006) has five records of occurrences of western spadefoot toad within the Plan Area. Two are within the city limits of Chico (one is along Intermittent Creek), another is reported from the vicinity of Wyandotte Creek south of Oroville (J. Shedd pers. comm.; see Figure A.16-1, *Western Spadefoot Toad Modeled Habitat and Recorded Occurrences*), another is from the TNC Vina Plains Preserve, and another is from the DFG Stone Ridge Ecological Reserve.

A.16.3 Habitat Requirements and Special Considerations

Western spadefoot toads require two distinct habitat components to complete their life cycle, and these habitats may need to be in close proximity (USFWS 2005). These components are presence of an aquatic habitat for breeding and a terrestrial habitat for feeding and aestivation. Western spadefoot toads are mostly terrestrial using upland habitats to feed and burrow in for their long dry-season dormancy. Further research is needed to determine the distance this species may travel from aquatic habitats to upland habitats for dispersal and aestivation. Current research on amphibian conservation suggests that average terrestrial habitat use is within 368 meters (1,207 feet) of aquatic habitats (Semlitsch and Brodie 2003).

Western spadefoot toads lay their eggs in a variety of permanent and temporary wetlands such as rivers, creeks, pools in intermittent streams, vernal pools, and temporary rain pools (CNDDB 2006), as well as stock ponds. It reproduces in water when temperatures are between 9°C and 30°C (48°F and 86°F), and water must be present for more than three weeks for the toad to undergo complete metamorphosis (Jennings and Hayes 1994). Optimal habitat, including vernal pools and other temporary wetlands used for reproduction, is free of native and nonnative predators such as fish, bullfrogs, and crayfish. The presence of these predators may impair recruitment by western spadefoot toad (Jennings and Hayes 1994).

Western spadefoot toads typically inhabit lowland habitats such as washes, river floodplains, alluvial fans, playas, and alkali flats (Stebbins 1985). This species can also be found in the foothills and mountains (USFWS 2005). They select areas with sandy or gravelly soil with open vegetation and short grasses. Vegetation communities where this species may occur include valley and foothill grasslands, open chaparral, and pine-oak woodland (USFWS 2005).

Adult toads feed on of insects, worms, and other invertebrates, including grasshoppers, true bugs, moths, ground beetles, predaceous diving beetles, ladybird beetles, click beetles, flies, ants, and earthworms (Morey and Guinn 1992, USFWS 2005). Tadpoles forage on planktonic organisms, algae, small invertebrates (Bragg 1964), and dead aquatic larvae of amphibians, even their own species.

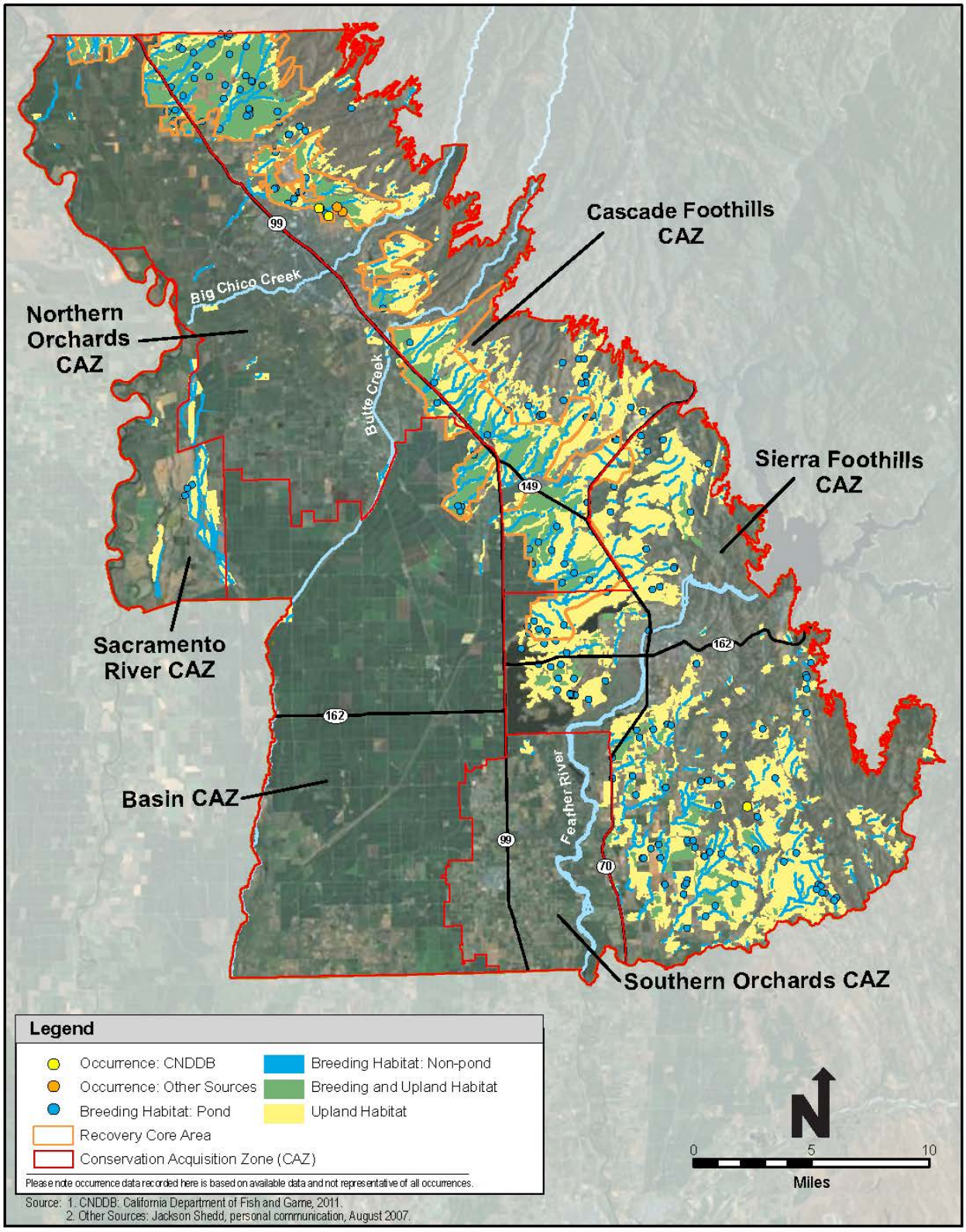


Figure A.16-1. Western Spadefoot Toad Modeled Habitat and Recorded Occurrences

A.16.4 Life History

The western spadefoot toad is primarily a terrestrial amphibian that enters the water mainly for reproduction. This species becomes active following warm rains occurring in the winter and spring. The toads emerge from burrows constructed in loose soil that are at least 1 meter (3 feet) deep (Stebbins 1972) and become active on the surface from October through April when enough rain has fallen (Morey and Guinn 1992).

Western spadefoot toads breed from January to May. Breeding aggregations can form with over 1,000 individuals, but are usually much smaller. These groups are highly vocal, and their breeding calls can be heard at great distances. These calls help individuals find each other to form breeding aggregations and suitable breeding sites (Stebbins 1985). Oviposition (egg-laying) does not occur until water temperatures reach the critical thermal minimum of 9°C (48°F), typically between late February and late May (Jennings and Hayes 1994). Females deposit their eggs in many small irregularly cylindrical clusters of 10 to 42 eggs with an average of 24 (Storer 1925) on stems or pieces of detritus in temporary rain pools, or sometimes in pools of ephemeral stream courses (Storer 1925, Stebbins 1985).

Depending on temperature and food availability, eggs hatch within 0.6 to six days after oviposition and larvae can complete development in three to 11 weeks (Jennings and Hayes 1994). If the water temperature is too high (above 21°C [70°F]), egg hatching success may decrease by half, possibly because this temperature is more favorable for destructive fungus (Storer 1925).

Metamorphosing larvae may leave the water before their tails fully disappear (Storer 1925). Larvae benefit from longer periods of development with persisting water and adequate temperatures because juveniles are allowed to reach larger sizes with greater fat reserves at metamorphosis (Morey 1998). After juveniles emerge from the water they take refuge in the surrounding area and may remain nearby for several days before dispersing to adjacent upland habitat. These individuals will then construct subterranean burrows and remain dormant for the following eight to nine months during the warm summer to avoid desiccation. Individuals may need at least two years to reach sexual maturity (Jennings and Hayes 1994).

A.16.5 Threats

The main reasons for the decline of western spadefoot toad are loss of habitat from urban development and conversion of native habitats to agricultural lands, the increase of nonnative predators (e.g., mosquitofish and bullfrogs, which consume western spadefoot toad eggs and larvae), and stochastic events that particularly impact small, isolated populations (USFWS 2006).

A.16.5.1 Habitat Loss and Fragmentation

Habitat loss and fragmentation produce small populations that are increasingly isolated and limited in space, which reduces the movement of individuals and genetic exchange between populations. Small, isolated populations are highly susceptible to extinction caused by

catastrophic or stochastic events. Isolation also limits the ability of the population to recolonize areas with suitable habitat where western spadefoot toads may have been present in the past.

Agricultural practices such as disking, intensive livestock grazing, and trampling have degraded many remaining vernal pool and wetland habitats, along with off-road vehicle use and contaminated runoff. Roads can create barriers to dispersal for western spadefoot toads and isolate populations. Contaminants from road materials, leaks, and spills may further degrade aquatic habitats used by this species.

A.16.5.2 Nonnative Predators

Nonnative invasive species prey upon and compete with the western spadefoot toad. The predation of spadefoot toad eggs and larvae by mosquitofish that are introduced into vernal pools through mosquito abatement programs may threaten some populations (Jennings and Hayes 1994). Bullfrogs have been reported to emigrate to some western spadefoot toad breeding pools and may threaten those populations through predation of spadefoot toad eggs and larvae. Exotic predators such as mosquitofish may also compete with western spadefoot toad larvae for limited food resources.

A.16.5.3 Noise and Vibration

Low frequency noise and vibration in or near western spadefoot toad habitat may be harmful, even fatal, to this species. Spadefoot toads are extremely sensitive to such disturbance, which causes them to break dormancy and emerge from their burrows (Dimmitt and Ruibal 1980). This could result in mortality or reduced productivity if it causes western spadefoot toads to emerge at inappropriate times (USFWS 2005).

A.16.6 Relevant Conservation Efforts

Habitat protection is the primary strategy for conserving the western spadefoot toad. However, Jennings and Hayes (1994) contend that more research is required to better understand the species' habitat requirements with respect to patch sizes, movement corridors, and other elements of conservation design strategies. Understanding the life history and important habitat requirements of the western spadefoot toad is also essential for conservation of the species (Jennings and Hayes 1994), with the most significant data gap being the relationship between habitat fragmentation and metapopulation structure.

Western spadefoot toad is a covered species under the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, and the Natomas Basin Habitat Conservation Plan. It is a proposed for coverage under the South Sacramento County Habitat Conservation Plan, the Yolo County Natural Heritage Program Plan, the Placer County Conservation Plan, and the Bay Delta Conservation Plan.

A.16.7 Species Habitat Suitability Model

A.16.7.1 Breeding Habitat

Western spadefoot toads lay eggs and rear larvae in aquatic habitats. Breeding habitat for the western spadefoot toad includes the following land cover types and conditions:

- Grassland with vernal swale complex (Breeding and Upland Habitat);
- Stock ponds located in grassland, grassland with vernal swale complex, and blue oak savanna;
- Segments of permanent and intermittent drainages (excluding the Sacramento and Feather Rivers) located within grassland, grasslands with vernal swale complex, vernal pools, altered vernal pools, and blue oak savanna;
- Segments of permanent and intermittent drainages (excluding the Sacramento and Feather Rivers) located within emergent wetlands that are adjoining or within grassland, grassland with vernal swale complex, vernal pools, altered vernal pools, and blue oak savanna; and
- Emergent wetlands adjoining grassland, grassland with vernal swale complex, vernal pools, altered vernal pools, and blue oak savanna.

A.16.7.1.1 Assumptions

Western spadefoot toads lay their eggs in a variety of permanent, semipermanent and temporary wetlands including rivers, creeks, pools in intermittent streams, vernal pools, and temporary rain pools (CNDDB 2006), as well as stock ponds. Western spadefoot toads typically inhabit lowland habitats such as washes, floodplains of rivers, alluvial fans, playas, and alkali flats (Stebbins 1985). This species may also be found in the foothills and mountains (USFWS 2005). Vegetation communities where this species may occur include valley and foothill grasslands, open chaparral, and pine-oak woodlands (USFWS 2005).

A.16.7.2 Upland Habitat

Western spadefoot toads use upland habitats for foraging, movement, and aestivation. Upland habitat for the western spadefoot toad includes the following land cover types and conditions:

- Grassland with vernal swale complex, vernal pool, and altered vernal pool, (Breeding and Upland Habitat); and
- Grassland and blue oak savanna adjoining and extending 1 mile from stock ponds, emergent wetlands, and permanent and intermittent streams (excluding the Sacramento and Feather Rivers).

A.16.7.2.1 Assumptions

To complete their life cycle, the western spadefoot toad requires aquatic habitat for breeding and terrestrial habitat for feeding and aestivation (USFWS 2005). Further research is needed to determine the distance this species may travel from aquatic habitats into upland habitats. The western spadefoot habitat model assumes that grassland and savanna habitats up to 1 mile from breeding habitat may be used by the spadefoot. Although the distance that western spadefoot toads may travel from aquatic habitat is uncertain, a travel distance of 1 mile is consistent with known travel distances for other amphibians.[1]

A.16.8 Recovery Plan Goals

The western spadefoot toad was included in the "Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon" (USFWS 2005). The primary focus of the Recovery Plan is protection of vernal pool habitat, in the largest blocks possible, from loss, fragmentation, degradation, and incompatible uses (USFWS 2005). For the western spadefoot toad, the Recovery Plan calls for the following:

- Conducting research on juvenile and adult dispersal to and from breeding locations;
- Conducting research on the effects of habitat management practices on the western spadefoot toad and their habitat to determine the limiting factors with respect to determining minimum reserve sizes;
- Studying the impacts of low-frequency noises and vibrations; and
- Determining the influence of nonnative aquatic vertebrate predators (e.g., bullfrogs and mosquitofish) on population dynamics.

Overall goals, which includes the western spadefoot toad, are to "achieve and protect in perpetuity self-sustaining populations throughout the full ecological, geographical, and genetic range of each listed species by ameliorating or eliminating the threats that caused the species to be listed" (USFWS 2005). Specifically for western spadefoot toad, the goal is to ensure long-term conservation. The Vernal Pool Recovery Plan concluded the following:

> *Based on calculations from upland habitat use data analyzed by Semlitsch and Brodie (2003), a minimum conservation area to preserve the ecological processes required for the conservation of amphibians may fall within a distance of approximately 368 meters (1,207 feet) from suitable breeding wetlands. Given a square preserve surrounding a single breeding pond, this estimate would suggest a minimum preserve size of approximately 54.2 hectares (134 acres). In any given western spadefoot toad metapopulation, we expect that some subpopulations will disappear, but the habitat they occupied will eventually be recolonized if it remains acceptable. To enable natural*

[1] USFWS defines uplands within 0.7 mile between occupied habitats as dispersal habitat for California red-legged frog (USFWS 2005) and California tiger salamanders may travel up to 1 mile from breeding pools (69 FR 3064).

recolonization of unoccupied habitat, and to allow for gene flow that is vital for preventing inbreeding, opportunities for dispersal and interbreeding among subpopulations of the western spadefoot toad must be maintained. Where possible, habitat corridors between breeding sites should be protected and maintained."

A.16.9 References

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Personal Communications

Jackson Shedd, Wildlife Biologist. 2007. Western spadefoot toad occurrence locations.

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