A.41 GREENE'S TUCTORIA (*TUCTORIA GREENEI*)


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A.41.1 Legal and Other Status

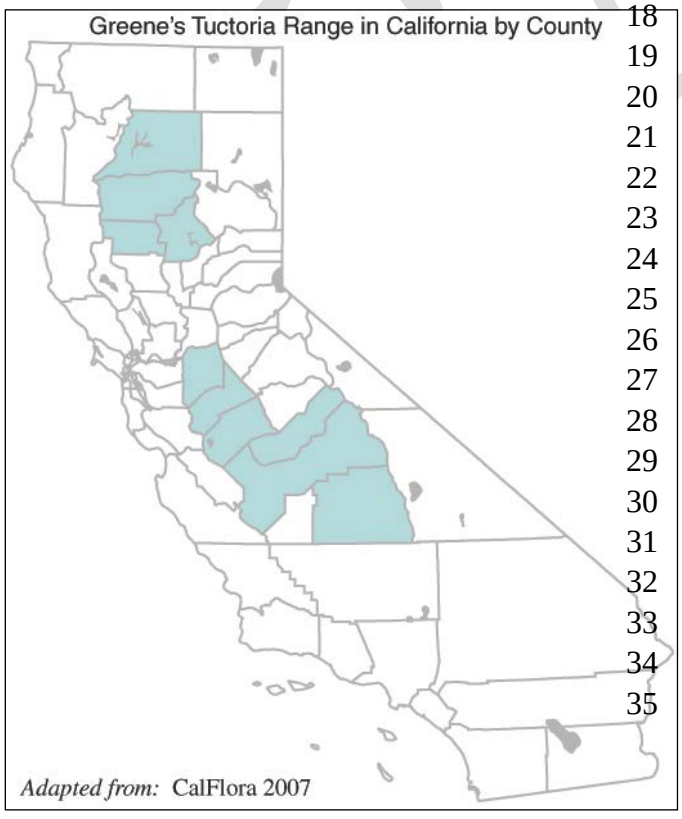
Greene's tuctoria or Greene's Orcutt grass (*Tuctoria greenei*) is listed as endangered under the federal Endangered Species Act (ESA) throughout its range and is listed as rare under the California ESA (DFG 2011). The California Native Plant Society (CNPS) includes Greene's tuctoria on List 1B, rare and endangered in California and elsewhere (CNPS 2006).

Critical habitat has been designated under ESA for Greene's tuctoria, including one location in Butte County, on private property south of Chico along Highway 99 and 0.4 mile (0.64 kilometer[km]) south of the junction of Pentz Road (71 FR 7118).

A.41.2 Species Distribution and Status

A.41.2.1 Range and Status

The current range of this species extends 258 miles (567 kilometers) in Butte, Merced, Tehama, Shasta, and Glenn counties (62 FR 14338). Historically, the species was also reported from Fresno, Madera, San Joaquin, Stanislaus, and Tulare counties, but these populations are believed to have been extirpated (CNPS 2006). There are currently 22 extant reported occurrences for this species, 14 of which are in the Northeastern Sacramento Valley Vernal Pool Region, including 10 in the vicinity of Vina Plains in Tehama County and four in Butte County. The next largest concentration is in the Southern Sierra Foothills Vernal Pool Region, with seven extant occurrences in eastern Merced County. The other extant occurrence is in the Modoc Plateau Vernal Pool Region in Shasta County (CNDDB 2006). There is also a report of this species in Glenn County, in the Solano-Colusa Vernal Pool Region (USFWS 2005). Nearly all the extant populations are on private lands, including five on the Nature Conservancy's (TNC) Vina Plains Preserve (CNDDB 2006). The general trend for the species is one of



decline due to habitat alteration and destruction (62 FR 14338).

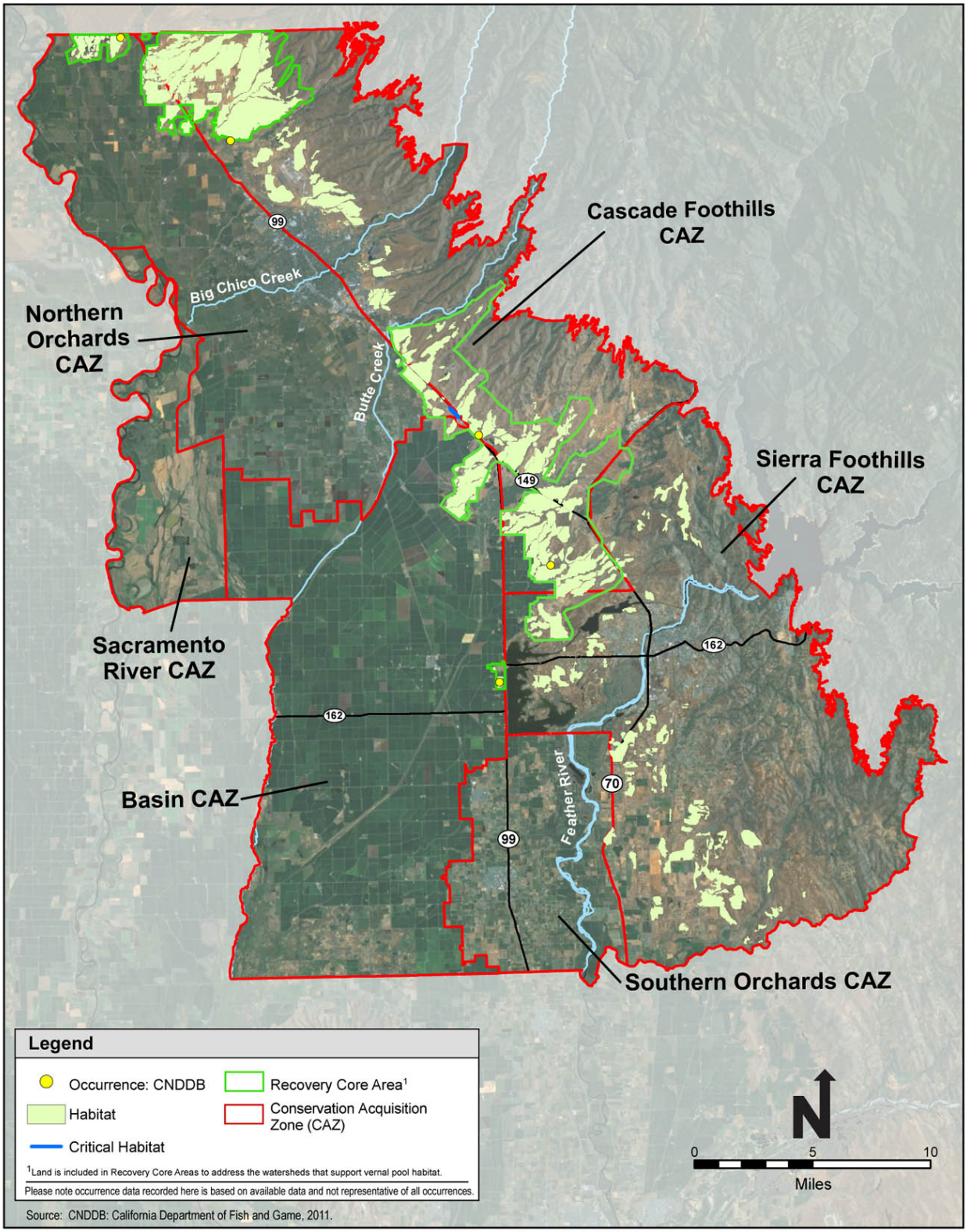


Figure A-41. Greene's Tuctoria Modeled Habitat and Recorded Occurrences

A.41.2.2 Distribution and Status in the Plan Area

Greene's tuctoria is reported from four extant locations in Butte County (see Figure A-41.). Two locations are on private property south of Chico along Highway 99: the first is about 0.4 mile (0.64 km) south of the junction of Pentz Road, which is the same reported location for Hoover's spurge (*Chaemasyce hooveri*) and hairy Orcutt grass (*Orcuttia pilosa*); and the second is in the Richvale Vernal Pools about 0.75 mile (1.2 km) south of the junction of Highway 163. A small population is located east/northeast of Shippee, north of Cottonwood Road, just west of a substation. And another small population is reported to occur in the Wurlitzer Unit of TNC's Vina Plains Preserve. These populations are threatened by grazing, trampling and invasive plant species (CNDDB 2006).

A.41.3 Habitat Requirements and Special Considerations

Greene's tuctoria has been found on both low and high terraces in Northern Basalt Flow, Northern Claypan, and Northern Hardpan vernal pools (USFWS 2005, Sawyer and Keeler-Wolf 1995). Of pools where the species was known to be extant in 1987, the median size was 1.5 acres (0.6 hectare [ha]), with a range of 0.01 acre (50 square meters) to 8.4 acres (3.4 ha). It was noted that this species grew in shallower pools than other members of the tribe or on the shallow margins of deeper pools, although pool depth was not quantified. At Vina Plains, Greene's tuctoria grew in pools of "intermediate" size, which dried in April or early May of 1995. The Central Valley pools containing this species were in grasslands at elevations of 110 to 440 feet (33.5 to 134 meters). The Shasta County occurrence is surrounded by pine forest at 3,500 feet (1,067 meters) (USFWS 2005, CNDDB 2006).

At the Vina Plains Preserve, frequent associates of Greene's tuctoria are coyote thistle (*Eryngium castrense)* and water shamrock (*Marsilea vestita).* Other associates in the Butte County locations include popcorn flower (*Plagiobothrys stipitatus)*, annual hair grass *(Deschamsia danthonioides)*, adobe allocarya *(Plagiobothryus acanthocarpus)*, navarretia *(Navarretia leucocephala)*, Tehama navarretia *(Navarretia heteranda)*, dowingia *(Dowingia* spp.*)*, and whitetip clover *(Trifolium variegatum).* Nonnative plants included prickle grass *(Crypsis* spp.*)*, common unicorn plant *(Proboscidea louisianica)*, and Mediterranean barley *(Hordeum marinum* ssp. *gussoneanum).* At one location in Butte County, this species occurred with other rare species including Hoover's spurge and hairy Orcutt grass (USFWS 2005, CNDDB 2006).

A.41.4 Life History

Greene's tuctoria is in the grass family (Poaceae) in the tribe Orcuttieae and was formerly included in the genus *Orcuttia*. It has similar life history characteristics of other members of this group. The Orcuttieae are all annuals and wind-pollinated, although the pollen probably is not carried long distances between populations. Local seed dispersal is by water, which breaks up the inflorescences. It is speculated that long-distance dispersal is unlikely, but seed may have historically been carried by waterfowl or other animals that visit the vernal pools. The seeds can

remain dormant for an undetermined length of time (at least 3 to 4 years) and germinate underwater after they have been immersed for prolonged periods (USFWS 2005).

Optimum germination of Greene's tuctoria seed occurs when the seed is exposed to light and anaerobic conditions after stratification. Germination occurs about two months following inundation. Seedlings of *Tuctoria* do not develop floating juvenile leaves, as *Orcuttia* does, and the plants apparently do not tolerate inundation. Greene's tuctoria flowers from May to July, with peak flowering in June and July. As with other vernal pool annuals, population size varies widely from year to year, and populations that have no visible plants one year can reappear in large numbers in later years. Population fluctuations may be due to annual variations in weather, particularly rainfall, to changes in management, or combinations of the two. Populations that decline to zero may not always be capable of rebounding from the soil seed bank and the population is likely extirpated if the plants do not reappear under favorable conditions. A study of genetic partitioning in five species of *Orcuttia* and *Tuctoria* revealed that Greene's tuctoria had the lowest genetic diversity (50 percent) of the species studied and indicated low levels of gene flow between populations, but high levels of gene flow within populations (USFWS 2005).

A.41.5 Threats

Greene's tuctoria is threatened by destruction of vernal pools through agriculture, urban developments, and overgrazing. Additional threats include competition from introduced annual grasses and other non-native species. Despite intensive surveys of vernal pools during the past 10 years, only five new occurrences have been located (DFG 2000, USFWS 2005, CNPS 2006). Threats to vernal pool habitat and species in general, including Greene's tuctoria, were identified in the Recovery Plan (USFWS 2005). In addition, the Recovery Plan identified several threats specific to Greene's tuctoria.

Conversion of land use, such as from grasslands or pastures, to more intensive agricultural uses, such as croplands or from one crop-type to another, has contributed and continues to contribute to the decline of vernal pools in general (USFWS 2005). Over half of the nearly 40 historically reported occurrences of Greene's tuctoria were extirpated through habitat conversion to irrigated agriculture and intensive cattle grazing. Greene's tuctoria is particularly sensitive to livestock trampling because it germinates as the pool water is receding, whereas many other vernal pool plants are already established at this phase (DFG 2000). Most of the remaining populations of Greene's tuctoria are subject to grazing (CNDDB 2006). However, grazing can also help control invasive species if timed correctly. Research is currently being conducted on the effects of grazing (DFG 2000).

One potential factor that may affect Greene's tuctoria is decimation by grasshopper outbreaks. Grasshoppers have been noted consuming entire populations of Greene's tuctoria before they set seed. However, sampling analysis conducted at the Vina Plains Preserve in Tehama County indicated the seed bank allowed for some recovery of the species after total destruction by grasshoppers (USFWS 2005, 2006).

Small population size has been identified as a specific problem for some occurrences. Small population size poses a continuing threat to seven occurrences including three in Butte County. Each of these populations numbered 110 or fewer individuals at its peak. Small populations are threatened with extirpation from random events, such as extreme weather and lack of genetic diversity. Small, less genetically diverse populations are less likely to adapt and survive environmental changes, even relatively minor events (USFWS 2005, CNDDB 2006).

Threats to vernal pool habitat and species in general, including Greene's tuctoria, are described in the Recovery Plan for Vernal Pool Ecosystems for California and Southern Oregon (Recovery Plan), approved by the USFWS in December 2005 (USFWS 2005). Threats include the following:

- Habitat loss and fragmentation generally resulting from urbanization, agricultural conversion, mining, and also occurring as a result of habitat alteration and degradation due to changes to natural hydrology, invasive species, incompatible grazing regimes (including insufficient grazing for prolonged periods), infrastructure projects (such as roads and utility projects), recreational activities (such as off-highway vehicles and hiking), erosion, climatic and environmental change, and contamination.
- Competition from invasive species. In addition, native plant species that occupy the same microhabitat can also compete with vernal pool plants such as Greene's tuctoria. Threats to Greene's tuctoria include competition from introduced annual grasses and other nonnative species, particularly cocklebur (*Xanthium* spp.) and swamp grass or swamp timothy (*Cripsis schoenoides*). Increasing dominance by competitors may also contribute to changes in hydrology and livestock grazing practices (USFWS 2005).
- Changes in hydrology that result in a change in the timing, frequency, and duration of inundation in vernal pools, creating conditions that render existing vernal pools unsuitable for vernal pool species (CNDDB 2006).
- Several other threats to vernal pools and their associate species in general were identified in the Recovery Plan. Slight changes in water chemistry directly affect sensitive vernal pool species, such as crustaceans. Water contamination can occur from use of herbicides, fertilizers, and other chemicals commonly used in urban and agricultural settings. Fertilizers may also contribute to the growth of invasive plants (USFWS 2005). Increased human presence may lead to overuse, trampling (by walking or off-road vehicles), vandalism, and dumping (62 FR 14338). Habitat alteration may also occur due to large-scale climate and environmental changes, such as global warming, which lead to changes in the precipitation pattern and atmospheric conditions (USFWS 2005).

A.41.6 Relevant Conservation Efforts

Five extant populations of Greene's tuctoria are protected at TNC's Vina Plains Preserve, including four in Tehama County and one in Butte County (CNDDB 2006). A population in Glenn County is in the Sacramento National Wildlife Refuge (USFWS 2005). The two remaining extant populations in Butte County are on private property (CNDDB 2006).

A.41.7 Species Habitat Suitability Model

A.41.7.1 Habitat

Greene's tuctoria habitat includes areas with suitable soil type in the following BRCP mapped land cover types:

- Vernal pools;
- Altered vernal pools; and
- Grassland with vernal swale complex.

Vernal pools that may support Greene's tuctoria habitat may also occur as inclusions in mapped grassland, blue oak savanna, ranchettes – open, and disturbed ground land cover types. These inclusions were not mapped because they did not meet the mapping criteria for vernal pool, altered vernal pool, and grassland with vernal swale complex land cover types.

A.41.7.2 Assumptions

Greene's tuctoria has been found on both low and high terraces in three types of vernal pools: Northern Basalt Flow, Northern Claypan, and Northern Hardpan (Sawyer and Keeler-Wolf 1995, USFWS 2005). Occupied pools are or were underlain by iron-silica cemented hardpan, tuffaceous alluvium, or claypan (USFWS 2005). Pool depth has not been quantified but it was noted that the species can grow along shallow margins of deeper pools or dry bottoms of vernal pools in open grasslands (CNDDB 2007).

Given these habitat preferences, suitable habitat for the Greene's tuctoria is defined as any mapped vernal pool or altered vernal pool within the Plan Area. Additionally, the grassland with vernal swale complex land cover type is included in the model. This type may include areas that pool in a given year but that were not captured as individual vernal pools in the GIC/SAIC vernal pool mapping effort. Because vernal elements were identified based on photo interpretation of aerial photography from winter 2002 (an average rainfall year), an above average rainfall year may result in more areas of ponded water within the Plan Area.

A.41.8 Recovery Plan Goals

A general statement for recovery of Greene's tuctoria is presented in the Recovery Plan: to ensure protection of the full geographic, genetic and ecological extent of this species and to improve the circumstances that caused it to be listed in the first place. Accomplishment of this goal would be achieved by protecting 80 percent of this species' occurrences throughout its range, including 85 percent of its suitable habitat in the Western Modoc Plateau, Richvale, Fresno, and Waterford Core Areas and 95 percent of suitable habitat in the Oroville, Vina Plains, Sacramento NWR, Madera, and Merced Core Areas. In addition, seed from each vernal pool region with its distribution would be banked. The Recovery Plan also includes five introductions

into vernal pool regions, counties, and soil types from which surveys indicate that it has been eradicated, including in Fresno, San Joaquin, Stanislaus, and Tulare Counties.

A.41.9 References

Literature Cited

Calflora. 2007. Berkeley, California: The Calflora Database. Accessed February 1, 2007 from http://www.calflora.org/.

CNDDB (California Natural Diversity Database). 2006. Natural Heritage Division. California Department of Fish and Game. RareFind, October.

CNDDB (California Natural Diversity Database). 2007. Sacramento: California Department of Fish and Game.

CNPS (California Native Plant Society). 2006. Inventory of Rare and Endangered Plants (online edition, v7-06d). Sacramento: California Native Plant Society. Accessed December 4, 2006 from http://www.cnps.org/inventory.

DFG (California Department of Fish and Game). 2000. The Status of Rare, Threatened, and Endangered Animals and Plants of California, Greene's tuctoria (*Tuctoria greenei*). DFG Habitat Conservation Branch. http://www.dfg.ca.gov/hcpb/species/search_species.shtml.

DFG (California Department of Fish and Game). 2011. Special Vascular Plants, Bryophytes, and Lichens List, Natural Diversity Database. Accessed May 19, 2011 from http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPPlants.pdf.

Sawyer, J. O., and T. Keeler-Wolf. 1995. A Manual of California Vegetation. Sacramento: California Native Plant Society.

USFWS (U.S Fish and Wildlife Service). 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, OR.USFWS (U.S Fish and Wildlife Service). 2006. Sacramento Fish and Wildlife Office. Species Account: Greene's tuctoria (*Tuctoria greenei*). http://www.fws.gov/sacramento/es/plant_spp_accts/greenes_tuctoria.htm.

Federal Register

62 FR 14338. 1997. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Three Plants and Threatened Status for Five Plants from Vernal Pools in the Central Valley of California; Final Rule. *Federal Register* 62:14338

71 FR 7118. 2006. Endangered and Threatened Wildlife and Plants: Designation of critical habitat for four vernal pool crustaceans and eleven vernal pool plants; Final Rule. Federal Register 71:7118.