Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon

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ABSTRACT. The Recovery Plan features 33 plants and animals that occur exclusively or primarily within vernal pool habitat in California and southern Oregon. It presents an ecosystem-level strategy for recovery and conservation because the species co-occur in the same natural ecosystem and all face similar threats, primarily habitat loss and fragmentation. The overall goals of the Recovery Plan are to achieve and protect self-sustaining populations of each species through habitat protection and management. The five key elements of the conservation strategy are: habitat protection; adaptive management, restoration, and monitoring; status surveys; research; and public participation and outreach. The plan outlines specific actions for each species and the areas where they should take place in order to reach the recovery goals. However, because all recovery plan actions are voluntary, the plan can only work if implementation teams consisting of interested private landowners, species experts, researchers and other agencies are developed and are successful.

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INTRODUCTION

The mission of the U. S. Fish and Wildlife Service (Service) is to work with others to conserve, protect, and enhance fish, wildlife, and plants, and their habitats for the continuing benefit of the American people. The Service administers the Federal Endangered Species Act (Act) and is directed by Section 4(f) of the Act to list species as threatened or endangered and to develop and implement recovery plans for every listed species. Recovery plans are the Service's official guidance on what actions are necessary to recover the species to the point that they can be taken off the endangered species list. Recovery plans are guidance documents; not regulatory documents. All recovery actions are completely voluntary; no agency or other entity is required to implement any of the recommendations. Because the majority of occurrences of these species are found on privately-owned lands and because the recovery actions are voluntary, the success of this plan and the recovery and conservation of the species is dependent on the voluntary support, coordination, and cooperation of the public and other agencies.

In March of 2006, the Service published the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon which was signed in December of 2005 (U. S. Fish and Wildlife Service, 2005). The Recovery Plan presents an ecosystem-level strategy for recovery and conservation of the species addressed in the plan because the species occur in the same habitat type and are generally threatened by the same human activities. By protecting entire ecosystems, the likelihood of successful recovery and conservation is increased.

Recovery is defined as the process by which the decline of an endangered or threatened species is stopped and the threats to its survival are minimized so that its long-term survival in nature is ensured. All recovery plans identify site-specific management actions, estimate time frames and costs of the actions, and set forth precise, objective, measurable criteria for recovery of listed species. The goal is the maintenance of secure, self-sustaining wild populations of species with the minimum necessary investment of resources.

Recovery plans broadly address conservation needs of the species by identifying research, habitat protection and restoration, and management, and all other actions that must be taken to bring a species to a state in which it may be delisted or downlisted. Re-

covery planning documents are necessarily expansive, identifying as many options and strategies that may contribute to recovery as possible.

General Steps in the Recovery Process

There are six general steps in the recovery process. Firstly, scientific information and studies are gathered and analyzed about the species' status, population trends, habitat requirements, and threats. This information is also collected from knowledgeable biologists with personal experience with the species, private landowners, academia, and other agencies such as the California Department of Fish and Game, Bureau of Land Management, National Park Service, and U. S. Forest Service. A draft recovery plan which includes the description and status of each species, a discussion of the threats, and recommended recovery actions and recovery criteria is then written and made available to the public for comment. After the public comment period has closed, the draft plan is revised based on the public comments and a final version of the plan is published. After publication of the recovery plan, teams comprised of members of the public and agency staff may be formed to implement the recovery actions.

Areas Included in the Recovery Plan

Vernal Pool Regions. The Recovery Plan addresses vernal pool species that are found from the Agate Desert in southern Oregon down to California's southern border with Baja California—a distance of approximately 800 miles. The general areas that support vernal pool habitat are divided into 16 Vernal Pool Regions. Vernal Pool Regions are large areas that share the same watershed boundaries, soil types, and support the same vernal pool species although there is some overlap of these features among the regions. The region boundaries are based on the vernal pool regions identified by the California Department of Fish and Game in their California Vernal Pool Assessment Preliminary Report (Keeler-Wolf et al., 1998); however, these regions did not extend into Oregon. The combined estimated acreage of all vernal pool regions is 21,700,000 acres. Not all land within the region boundaries is vernal pool habitat or supports the species addressed in the Recovery Plan.

Core Areas. Within each Vernal Pool Region, the areas that support the highest density of vernal pools and the greatest number of vernal pool species and populations are designated as "core areas." The core areas are ranked as Zone 1, 2, or 3 in order of their overall priority for recovery. Zone 1 core areas are those areas that support the highest number of species and populations, are occupied by very narrowly endemic species, and whose protection is necessary to prevent the extinction or irreversible decline of one or more species. Zone 2 core areas have fewer species and populations or are occupied by species that are more widespread, with greater numbers of occurrences. Zone 3 core areas no longer support the species addressed in this plan but include historic occurrences that are potential sites for restoration or reintroduction of the species. Not all vernal pool habitat or populations of the species addressed in the Recovery Plan are included in core areas due to factors such as large numbers of other occurrences located within core areas. The combined acreage of the core areas in all three zones is 1.6 million acres. The acreage of core areas in Zones 1, 2, and 3 is 683,000 acres, 881,000 acres, and 52,000 acres, respectively.

The total area of lands that are currently protected in all three zones is 404,000 acres, leaving 1.2 million acres within the core areas that are currently unprotected. However, we do not anticipate that protection of all 1.6 million acres will be required to recover and conserve the plan's covered species. The Recovery Plan calls for habitat assessments to be conducted that will refine the localities within the core areas to be targeted for conservation. Also, it is anticipated that a number of the species in the Recovery Plan can be recovered primarily through the protection of Zone 1 core areas. In particular, the most narrowly endemic species (e.g., Butte County meadowfoam (*Limnanthes floccosa* ssp. *californica*)) occur only in Zone 1 and do not require further protection of Zone 2 habitat. On the other hand, the most widely distributed species such as vernal pool fairy shrimp (*Branchinecta lynchi*) and slender Orcutt grass (*Orcuttia tenuis*) occur broadly through Zones 1 and 2. For these species protection of Zone 2 core areas will significantly contribute to recovery, and if sufficient, might offset the need to protect some lands within the Zone 1 core areas.

Species Addressed in the Plan

This recovery plan features 33 species of plants and animals that occur exclusively or primarily within a vernal pool ecosystem in California and southern Oregon (Table 1). The 20 federally listed species include 10 endangered plants, five threatened plants, three endangered animals, and two threatened ani-

mals. In addition, 13 species of concern are addressed. Species of concern are sensitive species that have not been listed, proposed for listing, or placed in candidate status. "Species of special concern" is an informal term used by some but not all U. S. Fish and Wildlife Service offices. Species of concern receive no legal protection and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species. The species of concern in the Recovery Plan are included because they are found in the same habitat as the listed species addressed in the Plan and share similar threats and needs. These species occur primarily in vernal pool, swale, or ephemeral freshwater habitats and are largely confined to a limited area by topographic constraints, soil types, and climatic conditions. By including species of concern in this community-level plan, they may benefit from the actions that protect the listed species and therefore may not need to be listed themselves.

THREATS TO SPECIES

The primary threat to all species addressed in the Recovery Plan is loss and fragmentation of vernal pool habitat. The majority of historic and current habitat loss has resulted from conversion of vernal pool habitat to urban or agricultural development. In addition to direct habitat destruction, vernal pool habitat and hydrology are altered and degraded by fragmentation from roads; competition with invasive, nonnative plant species; erosion from off-road vehicles; and contamination of vernal pool water quality from contaminated surface runoff or overspray of pesticides and herbicides. Inappropriate grazing regimes, including insufficient grazing for prolonged periods, can lead to competition with aggressive plant species, particularly nonnative grasses. Habitat alteration may result from climate and environmental changes including nitrogen deposition, changes in precipitation patterns, increase in atmospheric carbon dioxide, and increasing temperatures. On a local scale, climate changes may result in alteration of the current vernal pool habitat to be more suitable to nonnative species and less suitable for native species, thus altering the species' ranges (Dukes and Mooney, 1999).

RECOVERY STRATEGY

The recovery strategy of this Recovery Plan has five basic elements.

1) *Habitat Protection*. Because habitat loss and fragmentation are the greatest threats to the species, habitat protection is the most important strategy to assist in recovery of the species. Habitat protection includes the preservation of the hydrology, pollinators, and topographic features that are components of the vernal pool habitat supporting the species. Habitat protection can be achieved in several ways. Cooperative efforts with private landowners will need to utilize tools such as fee title acquisition, conservation easements, or participation in voluntary programs (e.g., the Partners for Fish and Wildlife program of the U. S. Fish and Wildlife Service) to maintain or enhance habitat values for vernal pool species and their habitat while continuing certain types of land uses (e.g., appropriately managed grazing).

2) *Adaptive Habitat Management, Restoration, Creation, and Monitoring*. Habitat protection alone, however, is not sufficient to accomplish recovery. In all cases, an adaptive management plan to control nonnative species and maintain the hydrology of the habitat is important to guide the management of the species. In areas where the species have been extirpated, restoration of habitat and reintroduction of the species may be appropriate. Monitoring habitat will provide valuable information on population trends and whether management techniques are successful. As a last resort, creation of vernal pool habitat may be useful if it maintains the range of the species and the habitat.

3) *Status Surveys*. The purpose of conducting status surveys is to determine how a species is doing throughout its entire range and to identify locations that would be suitable for introduction or reintroduction of the species. The majority of the species in the Recovery Plan have not had status surveys for at least the last decade, and the status in many locations is unknown.

4) *Research*. Currently, little information is available regarding the needs of many of the species in the Recovery Plan. Research is needed regarding habitat requirements, habitat management and restoration techniques, and species biology and ecology. Research is also needed to determine optimum preserve design to meet the species' needs, particularly in the case of drought and climate change, and the need to establish linkages to potential refugia.

5) *Participation and Outreach*. The species addressed in this Recovery Plan are found on lands

TABLE 1. Species addressed in the Recovery Plan for vernal pool ecosystems of California and Southern Oregon.

Scientific Name	Common Name	Status*
Listed Plant Species		
Castilleja campestris ssp. *succulenta*	fleshy owl's clover	FT, SE
Chamaesyce hooveri	Hoover's spurge	FT
Eryngium constancei	Loch Lomond button-celery	FE, SE
Lasthenia conjugens	Contra Costa goldfields	FE
Limnanthes floccosa ssp. *californica*	Butte County meadowfoam	FE, SE
Navarretia leucocephala ssp. *pauciflora*	few-flowered navarretia	FE, ST
Navarretia leucocephala ssp. *plieantha*	many-flowered navarretia	FE, SE
Neostapfia colusana	Colusa grass	FT, SE
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	FT, SE
Orcuttia pilosa	hairy Orcutt grass	FE, SE
Orcuttia tenuis	slender Orcutt grass	FT, SE
Orcuttia viscida	Sacramento Orcutt grass	FE, SE
Parvisedum leiocarpum	Lake County stonecrop	FE, SE
Tuctoria greenei	Greene's tuctoria	FE, SR
Tuctoria mucronata	Solano grass	FE, SE
Listed Animal Species		
Branchinecta conservatio	Conservancy fairy shrimp	FE
Branchinecta longiantenna	longhorn fairy shrimp	FE
Branchinecta lynchi	vernal pool fairy shrimp	FT
Elaphrus viridis	delta green ground beetle	FT
Lepidurus packardi	vernal pool tadpole shrimp	FE
Plant Species of Concern		
Astragalus tener var. *ferrisiae*	Ferris' milk vetch	None
Astragalus tener var. *tener*	alkali milkvetch	None
Atriplex persistens	vernal pool smallscale	None
Eryngium spinosepalum	spiny-sepaled button-celery	None
Gratiola heterosepala	Boggs Lake hedge-hyssop	SE
Juncus leiospermus var. *ahartii*	Ahart's dwarf rush	None
Legenere limosa	legenere	None
Myosurus minimus var. *apus*	little mousetail	None
Navarretia myersii ssp. *deminuta*	small pincushion navarretia	None
Plagiobothrys hystriculus	bearded popcornflower	None
Animal Species of Concern		
Branchinecta mesovallensis	midvalley fairy shrimp	None
Linderiella occidentalis	California fairy shrimp	None
Spea hammondii	western spadefoot toad	None

* FE=Federally Endangered, FT=Federally Threatened, SE=State Endangered, ST=State Threatened, SR=State Rare

owned or managed by many different stakeholders: federal agencies, state and local agencies, and to a large extent, private landowners. Recovery and conservation of these species cannot be accomplished by the Service alone. Little funding is available; it will require the support and cooperation of many groups. Developing working relationships with all stakeholders, including public and private landowners, is essential to secure and recover vernal pool ecosystems. A single implementation team composed of federal and state agencies, agriculture, industry and species experts will be established. This team will oversee the range-wide recovery efforts. Within each vernal pool region, a regional working group will be formed to develop outreach and incentive programs and track the progress of recovery actions within the region.

ESTIMATED TIME TO RECOVERY

The estimated time to accomplish recovery and conservation is defined in relation to a climatological cycle for most species covered in this Recovery Plan. If recovery criteria are met, we estimate that most listed species covered in this Recovery Plan could be recovered by 2064 (58 years), based on the interval between the last two droughts of 5 years or longer. To determine if the species are self-sustaining, they must be able to survive a substantial drought (5 years in duration or longer). Because of the interval between the last two droughts of this severity, we presume that the next drought will have occurred within the next 58 years. Some species, such as those with narrow distributions, could be recovered in less time.

COST OF PLAN IMPLEMENTATION

The total cost of implementation of the Recovery Plan will depend on what level of effort is needed to achieve recovery for all the species. For example, the estimated cost to implement all recovery actions and protect all currently unprotected Zone 1 lands that cost less than $2,500 per acre is $774 million. However, the use of conservation easements as the primary method of habitat protection would reduce the cost by approximately 40 percent. The cost to implement *all* recovery actions and protect *all* currently unprotected lands in all core areas in the three zones (~1.2 million acres) is approximately 2.08 billion dollars. However, as stated previously, we do not anticipate the need to protect all lands in all core areas to achieve recovery and conservation of the species. Some costs, such as protecting habitat, are dependent on local economics and may vary from the estimates given. Because the implementation of the recovery actions will occur over an approximate 58-year period, the costs will be incurred over that same period rather than all at once.

SUMMARY

The Recovery Plan is an ecosystem-based guidance document that outlines the actions the Service believes are necessary to recover 20 listed vernal pool species to the point that they can be delisted or downlisted and to conserve 13 species of concern. Because the actions are voluntary, the success of the plan depends on the voluntary support from and coordination with other public agencies, private landowners, and stakeholders. The goal of this and all recovery plans is the maintenance of secure, self-sustaining wild populations of each species. The primary threat to each of the 33 species is loss and fragmentation of habitat from conversion to urban or agricultural uses; therefore, the primary recovery strategy is protection of habitat. The areas that are most important to the recovery of the species are delineated as core areas within the vernal pool regions. Recovery actions will target the Zone 1, 2 and 3 core areas, in that order. The time for meeting the recovery goals for most of the species has been roughly estimated at 58 years, which includes the time needed to determine if the species can survive a substantial drought. All recovery plan actions are voluntary, therefore, the plan can only work if implementation teams consisting of interested private landowners, species experts, researchers and other agencies are developed and are successful.

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