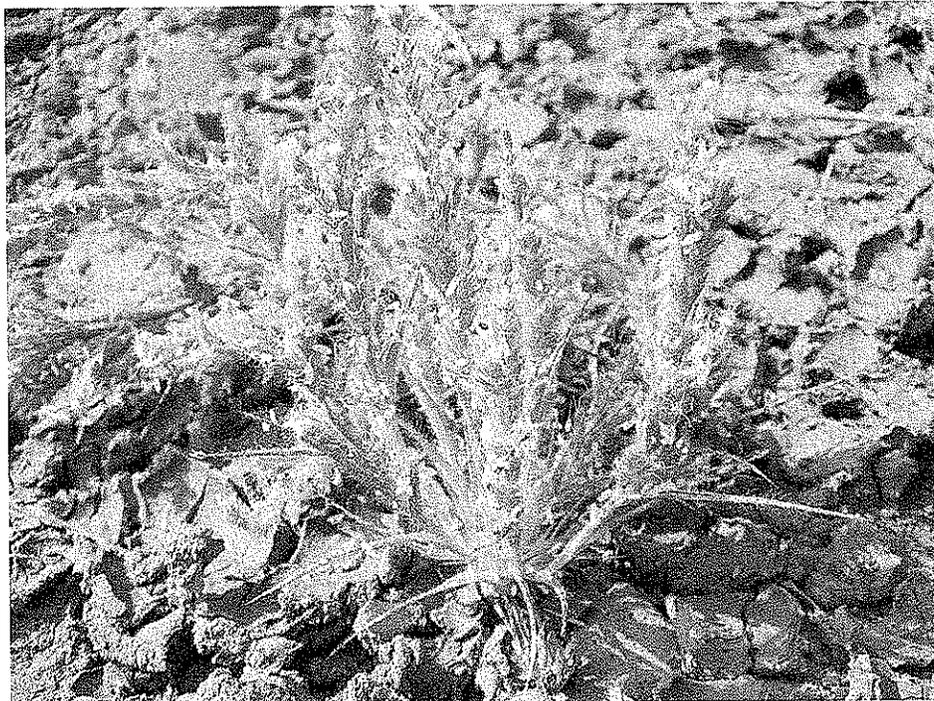


**Hairy Orcutt Grass**  
*(Orcuttia pilosa)*

**5-Year Review:  
Summary and Evaluation**



Hairy orcutt grass at the Vina Plains Preserve  
(R. Kuyper)

**U.S. Fish and Wildlife Service  
Sacramento Fish and Wildlife Office  
Sacramento, California**

**June 2009**

**5-YEAR REVIEW**  
**Hairy Orcutt grass (*Orcuttia pilosa*)**

**I. GENERAL INFORMATION**

**I.A. Methodology used to complete the review:**

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO) of the U.S. Fish and Wildlife Service (Service) using information from the 2005 *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Recovery Plan) (Service 2005), Environmental Impact Statements, documents generated as part of section 7 consultations, peer reviewed journal articles, species survey and monitoring reports, Federal Register Notices, the California Natural Diversity Database (CNDDDB), which is maintained by the California Department of Fish and Game, and personal communications with species experts.

**I.B. Contacts**

**Lead Regional or Headquarters Office – Contact name(s) and phone numbers:** Region 8, Pacific Southwest Region; Diane Elam and Jenness McBride, (916) 414-6464

**Lead Field Office – Contact name(s) and phone numbers:** Sacramento Fish and Wildlife Office; Kirsten Tarp, (916) 414-6600

**I.C. Background**

**I.C.1 FR Notice citation announcing initiation of this review:** Federal Register 71 FR 14538-14542; we received no information from the public in response to this notice.

**I.C.2. Listing history**

Original Listing

FR notice: 62 FR 14338-14352

Date listed: March 26, 1997

Entity listed: Species – Hairy Orcutt grass (*Orcuttia pilosa*), a listed plant species

Classification: Endangered

**I.C.3. Associated rulemakings**

Critical habitat for this species was proposed on September 24, 2002 (67 FR 60033). The final rule to designate critical habitat for the Contra Costa goldfields was published on August 6, 2003 (68 FR 46683). A re-evaluation of non-economic exclusions from the August 2003 final designation was published on March 8, 2005 (70 FR 11140). An evaluation of economic exclusions from the August 2003 final designation was published on August 11, 2005 (70 FR 46923). Administrative revisions were published on February 10, 2006 (71 FR 7117). Clarifications on the economic and non-economic exclusions for the final designation of critical habitat were published on May 31, 2007 (72 FR 30269).

**I.C.4. Review History:** No 5-year reviews have been conducted for this species since the listing in 1997

**I.C.5. Species' Recovery Priority Number at start of review:** The recovery priority is 2C, reflecting a high degree of threat, a high potential for recovery, a taxonomic rank of full species, and potential conflict with construction or other development or forms of economic activity.

**I.C.6. Recovery Plan or Outline**

Name of plan: Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon  
Date issued: December 15, 2005

**II. REVIEW ANALYSIS**

**II.A. Application of the 1996 Distinct Population Segment (DPS) policy**

**II.A.1. Is the species under review listed as a DPS?**

     Yes  
  X   No

The Endangered Species Act of 1973, as amended (Act), defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

**II.B. Recovery Criteria**

**II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?**

  X   Yes  
     No

**II.B.2. Adequacy of recovery criteria.**

**II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?**

  X   Yes  
     No

**II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?**

  X   Yes  
     No

**II.B.3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors\* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

General recovery criteria for all vernal pool floral and faunal species are outlined in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (Recovery Plan) (Service 2005). Where applicable, criteria specific for hairy Orcutt grass have been noted. Listing factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not relevant to this species.

The Recovery Plan describes the geographic distribution of vernal pool taxa according to the vernal pool regions defined by the California Department of Fish and Game (CDFG) (Keeler-Wolf *et al.* 1998). Vernal pool regions are discrete geographic regions identified largely on the basis of endemic species, with soils and geomorphology as secondary elements. Within the vernal pool regions, the Recovery Plan identifies core areas that support high concentrations of federally listed vernal pool species, are representative of a given species' range, and are generally where recovery actions are focused. Core areas are distinct areas that provide the features, populations, and distinct geographic and/or genetic diversity necessary to the recovery of a species. More than one federally listed vernal pool species may be found within a single core area, and the core areas encompass areas larger than just the location of any single species. Within each core area, the Recovery Plan identifies specific percentages of suitable habitat that should be protected to achieve recovery for listed species. Core areas are ranked as Zone 1, 2, or 3 in order of their overall priority for recovery, with Zone 1 reflecting the highest priority areas. Protection of the majority of suitable habitat within Zone 1 core areas, and Zone 2 and 3 core areas where appropriate, is recommended to provide corridors and dispersal habitat, support metapopulation dynamics, provide for reintroduction or introduction sites, and to protect currently undiscovered populations.

In this review, most hairy Orcutt grass occurrences are those reported in the California Natural Diversity Database (CNDDDB). The CNDDDB defines occurrence as any documented collection, observation, or museum specimen of a species that is submitted to CDFG by the public. Each collection or observance may be recorded and mapped separately, but if there are multiple observations or collections within 1/4 mile of each other they may be combined into a single

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\* 1) Present or threatened destruction, modification or curtailment of its habitat or range;  
2) Overutilization for commercial, recreational, scientific, or educational purposes;  
3) Disease or predation;  
4) Inadequacy of existing regulatory mechanisms;  
5) Other natural or manmade factors affecting its continued existence.

occurrence record. Individual occurrences represent locations where a species has been documented to occur; they do not represent distinct populations as they are observation records of individuals, not population-level records (D. McGriff, CDFG, *in litt.* 2007). For the purposes of this 5-year review, “occurrence” refers to a report contained in the CNDDDB. Places where the species is found but that are unreported to CNDDDB are noted as “sites”, “localities”, etc., in order to differentiate them from occurrences as reported and defined in the CNDDDB.

Downlisting /delisting criteria for hairy Orcutt grass include:

**1. Habitat protection: Accomplish habitat protection that promotes vernal pool ecosystem function sufficient to contribute to population viability of the covered species.**

Recovery criteria 1A-C address listing factor A.

**1A. Suitable vernal pool habitat within each prioritized core area for the species is protected.**

Core areas are ranked as Zone 1, 2, or 3 in order of their recovery priority (Zone 1 having highest priority, Zone 3 having lowest priority). Hairy Orcutt grass is a narrowly endemic species that occurs almost exclusively in Zone 1, including the Oroville, Vina Plains, Sacramento National Wildlife Refuge (NWR), Madera, and Merced core areas. Protection of the Turlock core area (Zone 2) will contribute to recovery of hairy Orcutt grass, and if sufficient, may offset the need to protect some habitat in Zone 1 core areas. For hairy Orcutt grass, downlisting will be considered when 95 percent of the suitable habitat in five core areas (Oroville, Vina Plains, Sacramento NWR, Madera and Merced) and 85 percent in the Turlock core area are protected. In general, recovery recommendations in Zones 2 and 3 are more flexible than those in Zone 1. The core areas that pertain to the hairy Orcutt grass are distributed among three vernal pool regions: Northeast Sacramento, Solano-Colusa, and Southern Sierra Foothills.

This criterion has not yet been met. Of the 34 occurrences listed in the California Natural Diversity Database (CNDDDB 2009), not counting a misidentified occurrence of San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*) (Stone 1992), 23 natural occurrences and 1 introduced occurrence are “presumed extant” (Table 1). Thirteen of the “presumed extant” occurrences (54 percent) are on privately-owned land. We cannot assume that occurrences on private land are protected. However, CNDDDB does not provide an indication of the amount of suitable habitat, only known occupied habitat. There may be more occurrences that have not yet been discovered, particularly on private lands which are usually inaccessible to researchers and surveyors. Ten occurrences are listed in CNDDDB as “extirpated” or “possibly extirpated.” It is possible some of these formerly occupied sites could still provide suitable habitat, particularly if a seed bank is still present and the hydrological regime has not been modified or can be restored to natural conditions. However, some of these sites have been disturbed from either agricultural or urban activities and may no longer be suitable for occupation by hairy Orcutt grass. The Service has only recently approved the Recovery Plan and does not yet have sufficient information to quantify either the acreage of suitable habitat within each core area or the acreage of protected habitat that is suitable for hairy Orcutt grass.

Table 1. Occurrence Number, Population Trend, Occurrence Rank, Last Date surveyed and Ownership for the presumed extant occurrences of hairy Orcutt grass (based on information from CNDDDB 2009).

Core Area	Occurrence Number	Population Trend	Occurrence Rank	Last Date Surveyed	Ownership Type
<b>NORTHEAST SACRAMENTO VERNAL POOL REGION:</b>					
Vina Plains (8)	12	unknown	good	07/27/1988	Private
	13	unknown	excellent	05/19/2007	TNC-Vina Plains Preserve
	23	decreasing	unknown	06/17/1983	TNC-Vina Plains Preserve
	24	fluctuating	excellent	05/18/2007	TNC-Vina Plains Preserve
	32	decreasing	unknown	07/10/1990	TNC-Vina Plains Preserve
	33	stable	good	08/03/1987	Private
	41	unknown	good	05/19/2007	Private
	42	decreasing	fair	08/11/1987	Private
Oroville (1)	30	unknown	unknown	06/25/1986	Private
<b>SOLANO-COLUSA VERNAL POOL REGION:</b>					
Sacramento NWR (4)	35	fluctuating	good	05/23/2007	USFWS-Sacramento NWR
	36	decreasing	fair	05/06/2004	USFWS-Sacramento NWR
	38	fluctuating	unknown	08/08/2006	USFWS-Sacramento NWR
	39	decreasing	fair	09/06/2005	USFWS-Sacramento NWR
Not in a Core Area (1)	40	unknown	unknown	1937	USFWS-Sacramento NWR
<b>SOUTHERN SIERRA FOOTHILLS VERNAL POOL REGION:</b>					
Madera (7)	10	decreasing	unknown	07/23/1958	Private
	18	decreasing	poor	07/04/2000	Private
	22	unknown	poor	05/21/1986	Private
	28	unknown	fair	08/10/1986	Private
	43	unknown	good	08/12/1995	Private
	44	unknown	good	08/12/1995	Bureau of Reclamation
	45	unknown	good	09/12/1995	California Department of Transportation
Merced (1)	2	unknown	good	05/18/2001	Private
Turlock (0)	none	N/A	N/A	N/A	N/A

Not in a Core Area (2)	11	decreasing	poor	05/17/2001	Private
	19	decreasing	fair	05/21/1986	Private

**1B. Species occurrences distributed across the species geographic range and genetic range are protected. Protection of extreme edges of populations protects the genetic differences that occur there.**

For hairy Orcutt grass, at least 90 percent of the occurrences should be protected in order to downlist the species. To delist, 100 percent of reintroduced occurrences should also be protected. Reintroductions should occur at historical localities from which the species has been extirpated.

This criterion has not yet been met. Eleven out of 24 “presumed extant” occurrences (46 percent) are on “protected” land: 1 reintroduced occurrence on California Department of Transportation (Caltrans) land, 1 on Bureau of Reclamation land, 5 on the Sacramento NWR, and 4 on The Nature Conservancy’s Vina Plains Preserve. However, these lands may not be specifically “protected” for the benefit of hairy Orcutt grass. For example, grazing allotments may exist on Bureau of Reclamation land, but these may or may not be managed to reduce the severity and for appropriate timing of grazing. To our knowledge, no reintroductions have occurred or are planned to occur in the near future in any other areas.

**1C. Reintroductions must be carried out and meet success criteria established in the recovery plan.**

Reintroductions or introductions are recommended for a species with greater than 25 occurrences, such as hairy Orcutt grass had at the time the Recovery Plan was written, if it has: (2) has experienced loss of greater than 10 percent of its known occurrences; and (3) occurs in 3 or fewer vernal pool regions. For hairy Orcutt grass, reintroductions are recommended in the Southern Sierra Nevada Vernal Pool Region in Stanislaus, Merced, and Madera Counties.

This criterion has not yet been met. No reintroductions have occurred at historically known occupied locations. Before the species was listed in 1997, hairy Orcutt grass was introduced to created vernal pools in Madera County which are owned and managed by Caltrans as compensation for the State Highway 41 realignment project (Durgarian 1995; Stebbins et al. 1995). Fifty plants were seen in one of these pools in 1995 (CNDDDB 2006). Ellen Cypher (California Department of Fish and Game [CDFG] botanist, formerly of the Endangered Species Recovery Program [ESRP], California State University, Stanislaus Foundation) and Nur Ritter (botanist, ESRP) observed hairy Orcutt grass in several of the Caltrans pools in 2005 (Ellen Cypher pers. comm. 2006). Anecdotal evidence suggests these sites have had additional surveys; however, these results have not been reported or are not readily available to the Service.

**1D. Additional occurrences identified through future site assessments, GIS and other analyses, and status surveys that are determined essential to recovery are protected. Any newly found occurrences may count towards recovery goals if the occurrences are permanently protected as described in the recovery plan.**

No additional occurrences have been identified since the Recovery Plan was finalized.

**1E. Habitat protection results in protection of hydrology essential to vernal pool ecosystem function, and monitoring indicates that hydrology that contributes to population viability has been maintained through at least one multi-year period that includes above average, average, and below average local rainfall as defined above, a multi-year drought, and a minimum of 5 years of post-drought monitoring.**

This recovery criterion has not been met. Monitoring of hydrology has not occurred at any of the known extant occurrences; therefore we have no data to evaluate ecosystem function of protected areas.

## **2. Adaptive Habitat Management and Monitoring**

Recovery criteria 2A-D implicitly address all relevant listing factors.

**2A. Habitat management and monitoring plans that facilitate maintenance of vernal pool ecosystem function and population viability have been developed and implemented for all habitat protected, as previously discussed in sections 1A-E.**

Although, a management and monitoring plan in place at Vina Plains We are unaware of any completed or draft adaptive management plans specifically for hairy Orcutt grass on any of the currently protected lands. Monitoring and management plans will be assessed individually as land is bought, placed under a conservation easement or deed restriction, or otherwise protected for assurance that recovery goals are met. Funding assurances will be required for monitoring and/or management in perpetuity. A Draft Comprehensive Conservation Plan was published for the Sacramento NWR in July 2008, which discussed management issues for vernal pool species (Service 2008; J. Silveira pers. comm. 2009).

**2B. Mechanisms are in place to provide for management in perpetuity and long-term monitoring of 1A-E, as previously discussed (funding, personnel, etc).**

This criterion has not been met. Most of the occurrences are on private lands that have no known management in perpetuity or long-term monitoring. The Vina Plains Preserve was established by The Nature Conservancy in 1982. An endowment fund was not established when the preserve was purchased, so funds for preserve operations are obtained each year through private fund-raising efforts. Additionally, a small portion of the operating funds are received from a lease for on-site livestock grazing. Funding for management and protection of vernal pool species is allocated to the Sacramento NWR annually

Funding for these plans should be sufficient to assure long-term monitoring and management to assure inclusion of years with normal, above, and below average rainfall conditions, a multi-year drought, and a minimum of 5 years of post-drought monitoring. A multi-year drought is defined in the Recovery Plan as a period of 5 or more years of below average local rainfall.

**2C. Monitoring indicates that ecosystem function has been maintained in the areas protected under 1A-D for at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years**

### **of post-drought monitoring.**

The occurrences on the main tract of the Vina Plains Preserve and on the Sacramento NWR have been monitored; however, continuous monitoring of ecosystem function has not occurred for a duration that meets the requirements specified in the 2005 Recovery Plan (one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years of post-drought monitoring). This criterion has not been met.

### **2D. Seed banking actions have been completed for species that would require it as insurance against risk of stochastic extirpations or that will require reintroductions or introductions to contribute to meeting recovery criteria.**

The Recovery Plan directs collection of seeds from each core area. The Service is not aware of any seed banking collections that would indicate that this criterion has been met.

### **3. Status Surveys:**

Recovery criteria 3A-B implicitly address all relevant listing factors.

### **3A. Status surveys, 5-year status reviews, and population monitoring show populations within each vernal pool region where the species occur are viable (e.g., evidence of reproduction and recruitment) and have been maintained (stable or increasing) for at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years of post-drought monitoring.**

This criterion has not been met. Although several of the occurrences have periodically received some level of monitoring, the monitoring has not occurred over a duration that meets the requirements specified in the 2005 Recovery Plan (one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years of post-drought monitoring for all habitat protected in 1. A-E).

Multi-year monitoring has occurred on (1) The Nature Conservancy's Vina Plains Preserve in Tehama County (Nicoletti and Reiner *in litt.* 2003; Robert Schlising, Chico State University, pers. comm. 2006), and (2) the Sacramento NWR (Silveira *in litt.* 1997). At Vina Plains, Robert Schlising monitored 35 pools from 1995 to 1999, and 17 of those pools from 1999 to 2004. The results of these surveys are still being analyzed and have not yet been reported to the Service. Alexander and Schlising (1998) summarized the 1995 survey work. In the summer of 2003, hairy Orcutt grass was found in four pools and a high presence of this and other rare vernal pool plant species was reported at the Vina Plains Preserve; the abundance of hairy Orcutt grass was attributed to the large amount of rainfall that had occurred the previous winter and spring (Nicoletti and Reiner *in litt.* 2003). Six pools have been and continue to be monitored since 1993 at the Sacramento NWR (Joe Silveira, pers. comm. 2006). We are unaware of any other multi-year monitoring or surveying efforts for this species.

### **3B. Status surveys, status reviews, and habitat monitoring show that threats identified during and since the listing process have been ameliorated or eliminated. Site-specific**

**threats identified through standardized site assessments and habitat management planning also must be ameliorated or eliminated.**

This criterion has not yet been met (see sections II.C.2.a. and II.C.2.e). Extirpation of occurrences and modification of habitat on private land due to development pressure and nonnative plants remain a threat.

#### **4. Research:**

Recovery criteria 4A-C implicitly address all relevant listing factors.

**4A. Research actions necessary for recovery and conservation of the covered species have been identified (these are research actions that have not been specifically identified in the recovery actions but for which a process to develop them has been identified). Research actions (both specifically identified in the recovery actions and determined through the process) on species biology and ecology, habitat management and restoration, and methods to eliminate or ameliorate threats have been completed and incorporated into habitat protection, habitat management and monitoring, and species monitoring plans, and refinement of recovery criteria and actions.**

This criterion has not been met, but efforts are underway to address it. Boykin et al. (2008) describes the leaf anatomy and photosynthetic pathway for grasses in the Orcuttieae tribe. This study was the first to describe the leaf anatomy of Orcuttieae grasses. This study found that Orcuttieae grasses are unique among plants with the C4 photosynthetic pathway (a specialized form of photosynthesis in some plants) in that the aquatic and terrestrial phases are different. Plants with C4 photosynthesis have a competitive advantage under conditions of drought, high temperatures, and nitrogen or carbon dioxide limitation. The terrestrial (dry) and floating leaves of Orcuttieae grasses have kranz anatomy (radially arranged mesophyll cells surrounding the bundle sheath; generally considered essential for C4 photosynthesis) and the aquatic leaves do not. The leaves seem to switch to kranz anatomy when exposed to a terrestrial environment. The reasons for this switch are unclear. Different patterns of leaf anatomy and development for terrestrial and aquatic leaves may be an adaptation to their vernal pool habitat (Keeley 1998), which exhibits a cyclical inundation and drying seasonal regime. From these observations, Boykin et al. (2008) theorize that Orcuttieae grasses derived from a single terrestrial ancestor and have become more specialized to an aquatic environment than their terrestrial ancestors (*Neostapfia* and *Tuctoria* species), an observation also found by Keeley (1998).

**4B. Research on genetic structure has been completed (for species where necessary – for reintroduction and introduction, seed banking) and results incorporated into habitat protection plans to ensure that within and among population genetic variation is fully representative by populations protected in the Habitat Protection section of this document, described previously in sections 1A-E.**

This criterion has not yet been met, but efforts are underway to address it. Boykin et al. (2004 in review) outline genetic work to determine the evolutionary root of the tribe Orcuttieae, analyze the phylogenetic (presumed evolutionary) relationships between the genres of this tribe, and use

this information to estimate the evolutionary development of the C4 photosynthesis. The results support the hypothesis that the *Orcuttia* genus is monophyletic (one ancestor and all descendent species) and that the *Orcuttia* species should be divided into two groups: (1) *O. pilosa* and *O. inaequalis*; and (2) *O. tenuis*, *O. viscida*, and *O. californica*. It was also demonstrated that there has been DNA divergence between *O. pilosa* (hairy Orcutt grass) occurrences at the Vina Plains Preserve in Tehama County (the northern population) and occurrences in Madera, Merced, and Stanislaus Counties (the southern population). This divergence was probably a result of genetic drift caused by isolation and lack of gene flow between these two populations. Their data also supports the hypothesis in Boykin et al. (2004 in review) that *Orcuttia* grasses are more specialized to an aquatic environment than their terrestrial ancestors (*Neostapfia* and *Tuctoria* species). The authors hope this research will aid conservation efforts of Orcuttieae grasses by showing genetic variation exists among occurrences, and recommends that future studies should include genetic work across the Orcuttieae range to quantify this genetic variation.

**4C. Research necessary to determine appropriate parameters to measure population viability for each species have been completed.**

No such research has been completed for this species.

**5. Participation and outreach:**

Recovery criteria 5A-D implicitly address all relevant listing factors.

**5A. Recovery Implementation Team is established and functioning to oversee rangewide recovery efforts.**

This criterion has not yet been met. The Recovery Plan discusses a variety of participation programs to achieve the goal of recovery of the listed species in the plan. An essential component of this collaborative approach is the formation of a single recovery implementation team overseeing the formation and function of multiple working groups formed at the vernal pool region level. The Service has selected the implementation team which will start meeting in June 2009. The implementation team will select the members of the regional working groups with assistance from the Service.

**5B. Vernal pool regional working groups are established and functioning to oversee regional recovery efforts.**

This criterion has not yet been met. Working groups have not been formed.

**5C. Participation plans for each vernal pool region have been completed and implemented.**

This criterion has not yet been met. Participation plans have not been initiated.

**5D. Vernal pool region working groups have developed and implemented outreach and incentive programs that develop partnerships contributing to achieving recovery criteria 1-4.**

This criterion has not yet been met. Working groups have not been formed.

## **II.C. Updated Information and Current Species Status**

### **II.C.1. Biology, Habitat, Abundance, and Distribution**

Hairy Orcutt grass is an annual grass that is found on high or low stream terraces and alluvial fans (Stone et al 1988). It occurs in Northern Basalt Flow, Northern Claypan, and Northern Hardpan vernal pools (Sawyer and Keeler-Wolf 1995) within annual grasslands (CNDDDB 2003). This species is known from elevations of 25 meters (85 feet) in Glenn County to 123 meters (405 feet) in Madera County (CNDDDB 2009).

When hairy Orcutt grass was listed as endangered in 1997, there were 24 native extant populations and 1 introduced population (62 FR 14338). Currently, there are 23 native presumed extant occurrences, and 1 introduced occurrence (CNDDDB 2009). A possible new occurrence was discovered at a proposed conservation bank site in Eastern Merced County near Baxter Road (Vollmar 2002), although this occurrence is not reported in the CNDDDB and the exact location is unknown to the Service. John Vollmar of Vollmar Consulting, Inc., has performed several vernal pool plant surveys in recent years at various sites in Stanislaus, Merced, Madera, and Fresno Counties and has not observed any new occurrences of hairy Orcutt grass (J. Vollmar, pers. comm. 2006).

### **II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

#### **II.C.2.a. Factor A, Present or threatened destruction, modification or curtailment of its habitat or range:**

The final rule listing hairy Orcutt grass as endangered in 1997 identified urbanization, agricultural conversion, highway expansion project, discing, and off-road vehicle use as threats to the species (62 FR 14338). There has been no significant change in the imminence of these threat factors since the 1997 listing. Agricultural conversion remains the primary threat to the habitat of hairy Orcutt grass, but the expansion of suburban development into hairy Orcutt grass habitat has increased since 1997. Since the final listing rule, Stanislaus County has had one occurrence extirpated (probably due to plowing or discing of the vernal pool) (CNDDDB 2006), and another occurrence's habitat was converted to vineyard in 2001 (CNDDDB 2006). In Madera County, an occurrence on Bureau of Reclamation property has been fenced to exclude cattle and is presumed extant, although the site has not been specifically surveyed for hairy Orcutt grass in recent years (CNDDDB 2006).

The Service has written several biological opinions for projects evaluated under section 7 of the Endangered Species Act, as summarized in section II.C.2.d. These biological opinions authorized activities such as the construction of a new university, road construction, and the Central Valley Project (which supplies water to the Central Valley). A biological opinion on the wildland fire plan for the Service's Sacramento NWR Complex authorizes prescribed burning and grazing in the refuge's vernal pools, and includes monitoring and reporting requirements to

determine what affect implementation of the plan has on federally listed species, including hairy Orcutt grass. Given the continuing rate of development, we anticipate future consultations to include transportation, infrastructure, and projects requiring a permit by the U.S. Army Corps of Engineers for impacts to wetlands or waters of the U.S.

Most of the Madera and Merced core areas are in private ownership. The southern portion of the Madera core area has several large proposed residential developments clustered around the Bureau of Reclamation's Friant Dam. There is an easement restricting development in the immediate area surrounding the Friant-Madera Canal, which transports water from Millerton Lake. However, we are unaware if other activities that may affect vernal pool species are restricted within this easement.

We assume that all suitable habitat in the Sacramento NWR core area is protected from direct effects from development because it is all owned and managed by the Service; however, this habitat could be indirectly affected by changes in hydrology caused by rice farming adjacent to the refuge boundary (J. Silveira, Sacramento NWR botanist, pers. comm. 2006). The Oroville core area contains a total of approximately 2,900 acres of land owned/managed by CDFG, U.S. Forest Service, and the Dove Creek Conservation Bank. However, this acreage is less than 30 percent of the habitat needed for recovery of hairy Orcutt grass.

The Vina Plains core area includes the (1) Vina Plains Botanical Management Area, a Caltrans-managed demonstration area along State Highway 99 extending northward from the Butte/Tehama county border to 4.5 miles north of the border; and (2) The Nature Conservancy's Vina Plains Preserve, a 4,600-acre area established for the protection of vernal pools. The Vina Plains Preserve provides protected habitat for the species; however, the Vina Plains Botanical Management Area does not have conservation easements or fee title for land in this area to protect any hairy Orcutt grass occurrences. Therefore, less than 95 percent of habitat in the Vina Plains core area is currently protected. The Vina Plains Preserve forms the western boundary of the The Nature Conservancy's Lassen Foothills Project, which is envisioned to protect 900,000 acres stretching from Lassen Peak to the Sacramento River. As of the date of this review, 80,000 acres has been put under easement for protection in perpetuity. If acquired, some of this acreage will be in the Vina Plains core area, and will protect any hairy Orcutt grass occurrences there from being destroyed by development.

In summary, of the 24 occurrences listed in the California Natural Diversity Database (CNDDDB) as "presumed extant", 13 (56 percent) are on privately-owned". We cannot assume that these occurrences on private land are protected. Eleven out of 24 CNDDDB occurrences (44 percent) are on "protected" land: Included in the 24 extant occurrences is 1 reintroduced occurrence on California Department of Transportation (Caltrans) land, 1 on Bureau of Reclamation land, 5 on the Sacramento NWR, and 4 on The Nature Conservancy's Vina Plains Preserve.

**II.C.2.b. Factor B, Overutilization for commercial, recreational, scientific, or educational purposes:** At the time of listing, overutilization has not been, and currently is not known to be a threat for this species.

**II.C.2.c. Factor C, Disease or predation:** The 1997 final listing rule stated that disease was not a factor and that livestock grazing and associated trampling was not a factor when moderate grazing regimes on dry pasture are utilized. However, livestock grazing and trampling may or may not adversely affect vernal pool plants depending on, among other things, the kind of livestock, stocking level, season-of-use, and grazing duration. Livestock grazing may have additional indirect effects on vernal pool hydrology and competition from nonnative plants (see II.C.2.e.)

Stone *et al.* (1988) identified competition between Orcutt grasses and invasive plants as an increasing problem. Researchers at The Nature Conservancy's Vina Plains Preserve have implemented a rotational grazing system and prescribed burning to benefit native plant species and control invasive species (Griggs 2000). Managed grazing, particularly the less destructive grazing of sheep, has been proposed as means to maintain the preferable low-growing vegetation and also to prevent the excessive accumulation of thatch along the margins of the vernal pools (Witham 2006). Overgrazing can be a threat to hairy Orcutt grass; however, total removal of cattle from areas of vernal pools may favor infestation of non-native annual plants (Barry 1998, Marty 2005), leading to increased competition for hairy Orcutt grass.

**II.C.2.d. Factor D, Inadequacy of existing regulatory mechanisms:**

In the final rule we identified the inadequacies of the Federal Clean Water Act, the California Environmental Quality Act, the California Endangered Species Act, and conservation easements.

Federal Laws and Regulations

Endangered Species Act: The Endangered Species Act of 1973, as amended (Act), is the primary Federal law that provides protection for hairy Orcutt grass. Section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed species. To jeopardize the continued existence of a species means to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild. Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, unless specially exempted; however, the take prohibition does not apply to plants. However, limited protection of listed plants from take is provided to the extent that the Act and the implementing regulations prohibit the removal and reduction to possession of federally listed threatened or endangered plants or the malicious damage of endangered plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of state law or regulation or in the course of any violation of a state criminal trespass law.

The following consultations with Federal agencies under section 7 of the Act were found likely to adversely affect, but not likely to jeopardize the continued existence of, hairy Orcutt grass, due to measures to avoid and minimize impacts to the species: Biological Opinion on Implementation of the Central Valley Project Improvement Act and the Continued Operation and Maintenance of the Central Valley Project (Service File # 1-1-95-F-0039), Intra-Service Consultation on the Management, Operations, and Maintenance of the Sacramento Valley NWR Complex, Willows, California (Service File 1-1-98-F-0013) and the Intra-Service Consultation

for the Updated Wildfire Management Plan for the Sacramento NWR Complex (Service File # 1-1-01-F-0197). The following consultations were found not likely to adversely affect hairy Orcutt grass: University of California, Merced Campus and Infrastructure Project (Service File # 1-1-02-F-0107), Monument 3D Seismic Prospect Project, Merced County, California (Service File # 1-1-02-F-0166), Merced NWR Sno-Bird Unit Project (Service File # 1-1-06-I-0045), State Route 70 and Ophir Road Interchange Project in Butte County (Service File # 1-1-05-F-0102), and Renewal of the Natomas Central Mutual Water Company Sacramento River Settlement Contract (Service File # 1-1-05-I-0699).

If a Federal agency is not involved in the project, and federally listed animals may be taken as part of the project, then the project proponent may obtain an incidental take permit pursuant to section 10(a)(1)(B) of the Act. The Service may issue such a permit upon completion of a satisfactory habitat conservation plan (HCP) for the listed species that would be taken by the project. Currently there are no completed regional or county-wide HCPs in any of the counties where hairy Orcutt grass occurs.

Clean Water Act: Under section 404, the U.S. Army Corps of Engineers (Corps or USACE) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to areas meeting the Corps’s criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, National Environmental Policy Act, and Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

The Corps interprets “the waters of the United States” expansively to include not only traditional navigable waters and wetlands, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. However, recent Supreme Court rulings have called into question this definition. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving “isolated” wetlands. Currently, Corps regulatory oversight of such wetlands (e.g., vernal pools) is in doubt because of their “isolated” nature. In response to the Supreme Court decision, the Corps and the U.S. Environmental Protection Agency (USEPA) have recently released a memorandum providing guidelines for determining jurisdiction under the Clean Water Act. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, isolated wetland habitat (USEPA and USACE 2007). The overall effect of the new permit guidelines on loss of isolated wetlands, such as vernal pool habitat, is not known at this time. If the Corps loses their regulatory authority over vernal pools, unmitigated destruction of potential habitat for hairy Orcutt grass may increase over the range of the species

#### State Laws and Regulations

California Endangered Species Act: Hairy Orcutt grass was State-listed as endangered in 1979. The California Endangered Species Act (California Fish and Game Code, Section 2050 *et seq.*) prohibits the unauthorized take of State-listed threatened or endangered species. Unlike the take

prohibition in the Federal Endangered Species Act, the State prohibition includes plants, although landowners are exempt from this prohibition for plants taken via habitat modification. The landowner is required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvaging of listed plants. However, salvaging may not be beneficial for hairy Orcutt grass as there is no evidence that the species would survive transplantation.

California Environmental Quality Act (CEQA): The CEQA requires full public disclosure of the potential environmental impact of proposed projects. The public agency with primary authority or jurisdiction over the project is designated as the lead agency and is responsible for conducting a review of the project and consulting with other agencies concerned with resources affected by the project. Section 15065 of the CEQA guidelines requires a finding of significance if a project has the potential to “reduce the number or restrict the range of a rare or endangered plant or animal”. Once significant impacts are identified, the lead agency has the option to require mitigation for effects through changes in the project or to decide that overriding considerations make mitigation infeasible. In the later case, projects may be approved that cause significant environmental damage, such as destruction of endangered species. Protection of listed species through CEQA is, therefore, at the discretion of the lead agency. The CEQA provides that, when overriding social and economic considerations can be demonstrated, project proposals may go forward, even in cases where the continued existence of the species may be jeopardized, or where adverse impacts are not mitigated to the point of insignificance.

#### Summary of Factor D

In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as endangered in 1997. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Endangered Species Act.

#### **II.C.2.e. Factor E, Other natural or manmade factors affecting its continued existence:**

Other natural or manmade threats cited in the 1997 final listing rule included competition from weedy nonnative grasses,. Current threats include the threat of competition discussed in the 1997 final rule, and in addition, drought and climate change, and extirpation due to random events.

#### Competition from Nonnative Invasive Plants

Invasive non-native plants have become greater threat to persistence of hairy Orcutt grass occurrences. Hairy Orcutt grass is threatened by competition with other more aggressive plants, such as modest prickle grass (*Crypsis vaginiflora*) at the Sacramento NWR (J. Silveira, Sacramento NWR, pers. comm. 2006) and also at the Delevan and Colusa refuges within the Sacramento NWR complex . African prickle grass (also known as *Crypsis*) germinates at the same time as hairy Orcutt grass, and competition may be exacerbated by the late spring rains the

Sacramento NWR complex has experienced in the last few years (Service 2006). Hairy Orcutt grass also competes with cocklebur (*Xanthium*) species on at least one site on private land in Tehama County (CNDDDB 2006). Zedler and Black (2004) found that the exotic grass *Agrostis avenacea* occurs in five of the six counties where hairy Orcutt grass occurs and thrives in similar inundated habitat. They also speculated that the prevailing theory that vernal pools are resistant to infestation by invasive species because of the extreme environmental conditions to which vernal pool species have adapted may be invalid. They theorize that it is more probable that vernal pools are less likely to become infested because of their relative isolation from human-induced changes, and that the infestation risk will increase as vernal pools are encroached upon by agricultural and residential or commercial development.

The Nature Conservancy has issued a Weed Alert announcing that waxy manna grass has invaded deep vernal pools, swales, ditches and stock ponds along entire east side of Central Valley (TNC 2006). Waxy manna grass is adapted to long periods of inundation and is currently found in Shasta, Tehama, Butte, Yuba, and Sacramento Counties. During the last 20 years it has spread rapidly through rice fields, vernal pools, ponds, and roadside ditches. This species is likely dispersed over long distances by waterfowl, which feed on the seeds. The seed also readily adheres to wet clothes, boots, fur, and feathers, making humans and wildlife likely dispersers over short distances. Dense invasions appear to eliminate or significantly reduce occurrences of all native annual plants (TNC 2006). Waxy manna grass has already been reported as a known problem for several Sacramento Orcutt grass occurrences (Sacramento County 2006b). It is now been reported from the Vina Plains Preserve (R. Reiner, TNC, pers. comm. 2008).

#### Drought and Climate Change

Hairy Orcutt grass may be threatened by anomalous weather events. Bauder (2005) reports that El Niño events resulting in wetter conditions may favor growth of two invasive wetland grasses, *Agrostis avenacea* and *Polypogon monspelienses*, which have invaded vernal pools in southern California. El Niño years usually result in higher than average winter rainfall amounts in Central California (Barsugli *et al.* 1999), which can increase vernal pool inundation depth and timing into the spring and summer. Whether or not these conditions favor invasive species in Central California to the detriment of hairy Orcutt grass needs additional study.

Miller *et al.* (2001, 2003) used models projecting to the year 2100 to demonstrate that climate change in California could range anywhere from slightly cooler and drier to substantially warmer and wetter. Climate change may affect vernal pools by altering inundation periods and changing predator/prey interactions (Pyke 2004), and may alter vernal pool hydrology and associated population dynamics and interaction of vernal pool animals and plants (Bauder 2005). These potential climate-mediated changes may be further complicated by habitat loss due to urbanization and agricultural activities. Pyke and Fischer (2004) deduced that if bioclimatic factors, such as rainfall patterns and temperature changes, were not taken into account when determining high-priority areas to preserve, then the habitat protected may be less representative of areas occupied by target species. This theory is applicable to hairy Orcutt grass, as bioclimatic factors could result in shifting of suitable habitat from areas where the species

historically occurred and/or currently occupies, and which may currently be protected, to areas formerly thought to be unsuitable or to areas not protected in perpetuity.

Hairy Orcutt grass is vulnerable to stochastic events, particularly flooding or drought. For example, a formerly occupied pool at the Sacramento NWR was inundated for an extended period of time in 1998, and no plants have been seen since then (J. Silveira, pers. comm. 2006).

## **II.D. Synthesis**

At the time of listing there were 24 native extant populations and 1 introduced population (62 FR 14338). Currently of the 34 occurrences listed in the California Natural Diversity Database (CNDDDB 2009), not counting a misidentified occurrence of San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*) (Stone 1992), 23 natural occurrences and 1 introduced occurrence are “presumed extant” (Table 1) Thirteen of the “presumed extant” occurrences (54 percent) are on privately-owned land.” We cannot assume that these 13 occurrences on private land are protected. Eleven out of 24 CNDDDB presumed extant occurrences (44 percent) are on “protected” land where they are protected from the direct affects of development, but may still be threatened by .

The primary threats identified in the final listing rule were: urbanization, agricultural conversion, highway expansion project, discing, off-road vehicle use, and competition from nonnative, aggressive weeds. Additional threats identified since listing include drought and climate change.

It appears that protection of known occurrences of hairy Orcutt grass is more assured in the northern portion (Butte, Glenn, and Tehama Counties) of their range than in the southern portion (Madera, Merced, and Stanislaus). The northern portion contains more habitat on National Wildlife Refuge and Nature Conservancy lands; the southern counties occurrences are primarily on private land. Given the likely genetic divergence of occurrences in these two areas (Boykin et al. 2004 in review) it is important that habitat in both of these regions is protected to protect the species’ range-wide genetic diversity. Preservation of occurrences throughout the species’ range also will also assure plants and genetic diversity are preserved in the event of a stochastic event which extirpates one or more occurrences.

After reviewing the current status and threats of hairy Orcutt grass, the combined presence of the continued threats indicate that this species still meets the Act’s definition of endangered (section 3[6]); no status change is recommended at this time.

## **III. RESULTS**

### **III.A. Recommended Classification:**

\_\_\_ Downlist to Threatened  
\_\_\_ Uplist to Endangered

- \_\_\_\_\_ **Delist** (*Indicate reasons for delisting per 50 CFR 424.11*):
- \_\_\_\_\_ *Extinction*
  - \_\_\_\_\_ *Recovery*
  - \_\_\_\_\_ *Original data for classification in error*
  - X   **No change is needed**

**III.B. New Recovery Priority Number**   2C   (no change)   

**IV. RECOMMENDATIONS FOR FUTURE ACTIONS**

1. Protection of vernal pool habitat from being destroyed or modified by development, agriculture, or other activities should be the top priority. Given the current uncertainty of the regulatory protection afforded by the Clean Water Act, it is now more than ever imperative that suitable and occupied habitat is protected. The “take” prohibition in section 9 of the Act does not apply to listed plants, thereby limiting legal protection of hairy Orcutt grass, particularly on private lands. Acquiring conservation easements or fee title to habitat lands are ways that conservators can guarantee protection of the species in perpetuity.
  
2. The Service should encourage local and county governments to consider developing HCPs to include vernal pool species. Take of the listed invertebrate species would be permitted on private land, and any habitat acquisition that would be required to mitigate this take may also protect hairy Orcutt grass occurrences. Stanislaus County has been awarded Federal funds for developing a HCP, and additional funds may be available in the future for counties who apply for them.
  
3. Private landowners can receive financial assistance, advice, and assurances from the Service to implement habitat improvement projects to benefit Federal trust species, including vernal pool species listed under the Act. Service biologists should work with private landowners on vernal pool projects, as private lands may serve as ideal protection, enhancement, introduction, or reintroduction sites, particularly for vernal pool plants. The cooperation of private landowners to allow access to their land can also help accomplish status surveys that are representative of the entire range of hairy Orcutt grass, and may allow the discovery of additional occurrences, further elucidating the true range and providing genetic material for future research on the species. In addition, establishment of vernal pool conservation banks will serve to further protect vernal pools from being destroyed or modified.
  
4. Landowners, land managers, and the Service should realize that conservation of these species can be compatible with other land uses, such as grazing and other agricultural activities, if appropriately implemented. Additional research on the effects of land use activities on vernal pool plants can go a long way toward shedding some light on this topic.
  
5. Efforts to protect vernal pool species should include conservation efforts on a landscape scale (Vollmar 2002). Knops *et al.* (1995) found that “wounded landscapes” (those which had a combination of disturbance to the hydrology of the vernal pools and fluctuating rainfall amounts) have an increased risk of infestation by invasive species and that had the disturbance not

occurred, the infestation probably would not have happened. Where possible, the Service should assess the effects of projects authorized pursuant to section 7 of the Act on a landscape scale in order to adequately analyze the additional potential indirect effects. This may entail a broader interpretation of a project's action area than what has previously been considered sufficient to include the hydrologic regime of vernal pools. The Service should also consider conservation on a landscape scale when considering conservation bank boundaries and habitat conservation plans.

6. Preserve design studies on hairy Orcutt grass and other vernal pool species should consider the effects of climate change on existing and introduced occurrences, as discussed in section II.C.2.e. Also, hairy Orcutt grass population numbers vary widely from year to year, depending on habitat conditions and rainfall patterns (Vollmar 2002). Therefore, it is important to design monitoring studies to include enough seasons to account for years with varying precipitation levels and timing to get a good idea of how occurrences are truly faring.

7. Development of a Geographic Information System (GIS) will give planners the ability to spatially analyze potentially suitable habitat (using soils, topography, hydrology, and other data layers to determine suitability) and prioritize which habitat needs to be protected because of an imminent threat of destruction by development or agricultural activities. GIS is a handy tool to see the "big picture" easily to overlay other important landscape components to analyze which occurrences are most at risk of extirpation and to determine where areas can be acquired to establish corridors and/or large preserves to "buffer" habitat from adjacent incompatible land uses.

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**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of Hairy Orcutt Grass (*Orcuttia pilosa*)**

Current Classification Endangered  
Recommendation resulting from the 5-Year Review

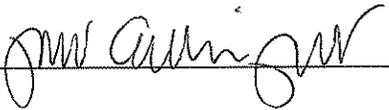
- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable N/A

Review Conducted By Sacramento Fish and Wildlife Office Staff

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve  Date 15 June 2009