

Amsinckia grandiflora
(Large-flowered fiddleneck)

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



USFWS

**U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California
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5-YEAR REVIEW

Amsinckia grandiflora (Large-flowered fiddleneck)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

As summarized from the *Large-flowered Fiddleneck (Amsinckia grandiflora) Recovery Plan* (U.S. Fish and Wildlife Service 1997 (Recovery Plan)), *Amsinckia grandiflora* (large-flowered fiddleneck) is an herbaceous plant in the Boraginaceae (borage family). This annual species has bright, red-orange, trumpet-shaped flowers arranged in a fiddleneck-shaped inflorescence. Its bright green foliage is covered with coarse, stiff hairs. Historically, *A. grandiflora* ranged from northern Contra Costa County, California, at the San Joaquin River Delta, south to Corral Hollow and adjacent areas in San Joaquin County. Currently, *A. grandiflora* is only found in two reintroduced locations, one at Site 300 in southwestern San Joaquin County and the second at Lougher Ridge in Contra Costa County. As a heterostylous species, *A. grandiflora* produces pin and thrum flower forms (morphs), where the female styles and stigmas have two distinct forms on different plants. Characteristic of the genus, each flower type has four ovaries at the base of the style, each of which matures into a seed. The fruit is known as a nutlet. Currently, it occurs in nonnative grassland, but historically it occurred in a native perennial bunchgrass community.

Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from the Recovery Plan and survey information from experts who have been monitoring various localities of this species. The Recovery Plan and personal communications with experts were our primary sources of information used to update the species' status and threats. This 5-year review contains updated

information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 5, 2008 [73 FR 11945]. No responses regarding *Amsinckia grandiflora* were received from the public. The Service received one response collectively regarding all 58 species covered in the notice, which we have considered in preparing this 5-year review.

Listing History:

Original Listing

FR Notice: 50 FR 19374

Date of Final Listing Rule: May 8, 1985

Entity Listed: *Amsinckia grandiflora*, a plant species

Classification: Endangered

State Listing *Amsinckia grandiflora* was listed by the State of California as endangered on April 16, 1982

Associated Rulemakings: **Critical habitat** 50 FR 19374, May 8, 1985

Review History: No formal status review has been conducted since the species was listed in 1985.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Amsinckia grandiflora* is 5 according to the Service's 2007 Recovery Data Call for the SFWO, based on a 1 to 18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a species that faces a high degree of threat and has a low potential for recovery.

Recovery Plan or Outline

Name of Plan or Outline: Large-flowered Fiddleneck (*Amsinckia grandiflora*)

Recovery Plan

Date Issued: September 29, 1997

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

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

Information on the Species and its Status

Species Biology and Life History *Amsinckia grandiflora* is an herbaceous annual that germinates with the onset of fall or early winter rain, grows vegetatively throughout the winter, flowers in the early spring, sets seeds and dies prior to the summer drought. Pollination studies by Carlsen (1996) and Carlsen et. al. (2002) indicate that *A. grandiflora* is not completely self-incompatible and, under greenhouse conditions, this species’ nutlet output can approach that of *A. tessellata*, a common, self-compatible, homostylous species. A pollination study compared *A. grandiflora* and *A. tessellata*. Germination and survivorship were similar between *A. grandiflora* and *A. tessellata*. Additionally, while intra- and inter-morph crosses (crosses within and between pin and thrum flowers) were both determined effective in producing seed in *A. grandiflora*, pollinators are needed for *A. grandiflora* to produce seeds (Carlsen et al. 2002).

Spatial Distribution Historically, the species was reported from a few locations in the northern Diablo Range in California. *Amsinckia grandiflora* ranged from northern Contra Costa County at the San Joaquin River Delta, south to Corral Hollow and adjacent areas in San Joaquin County (Pavlik and Heisler 1988). At the time of listing, there was one occurrence on U.S. Department of Energy land at Site 300 on the Lawrence Livermore National Laboratory in San Joaquin County (this site is known as the Droptower site). In 1988, a second occurrence was discovered in Draney Canyon about ¾ mile west of the original occurrence in Alameda County. A third natural occurrence, Carnegie Canyon, was found in 1993, southeast of the Droptower site. Additionally, attempts to reintroduce *A. grandiflora* were made in the late 1980s to 1990s (Table 1). Since listing, the natural populations have disappeared and only two reintroduced populations remain. Currently, *A. grandiflora* is only found in two reintroduced locations, one at Site 300 in southwestern San Joaquin County and the second at Lougher Ridge in Contra Costa County.

Abundance At the time of listing, there was one population in southwestern San Joaquin County, California, on U.S. Department of Energy land, at the Droptower site, with fewer than

50 plants. Currently there are no plants at either the Draney or natural Droptower sites, and 63 plants in a reintroduced population that is also located on the Department of Energy land at Site 300 (L. Paterson, Biologist, Lawrence Livermore National Laboratory, pers. comm., 2008). Additionally, as of 2005, there were 173 plants at the reintroduced site at Lougher Ridge (L. Paterson, pers. comm., 2008), located about 45 miles northwest of the Droptower site.

Habitat or Ecosystem *Amsinckia grandiflora* currently exists in nonnative annual grassland that apparently was originally a native perennial grassland. Research on the Droptower reintroduced population, the Lougher Ridge reintroduced population, and data from management of the Droptower natural population indicated that competition from nonnative annual grasses was contributing to the decline of *A. grandiflora*, and that long term management to reduce nonnative annual grass cover and restore and maintain the native perennial bunch grass community was necessary to ensure the persistence of this species (Pavlik et al. 1993, Pavlik 1994; Carlsen et al. 1999). Historically, *A. grandiflora* occurred in native perennial bunchgrass communities, which were dominated by species such as *Nassella pulchra* (purple needlegrass), in association with *Aristida ternipes* var. *gentiles* (spidergrass), *Poa secunda* (Sandberg bluegrass), and *Elymus* spp. (wild rye). Sometimes referred to as California prairie or valley grassland, this perennial bunchgrass community originally covered well-drained areas from sea level to 3,840 feet around the Central Valley in California (Barbour and Major 1988).

Changes in Taxonomic Classification or Nomenclature No change in either taxonomic classification or nomenclature has occurred since the listing.

Genetics Allozyme (different forms of a gene that codes for a protein) variation was studied using gel electrophoresis on two nutlet sources to be used in the reintroduction of *Amsinckia grandiflora* to Lougher Ridge in northern Contra Costa County (Pavlik et al. 1993). The nutlets used in this reintroduction ultimately came from the Site 300 collections made by Dr. Robert Ornduff (from the University of California at Berkeley) in the 1960s (Pavlik et al. 1993). Dr. Ornduff provided nutlets to two researchers at U.C. Davis in the 1980s who grew the nutlets at an experimental garden for several seasons. This source of nutlets is known as the cultivated population. The nutlets from the site 300 collections that were not grown at an experimental garden, but instead were stored for 25 years in cold storage, were known as the wild population. The two sources had different levels of genetic variability. The nutlets from the wild population had greater genetic variability than the nutlets from the cultivated population. Eighteen gene loci were examined. An allele is an alternative form of a gene (one member of a pair) that is located at a specific position (locus) on a specific chromosome. The mean number of alleles per locus for the two seed sources was 1.13, with only 17 percent being polymorphic (having multiple forms). The nutlets from the wild population had higher polymorphism than the cultivated population (Pavlik et al. 1993). Having higher polymorphism is an indicator of greater genetic variability.

Species-specific Research and/or Grant-supported Activities

A number of species-specific research or grant supported activities for *Amsinckia grandiflora* have been conducted since its listing in 1985. Studies on biotic requirements that have been conducted include: nutlet production and germination (Pavlik 1988), population and community ecology of *A. grandiflora* (Carlsen 1996), reproductive ecology of *A. grandiflora* (Carlsen et al.

2002), incompatibility in *A. grandiflora* (Weller and Ornduff 1989), pollen tube growth and inbreeding depression (Weller and Ornduff 1991), self-pollination ability (under four treatments) and nutlet yield (Espeland and Carlsen 1995), effects on germination (Carlsen and Gregory 1994), competition between *A. grandiflora* and grasses (Carlsen and Menke 1995), and reducing competitive suppression of *A. grandiflora* by restoring native California perennial grasslands (Carlsen et al. 2000).

Research on Management of Amsinckia grandiflora

Research and management of *Amsinckia grandiflora* native and reintroduced populations indicates that *A. grandiflora* produces more inflorescences in plots restored to low and medium densities of native perennial grasses compared to plots with low and medium densities of nonnative annual grasses, and that *A. grandiflora* produces more inflorescences at lower densities of both grass types compared to higher densities (Carlsen et al. 2000).

Pavlik (1990, 1991, 1992, 1995) has examined the effectiveness of various management techniques for the control of nonnative species including hand manipulation, selective herbicides, and fire in the reintroduction of *Amsinckia grandiflora* to several sites. Herbicide treatments have been used as a management tool for controlling nonnative annual grasses at the native Droptower population on the Lawrence Livermore National Laboratory. Grass-selective herbicide treatments were conducted at the native Droptower population during the 1990s to control densities of annual grasses. After each herbicide treatment, except the most recent conducted in 1998, *A. grandiflora* numbers increased dramatically. In addition, a long-term experiment is currently being conducted at the Droptower experimental population to study the effects of different fire frequencies on the establishment of perennial grasslands and the success of *A. grandiflora* (Carlsen et al. 2001, Carlsen et al. 2003).

Reintroduction of Amsinckia grandiflora

Several attempts have been made to reintroduce populations of *Amsinckia grandiflora*. As part of recovery plan efforts, seven reintroductions have been established from seed throughout *A. grandiflora*'s historic range (Pavlik 1990, Pavlik et al. 1993). Only two of these populations (one at Lougher Ridge on East Bay Regional Park District land, the second at Site 300 near the Droptower natural population), appear to have been successful, although these populations have also declined in recent years. In October 2002, the U.S. Bureau of Reclamation entered into an Interagency Agreement with Lawrence Livermore National Laboratory and the U.S. Department of Energy and provided funding to Lawrence Livermore Laboratory to conduct rapid seed bank enhancement at the Lougher Ridge and Droptower reintroduced sites (Paterson et al. 2005). Demographic monitoring has been conducted on the various natural and reintroduced sites.

Table 1. List of known natural and reintroduced *Amsinckia grandiflora* (updated from Pavlik 1996).

Recovery Area	Population	Reintroduced/Natural	Ownership ¹	Status
Northern	Lougher Ridge	Reintroduced	EBRPD	173 plants in 2005 ²
	Black Diamond	Reintroduced	EBRPD	Extirpated
Central	Los Vaqueros I	Reintroduced	CCWD	Extirpated
	Los Vaqueros II	Reintroduced	CCWD	Extirpated
Southern	LLNL Site 300		LLNL	
	Droptower	Natural		No plants seen in 2008 ²
	Draney	Natural		Extirpated ³
	Droptower	Reintroduced		63 plants seen in 2008 ²
	Carnegie Canyon	Natural	Private	No plants seen in 2003 ²
	Connolly Ranch	Reintroduced	Private	Extirpated
	Corral Hollow	Reintroduced	CDFG	Extirpated? ⁴

¹ CCWD = Contra Costa Water District
 CDFG = California Department of Fish and Game
 EBRPD = East Bay Regional Park District
 LLNL = Lawrence Livermore National Laboratory

² L. Paterson pers. comm. 2008.

³ Paterson et al. 2005

⁴ California Department of Fish and Game 2005

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range.

At the time of listing, the primary threat to *Amsinckia grandiflora* was the invasion of aggressive *Amsinckia* species and weedy nonnatives into the grassland habitat. This is still an ongoing threat.

As discussed in “Information on the Species and its Status”, two more natural occurrences were found after the listing, but these are thought to be extirpated. The Draney Canyon occurrence was extirpated due to a rock slide in 1997 (L. Paterson pers. comm. 2008), and the Carnegie Canyon occurrence by grazing as discussed in factor C.

At the Lawrence Livermore National Laboratory (LLNL), in California, 160 acres was preserved on April 28, 2000 (Houghton 2000). The *Amsinckia grandiflora* Reserve provides critical habitat for more than 300 species of plants and 95 species of mammals, birds, reptiles and amphibians. Plants in the Reserve that are protected include a portion of increasingly important native grasses. As described in the memorandum of agreement, as the landowner, the

Department of Energy will manage the environmental compliance, safety, health, fire protection, access, and cleanup activities, while limiting the future programmatic use of the area. The U.S. Fish and Wildlife Service will manage the recovery efforts for the endangered *Amsinckia grandiflora* resources within the area, and provide expertise and technical advice to the Department of Energy for the Reserve ecological management (Houghton 2000).

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

At the time of listing, we stated that *Amsinckia grandiflora* had an unusual flower morphology and highly restricted distribution. As a consequence, the species had been the subject of a number of studies concerning the reproductive biology and evolution of *Amsinckia*. It was thought that studies that often required reproductive parts or whole plants would threaten the species should the population numbers continue to decline and the collection of plants not be monitored or managed to reduce impacts.

We are not aware of any current impacts due to overutilization. *Amsinckia grandiflora* has been reintroduced and is currently extant at two sites due to the research that has been conducted. Without the research that has been conducted on *A. grandiflora* it would be extinct.

FACTOR C: Disease or Predation

At the time of listing it was thought that grazing may have been responsible, in part, for the extirpation of some populations of this species. The introduction of grazing animals to the Livermore area was thought to have degraded the native grasslands that once existed there. Since listing, a combination of either the change in the intensity of grazing or the change from cattle grazing to sheep grazing is thought to have possibly extirpated the natural population located at Carnegie Canyon (T. Carlsen, Lawrence Livermore National Laboratory, pers. comm. 2008). No plants were seen at this site in 2003 (T. Carlsen, pers. comm. 2008).

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, the California Endangered Species Act was not considered to provide adequate protection to the species in its natural habitat.

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA): The CESA (California Fish and Game Code, section 2080 *et seq.*) prohibits the unauthorized take of State-listed threatened or endangered species. The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species. The CESA requires State agencies to consult with the California Department of Fish and Game on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities. *Amsinckia grandiflora* is listed as endangered.

Furthermore, with regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners have been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of listed plants. We do not consider salvage to provide adequate protection.

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program.

With regard to federally listed plant species, 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 plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the "take" of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or

destruction of endangered plants on any other area in knowing violation of a state law or regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

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 1985. 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.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

At the time of listing, the relatively primitive reproductive system of *Amsinckia grandiflora* was thought to put the species at a competitive disadvantage with its congeners and with nonnative plants. This factor continues to threaten *A. grandiflora*. Additionally because of the small number of populations and their small sizes, stochastic (chance) extinction also threatens this species.

Small population size increases the susceptibility of a population to extirpation from random demographic, environmental and/or genetic events (Shaffer 1981, 1987; Primack 2006; Groom et al. 2006). In this 5-year review populations of 200 growing plants (not counting ungerminated seeds) or less are considered to be small, in keeping with Menges' (1992) calculation that populations of this size are especially vulnerable to even moderate levels of environmental uncertainty. The combination of few populations, small range, and restricted habitat renders *Amsinckia grandiflora* susceptible to extinction or extirpation from a significant portion of its range due to random events, such as flood, drought, disease, or other factors (Shaffer 1981, 1987; Groom et al. 2006). As an example, the Draney Canyon occurrence has been extirpated due to a rock slide in 1997. Repeated surveys have not relocated any plants (L. Paterson pers. comm. 2008).

Small populations may also be subject to increased genetic drift and inbreeding (Menges 1991; Ellstrand and Elam 1993). Populations that are continually small in size are particularly susceptible to adverse genetic changes due to drift. However, drift may also cause genetic changes with populations that occasionally fluctuate to small sizes (e.g., undergo population bottlenecks). Increased homozygosity resulting from genetic drift and inbreeding may lead to a loss of fitness (ability of individuals to survive and reproduce) in small populations. In addition, reduced genetic variation in small populations may make any species less able to successfully adapt to future environmental changes (Ellstrand and Elam 1993). The currently extant occurrences of *Amsinckia grandiflora* have populations of 63 and 173 plants (L Paterson pers. comm. 2008). Therefore, the species is also susceptible to extinction or extirpation from a significant portion of its range due to demographic events, genetic drift, and inbreeding.

Climate Change

Climate is predicted to change in California during the 21st century (Field et al. 1999; Cayan et al. 2005). Even modest changes in warming could result in a reduction of the spring snowpack, earlier snowmelt, and more runoff in winter with less runoff in spring and summer, more winter flooding, and drier summer soils (Field et al. 1999; Cayan et al. 2005). The predicted impacts on California's ecosystems projected with a high certainty include higher sea level; decreased suitable habitat for many terrestrial species as climate change intensifies human impacts; and increased competition among urban, agricultural, and natural ecosystem uses (Field et al. 1999). Although the specific effects of climate change on *Amsinckia grandiflora* are unknown, the effects of increased winter flooding and drought conditions in the spring have the potential to adversely affect this species.

III. RECOVERY CRITERIA

There is an approved final recovery plan for the species. Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and the threats to its survival are neutralized, so its long-term survival in nature can be ensured. The goal of this process is the maintenance of secure, self-sustaining wild populations of the species. Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. Sometimes recovery may be achieved without fully meeting all recovery plan criteria. The delisting or downlisting of a species comes as a result of an analysis of the 5 listing factors to determine if the threats to the species have been ameliorated or eliminated. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

Amsinckia grandiflora may be downlisted to threatened status when:

1. **A minimum of six management areas, including at least two natural populations, are secured and protected from the threats that caused listing initially, including urbanization, agricultural conversion, competition with invasive vegetation, and livestock grazing.** (This criterion addresses listing factors A, C, and E.). This criterion is up-to-date and relevant to the species' current status and current threats.

This criterion has not been met. Currently, one management area, the Lawrence Livermore National Laboratory in the southern recovery area, has been selected, secured, and in part protected from the threats that caused listing initially. The Recovery Plan calls for two management areas in the northern recovery area, two management areas in the

central recovery area, and two management areas in the southern recovery area. At the time the Recovery Plan was written, areas being recommended for selection included: Lougher Ridge, Connolly Ranch, Lawrence Livermore National Laboratory, and Carnegie Canyon. The reintroductions at Los Vaqueros and Black Diamond II had failed, so additional sites needed to be chosen for the northern and central recovery areas (U.S. Fish and Wildlife Service 1997). Connolly Ranch and Carnegie Canyon have since declined (California Department of Fish and Game 2005).

In April 2000, the Department of Energy entered into an agreement with the U.S. Fish and Wildlife Service and designated 160 acres within Lawrence Livermore National Laboratory Site 300 as the *Amsinckia grandiflora* Reserve to provide for the survival and recovery of the species. The Department of Energy will manage the environmental compliance, safety, health, fire protection, access, and cleanup activities at Site 300, while limiting the future programmatic use of the area (Houghton 2000).

2. **Sufficient information has been obtained to ensure perpetuation of native grassland communities in perpetuity, and appropriate management, based on this information, is being implemented at each management area.** (This criterion addresses listing factors A, C, and E). This criterion is up-to-date and relevant to the species' current status and current threats.

This criterion has not been met. Research has been conducted on reintroduced populations as discussed in the "Species-specific Research and/or Grant-supported Activities section". Appropriate management still needs to be implemented at six management areas.

3. **Each management area has a minimum of 1,500 reproductive individuals, with sufficient acreage of suitable habitat to support an expanded population and provide an appropriate buffer (see task 42).** (This criterion addresses listing factor E). This criterion is up to date and relevant to the species' current status and current threats.

This criterion has not been met. Currently, there are only two occurrences of *Amsinckia grandiflora*, and these occurrences have 63 and 173 plants (L Paterson, pers. comm. 2008).

4. **The six management areas concurrently demonstrate self-maintenance at or above this level for at least one precipitation cycle¹ without intensive management intervention (e.g., hand-pollination, seed collection, off-site propagation) needed to prevent population decline.** (This criterion addresses listing factors A, C, and E). This criterion is up to date and relevant to the species' current status and current threats.

This criterion has not been met. Only one occurrence has been protected and it is not yet self-maintaining.

¹A precipitation cycle is defined as a series of years which encompass average, above-average, and below-average rainfall conditions, starting and ending with average precipitation. The populations must demonstrate the ability to survive both precipitation extremes.

Self-maintenance will be measured by demographic monitoring, focusing on seed production, germination, and survival, to determine if populations are stable or increasing. These criteria may be revised as more information becomes available through recovery efforts undertaken in conformance with this plan.

The selection of a population size of 1,500 reproductive plants is based upon data presented by Pavlik (1990, 1991, 1992, 1996) and is a best guess at a minimum number necessary to support stable populations of an annual grassland forb such as *Amsinckia grandiflora*. The requisite distribution of management sites is based upon historical distribution.

There are no delisting criteria.

IV. SYNTHESIS

At the time of listing in 1985, one population of *Amsinckia grandiflora* was known from one natural occurrence at the Lawrence Livermore National Laboratory on Department of Energy lands in San Joaquin County, California. Currently there are two known extant occurrences, one in Contra Costa County and the other in San Joaquin County. At the time of listing the species was threatened by invasion of aggressive *Amsinckia* species, and weedy nonnatives into the grassland habitat, grazing, and the relatively primitive reproductive system for *A. grandiflora*. Since 1985, research and monitoring of *A. grandiflora* has included determining population status; research on management techniques for the control of nonnative species including hand manipulation, selective herbicides, and fire; and field and greenhouse experiments to identify techniques for propagation and reintroductions of *A. grandiflora*. Despite these efforts, the status of the species remains endangered due the low numbers of individuals, low numbers of populations, low reproductive success in the field, and competition from nonnative and native plants. Therefore, we believe *A. grandiflora* still meets the definition of endangered, and recommend no status change at this time.

V. RESULTS

Recommended Listing Action:

- Downlist to Threatened
- Uplist to Endangered
- Delist (indicate reason for delisting according to 50 CFR 424.11):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No Change

New Recovery Priority Number and Brief Rationale: No change in recovery priority number.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Secure the Carnegie Canyon population. The Carnegie Canyon population should be secured from a willing seller by fee title for the benefit of several listed species.
2. Conduct a management study whose first objective is the establishment of 6 to 10 acres of thriving *Amsinckia grandiflora* populations with the ultimate objective of determining what factors enable and prevent sufficient recruitment to sustain the populations. This study would be done in a completely controlled and intensively managed basis. *Amsinckia grandiflora* has been grown successfully in greenhouses, but we do not know why it is not thriving in the wild. Such a study would provide the information needed for recovery, while maintaining the seed stocks and as much genetic variability and adaptability as is needed to implement recovery. The expanded scale would also allow the study of more extensive techniques and the study of more kinds of management techniques simultaneously. (See also numbers 3 and 4 below.)
3. Maintain seed bank to have viable seeds for restoration.
4. Determine causes for the extirpations of the natural and reintroduced occurrences and remedy the decline of *Amsinckia grandiflora*.
5. Conduct a study to help determine the effect of grazing and other vegetation management on *Amsinckia grandiflora* populations and the restoration of perennial grasslands.
6. Conduct surveys to try to locate additional natural occurrences of *Amsinckia grandiflora*.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Amsinckia grandiflora (Large-flowered fiddleneck)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

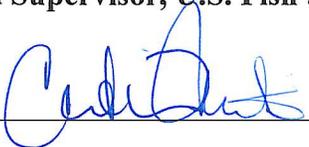
- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Review Conducted By: SFWO staff

Date Submitted to Region 8: _____

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve  Date 10/17/08

ACTING REGIONAL OFFICE APPROVAL:

Lead Regional Director, U.S. Fish and Wildlife Service, Region 8

Approve  Date 2-4-09