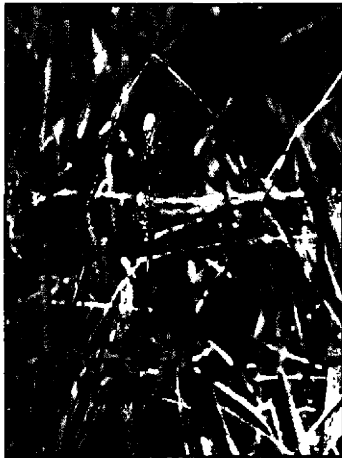


Carex albida
(White sedge)

Lilium pardalinum* ssp. *pitkinense
(Pitkin marsh lily)

**5-Year Review
Summary and Evaluation**



Kate Symonds, USFWS

Carex albida



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Lilium pardalinum* ssp. *pitkinense

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

August 2009

5-YEAR REVIEW

Carex albida (White sedge)
Lilium pardalinum ssp. *pitkinense* (Pitkin marsh lily)

I. GENERAL INFORMATION

Purpose of 5-Year Review:

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' statuses have changed since they were listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether these 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 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:

Carex albida is a perennial herb in the sedge family (Cyperaceae). The plant inhabits fresh water marshes, meadows, and seeps. *Lilium pardalinum* ssp. *pitkinense* is an herbaceous perennial in the lily family (Liliaceae) that occurs on sandy soils in wet meadows and at the edges of riparian areas. At the time of the 1997 listing, all known extant occurrences of *C. albida* and *L. pardalinum* ssp. *pitkinense* occurred within approximately eight miles of each other at two freshwater marshes in western Sonoma County, California (Service 1997). For the purpose of this review an "occurrence" is defined as a record of occurrence in the CNDDB. The CNDDB defines occurrence as a location separated from other locations of the species by at least one-fourth mile that may contain populations, individuals, or colonies. Additionally, for the purposes of this document, these marshes are referred to as the "northern" and "southern" marsh, with the northern marsh being divided into the "upper" and "lower" marsh. At the time of listing, *C. albida* was known from a single property in the lower northern marsh. *Lilium pardalinum* ssp. *pitkinense* occurred at both marshes. Documented only from no more than four historical marsh sites (four for *C. albida*, three for *L. pardalinum* ssp. *pitkinense*), these two marshes represent the last known locations that have not been destroyed by residential or agricultural land uses [California Natural Diversity Database (CNDDB) 2009]. The two marshes have related, but distinct regional wetland floras characterized by endangered plants and disjunct occurrences of several plant species more typical of acidic nutrient-poor wetlands habitats or fens further north in the Coast Ranges of California and elsewhere (Rubtsoff 1953; Baye 2005).

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 several field reconnaissances with experts and others who have been monitoring the two localities of this species, and the CNDDDB maintained by the California Department of Fish and Game (DFG). No recovery plan has been drafted for either species. Personal communications with experts and individuals familiar with the species and localities were our primary sources of information used to update the species' status and threats. We received only one letter directly in response to our Federal Notice initiating this 5-year review. However, we contacted several biologists and other individuals who were familiar with the species or their localities. We received responses from fourteen people to that latter request. 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 their 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:

Lead Regional Office – Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Pacific Southwest Regional Office, 916-414-6464

Lead Field Office – Kirsten Tarp, Recovery Branch, Sacramento Fish and Wildlife Office, 916-414-6600.

Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of these taxa 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 11945-11950). One comment letter was received directly from this request from the Attorney General, Department of Justice, State of California (E. Ochoa and J. Potter, Deputy Attorney General, State of California, in litt. 2008), recommending that we fully explore and evaluate the impact of global warming on *Carex albida* and *Lilium pardalinum* ssp. *pitkinense*. We address the potential impacts of global warming on these species in this review.

Listing History:

Original Listing

FR Notice: 62 FR 55791

Date of Final Listing Rule: October 22, 1997

Entity Listed: *Carex albida*, a species; *Lilium pardalinum* ssp. *pitkinense*, a subspecies.

Classification: Both taxa were listed as endangered

State Listing

Carex albida was listed by the State of California as endangered in November 1979.
Lilium pardalinum ssp. *pitkinense* was listed by the State of California as endangered in November 1978.

California Native Plant Society Status:

The California Native Plant Society (CNPS) placed both taxa on List 1B (rare or endangered throughout their ranges).

Review History: No 5-year reviews or other formal status reviews have been conducted since these species were listed in 1997

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number is 5C for both *Carex albida* and *Lilium pardalinum* ssp. *pitkinense* according to the Service's Recovery Data Call for the Sacramento Fish and Wildlife Office (Service 2008), based on a 1-18 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). These numbers indicate that *Carex albida* is a species and incorrectly that *Lilium pardalinum* ssp. *pitkinense* is also a species. Additionally both these taxa face a high degree of threat and have a low potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity. Both plant species are considered to have a high level of threat and a low potential for recovery because of impacts from rural residential and/or agricultural developments, alterations in hydrology from various surrounding land uses, competition from invasive species, and because of the extremely limited distribution of their specific habitats.

Recovery Plan or Outline

No Recovery Plans or outlines have been drafted for either species.

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 are plants, 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

Carex albida is a perennial herb in the sedge family (Cyperaceae) with short fiber-covered rhizomes. The culms (stems) are triangular, 4 to 6 decimeters (1.3 to 2.0 feet) tall, erect, and longer than the leaves. Several traits distinguish *C. albida* from other closely related sedges. *Carex albida* has inflorescences with staminate (male) flowers above the pistillate (female) flowers, especially on the terminal inflorescence, lateral spikelets, and leaves that are shorter than the stems and 3 to 5 millimeters (0.1 to 0.2 inch) wide. Some individuals of *C. lemmonii* (Lemmon's sedge), which has not been documented in Sonoma County, resemble *C. albida*, but differ in perigynia and fruit size, and in other respects.

Lilium pardalinum ssp. *pitkinense* is an herbaceous perennial in the lily family (Liliaceae). The slender, erect stems reach 1 to 2 meters (3 to 6 feet) in height. Leaves are yellow-green, up to 14 centimeters (5.5 inches) long, and 1 to 2 centimeters (0.4 to 0.8 inch) wide. The flowers are large, showy, and nodding. The petals, which are reflexed from the middle, are red at the outer edge changing to yellow at the center with small, deep maroon dots mostly within the yellow zone. Anthers (pollen-bearing part of the stamen) are purple-brown. The fruit is an elliptical capsule containing many rounded seeds (DFG 1993). The species flowers from June to July. *Lilium pardalinum* ssp. *pitkinense* is distinguished from *L. pardalinum* ssp. *pardalinum* by generally shorter petals and anthers. *Lilium pardalinum* ssp. *pitkinense* grows only in marshy wetlands and edges of riparian areas that are 35 to 60 meters (115 to 200 feet) in elevation. *Lilium pardalinum* ssp. *pitkinense* grown from seed in propagation takes at least three years to mature into blooming plants (B. Young, CNPS, pers. comm. 2009).

Spatial Distribution

Carex albida

At the time of listing, *Carex albida* was known from a single extant occurrence, the lower northern marsh. *Carex albida* at this occurrence is found associated with wet hillside meadows and freshwater wetlands between 45 and 60 meters (150 and 200 feet) in elevation.

Since the time of listing, *Carex albida* has not been found on any new properties. Surveys conducted on the lower northern marsh property in 2005 in support of a now defunct development proposal, mapped several of the known colonies or patches on site, as well as a newly documented colony (Patterson 2005). It is not clear if the five other colonies reported in 2005 are new colonies in the lower marsh or were part of the overall occurrence surveyed in the late 1980s (Patterson 2005). However, at least one new colony or patch was documented during the 2005 surveys. This new colony is an approximately 0.25-acre freshwater marsh from a hillside seep on the southeastern side of the property and it supports a few dozen *Carex albida* individuals (Symonds, pers. obs. 2007).

Plant surveys resumed in 2008 by a different consulting botanist also documented six colonies or patches of *Carex albida*, including yet another previously unknown colony (Warner 2008). This newest colony is also located in the southeast portion of the property in an area well out of the previously proposed development footprint (Warner 2008) and was not likely in the area searched in 2005. Therefore the potential exists that this patch has been in existence for a long time and is not likely the result of a recent expansion of this species on the property (Symonds,

pers. obs. 2008). These six colonies are in three general areas on the property. The two newest colonies are located within a few hundred meters of the previously known colonies on the same property.

The historical occurrence in the upper portion of this marsh is likely extirpated. No access for surveys has been granted since 1976 and impacts due to the addition of wells and other construction since that time have resulted in drier conditions. This interpretation is consistent with our final listing designation. Publicly available websites with online aerial photographs indicate that habitat appears to still exist in the upper reaches of the marsh (i.e., the habitat has not been converted to agriculture or development) (GoogleEarth 2009; MapQuest 2009). However, it is not possible to determine whether *Carex albida* is still extant in those areas without conducting ground surveys. With the lack of information about the status of

Table 1. Occurrences of *Carex albida* and *Lilium pardalinum* ssp. *pitkinense*; prepared for 5-year review, 2009. Occurrence trends are since the 1997 listing. **Bold** = extirpated. CNDDDB identification # = occurrence # assigned by the California Natural Diversity Database (CNDDDB 2009).

<i>Carex albida</i>					
CNDDDB Occurrence#	Occurrence Location	Current trend	Last observed	Last surveyed	Reference
2	Swamps, Santa Rosa Creek	Extirpated	Pre-1960's	1977	CNDDDB 2009
3	Perry Marsh (between Sebastopol and Forestville)	Extirpated	1971	1987	CNDDDB 2009
4 (and 5) ¹	Upper Northern Marsh	Likely extirpated	1976	1976	CNDDDB 2009
6	Lower Northern Marsh	Decreasing since 1997	2009	2009	CNDDDB 2009, K. Symonds, pers. obs. 2009, Warner 2008

<i>Lilium pardalinum</i> ssp. <i>pitkinense</i>					
CNDDDB Occurrence#	Occurrence Location	Current trend	Last observed	Last surveyed	Reference
1 ²	Upper Northern Marsh	Unknown, but presumed extant	1996	2001	CNDDDB 2009 DFG 2001 (survey performed in 2001)
2	Upper Northern Marsh	Unknown, but presumed extant	1980s	1988	CNDDDB 2009; M. Skinner 2008
3	Southern Marsh	Decreasing since 1997	2009	2009	CNDDDB 2009, K. Symonds, pers. obs. 2009

¹ CNDDDB reports this occurrence of *Carex albida* as extant. In the final listing rule we said that only the lower northern marsh site (CNDDDB Occurrence # 6) was extant. The author of this five year review, consistent with our final listing determination, has presumed CNDDDB Occurrence # 4 likely extirpated based on the low numbers last observed, the lengthy time since it was last seen, and the presence of a number of impacts observed at the occurrence the last time it was seen.

² CNDDDB #1 and 2 occurrences for *L. pardalinum* ssp. *pitkinense* are located on nearly adjacent properties

C. albida in the upper marsh in over 30 years, the lower marsh, as in the 1997 listing, continues to be regarded as the only extant occurrence for *C. albida*. Therefore, the species continues to be known from only one extant occurrence in the world, which is scattered in approximately six or seven patches totaling no more than approximately five acres within the 27-acre property.

Lilium pardalinum ssp. *pitkinense*

At the time of listing, three occurrences of *Lilium pardalinum* ssp. *pitkinense* at two marshes were presumed extant (Service 1997). All three occurrences are on private land within a distance of 13 kilometers (8 miles) in western Sonoma County. The northern marsh has two occurrences, which are each located on separate but nearby properties (CNDDB 2009).

Only the southern marsh occurrence has been confirmed as extant in 2009. No access for surveys has been granted for the other two upper northern marsh occurrences since the 1980s for CNDDB Occurrence #2 (CNDDB 2009) and 2001 (DFG 2001) for CNDDB Occurrence #1. Both occurrences in the northern upper marsh are presumed extant based on examination of publicly available online aerial photographs that indicate that habitat appears to still exist in the upper reaches of the marsh where it was once recorded (i.e., the habitat has not been converted to agriculture or development) (GoogleEarth 2009; MapQuest 2009). Confirmation of whether the species is still extant in this area is not possible without conducting ground surveys at the appropriate time of year. The CNDDB indicates these occurrences are still extant (CNDDB 2009).

The southern marsh, where *Lilium pardalinum* ssp. *pitkinense* is still known to occur, is under a 19-acre permanent conservation easement held by California Department of Fish and Game (DFG), which was established in 1998. The land is owned in fee title by several adjacent landowners who have allowed access to the Milo Baker Chapter of the CNPS and the Laguna de Santa Rosa Foundation and their volunteers to conduct habitat enhancements and Pitkin marsh lily monitoring for ten or more years. At the southern marsh, *L. pardalinum* ssp. *pitkinense* is scattered in ten small enclosed colonies (including three which were established through outplanting in 2009) within an approximately three acre area within the conservation easement boundaries. Although, the easement boundaries encompass only a portion of the historical marsh area, it does encompass all the known lily occurrences in the southern marsh (G. Cooley, DFG, pers. comm. 2007; Symonds, pers. obs. 2007).

Abundance

Carex albida

At the time of listing, approximately 1,000 plants were scattered within one property, which comprised the only known extant occurrence (B. Guggolz, CNPS, in litt. 1993). Other than a fence line observation in 1991 (Guggolz, in litt. 1993) no surveys were known to be conducted at this occurrence until 2005 when a consulting botanist conducted surveys on the lower marsh in support of a development proposal (Patterson 2005).

Currently, *Carex albida* continues to be known from one occurrence in the lower northern marsh. The surveys conducted in 2005 revealed the occurrence was distributed in six somewhat separate colonies on this 27-acre property and totaled approximately 200 plants on the entire property (Patterson 2005). The lowermost colony, which was thought to have about 1,000 plants in the late 1980s, had apparently declined to approximately 130 plants in 2005. The lower portion of the northern marsh, which encompasses the entire occurrence, was purchased for conservation in 2007. Warner (2008) estimated approximately 100 *C. albida* individuals in the six colonies combined. Factors cited as contributing to the low count were the driest spring on record, low temperatures during spring 2008, which could have reduced culm formation and flowering, and also the density and height of nonnative grasses that made it difficult to detect *C. albida* (Warner 2008).

Carex albida surveys were conducted at the lower northern marsh again in June 2009 by the same consulting botanist as in 2008, with staff from the Sonoma Land Trust, DFG, Service, and a CNPS volunteer. Because of the difficulty in determining individuals in a rhizomatous species, the survey team chose to count the number of reproductive culms as a more accurate and repeatable method of measuring abundance than trying to count “individuals,” which would be based on subjectivity. A total of 299 reproductive culms (stems) were counted in the six colonies. One isolated dense clump located between two of the existing colonies and covering approximately two square feet in size had been discovered in recent months by Land Trust staff. This clump contained 32 reproductive culms alone. In comparison, most other clumps had one or two culms. So if previous surveyors based abundance on counting a clump as an individual plant, then the number of clumps would be much less than the number of reproductive culms.

The abundance of *Carex albida* is not comparable across the survey years because of differing survey techniques and unknown criteria for differentiating what constitutes an individual plant in this rhizomatous species. For example, in 2009 one large clump contained 32 reproductive culms alone whereas most other clumps had one or two culms. Furthermore, survey intensity and timing also likely affects detection of *C. albida*. In 2009, reproductive culms and clumps of *C. albida* appeared to be more easily detected than in 2008 (Cooley pers. comm. 2009; Symonds pers. obs. 2009). However, it could be the result of having a five member survey team rather than a one or two member survey team. Additionally, the surveys were conducted one to two months earlier than the previous year when presumably lower grass height potentially allowed better detection of *C. albida*.

Despite the foregoing challenges in assessing abundance of *Carex albida* and the incremental discoveries of two new patches of *C. albida* coincident with increasing survey effort and frequency, the abundance of this species on this property seems to be much lower than the estimated number of 1,000 plants at the time of listing. The status of its historical occurrence in the upper portion of this marsh continues to be unknown with no access for surveys since 1976, but was considered extirpated in the 1997 listing (Service 1997).

Lilium pardalinum ssp. *pitkinense*

The only information on the status of the taxon at the upper northern marsh since the 1997 listing is a DFG report from 2001 in which Betty Guggolz reported that *Lilium pardalinum* ssp.

pitkinense was considered “stable and increasing” at CNDDDB Occurrence #1 (DFG 2001). However, the number of individuals was not provided in that report (DFG 2001). The most recent information on the abundance of this taxon in the upper northern marsh is a 1996 record of 19 individuals from CNDDDB Occurrence #1 (CNDDDB 1996), which was known at the time of the 1997 listing. No information is available since the 1997 listing on CNDDDB Occurrence #2 in the upper northern marsh (Table 1).

At the southern marsh where *Lilium pardalinum* ssp. *pitkinense* has been confirmed extant in 2009 (Symonds, pers. obs. 2009) (Table 1), the Milo Baker Chapter of the CNPS has been conducting surveys and habitat enhancements for over 10 years (B. Young, pers. comm. 2008; J. Herrick, CNPS, pers. comm. 2008). At the southern marsh, *Lilium pardalinum* ssp. *pitkinense* is found scattered in ten small enclosed colonies (two are combined into one) across an approximately 3-acre area within the 19-acre conservation easement boundaries. Each of the colonies is enclosed by woven wire fences primarily to protect from deer browsing. Three of those exclosures were established in April 2009 through outplanting 42 three-year old *L. pardalinum* ssp. *pitkinense* seedlings that had been propagated from seed collected at this marsh. A total of 42 individuals were out planted into the three new exclosures with another eight individuals planted in unfenced areas under native azaleas to assess whether this approach can deter deer from browsing them (B. Young, pers. comm. 2009; Symonds, pers. obs. 2009).

A *Lilium pardalinum* ssp. *pitkinense* census conducted by CNPS members during July 2004 at the southern marsh revealed 149 vegetative and 489 reproductive stems, 321 flowers, and 642 capsules (Basor and Young 2004). During May that year, thousands of seedlings were observed but most went dormant or died by July. Most of the lilies occurred in the single largest stand within the two combined exclosures (Basor and Young 2004). In 2007, CNPS members counted 94 plants, 152 flowers, and 110 capsules (Herrick, in litt. 2007). During a survey conducted in July 2008, Service staff counted a total of 165 reproductive stems, with colony size ranging from three to 115 reproductive stems (Symonds, pers. obs. 2008). In addition, the single largest colony had at least 200 seedlings, or low stature, non-blooming stems. As in the 2004 surveys, individual stems were counted as it was more accurate and repeatable than estimating number of individual plants (Symonds, pers. obs. 2008).

At the time of the 1997 listing, an estimated 300 individual lily plants remained on the two historical marshes (Guggolz, pers. comm. 1996). Because of the lack of recent information from the northern marsh occurrences, and that only reproductive stems were counted during the recent surveys at the southern marsh, it is difficult to compare the numbers from the time of listing to determine any trend in abundance. However, it appears in the past few years, the number of reproductive stems and seedlings may be decreasing at the southern marsh despite efforts to protect the lily colonies from herbivory and with supplemental planting of propagated *Lilium pardalinum* ssp. *pitkinense*. With apparently decreasing numbers at the one confirmed extant occurrence and the limited availability of suitable habitat within its restricted range, the taxon remains highly vulnerable to extinction.

Habitat or Ecosystem

Carex albida and *Lilium pardalinum* ssp. *pitkinense* are known from three historical marshes that form a biogeographically distinct group in southern Sonoma County (Rubtzoff 1953; Baye 2005). These marshes supported similar but distinctive local wetland floras which included numerous endemic and limited distribution species and species more common, but widely separated from their next nearest occurrence. These distinctive wetlands have ecological and floristic similarities with acidic, sandy/peaty fens occurring further north on the California and Oregon coast and northward, however, they are not equivalent with one another (Baye 2005). Of the three historical marshes, the northern marsh, which currently supports one occurrence of *C. albida* and two occurrences of *Lilium pardalinum* ssp. *pitkinense*, supports a richer native wetland flora than the southern marsh. It also has the highest number of co-occurring disjunct species typically found in acidic, nutrient poor wetlands of the northern Sonoma and Mendocino outer Coast Ranges and also supports two "quaking" fens known from nowhere else in this county. The southern marsh historically supported some uncommon to rare taxa that have not been reported at the northern marsh (Baye 2005).

The vegetation at these two remaining marshes has not been adequately sampled or formally described under the system described in the Manual of California Vegetation (Sawyer and Keeler-Wolf 1995). This manual contains the most widely accepted standardized vegetation classification system for California. Terms such as fen, freshwater swamp, and coastal and valley freshwater marsh would be generally applicable to these wetland habitats (J. Evens, CNPS Vegetation Specialist, in litt. 2008) and are described under the DFG's Natural Heritage Program's Terrestrial Natural Communities of California (Holland 1986). Previous descriptions of the northern marsh referred to it as a "sphagnum bog." The term "fen" is more accurate as its source of water is primarily from the ground and no bogs are found in California (Evens, in litt. 2008).

Suitable habitat for each species is extremely rare and isolated throughout their ranges due to the natural rarity of their soil types, unique vegetation associations, and from the conversion of some of the remaining areas for various land uses. This fragmentation and habitat alteration has resulted in naturally small isolated occurrences of these species (CNDDDB 2009).

Carex albida

The only extant occurrence of *Carex albida* is found in perennial wetlands and hillside seeps, between 45 and 60 meters (150 and 200 feet) in elevation. This marsh supports mixed native willow riparian, oak woodland, grasslands, perennial freshwater marsh containing seeps and other diverse wetland features such as two "quaking" fens. The observed drying trend in the marsh was noted in the 1997 listing coincident with the addition of wells and other land uses, and the increase in invasive native and nonnative vegetation continues, such as *Festuca arundinacea* (tall fescue), *Holcus lanatus* (velvet grass), *Rubus armeniacus* [= *Rubus discolor*, *R. procerus*] (Armenian (= Himalayan) blackberry), and willow (*Salix* sp.) (Patterson 2005; Cooley, pers. comm. 2008). *Carex albida* is scattered in six colonies on a 27-acre property (Patterson 2005; Warner 2008). However, the colonies occupy less than a few acre footprint within that property.

Lilium pardalinum ssp. *pitkinense*

The southern marsh which has a DFG conservation easement comprises several vegetation types across an elevational gradient from a small perennial stream channel to the gently sloping uplands. This gradient includes willow riparian woodland and floodplain and freshwater marsh, scattered large mature native oaks and pines not native to Sonoma County (mostly *Pinus radiata*), and well-drained grasslands which were formerly subject to agricultural uses and are now dominated by nonnative invasive perennial grasses. Dense stands of non-native *Rubus armeniacus* (Armenian (=Himalayan) blackberry) and native *R. californica* (California blackberry) form the understory in much of the *Salix* sp. (willow) riparian area. Most of the *Lilium pardalinum* ssp. *pitkinense* occurs in the lower willow riparian woodland and the riparian wetlands where near-surface soil moisture persists well into the growing season (Baye 2005).

The soils, however, are not permanently saturated as described in the final listing rule which stated that *Lilium pardalinum* ssp. *pitkinense* grows only in permanently saturated, sandy soils in freshwater marshes and wet meadows. At the southern marsh, this taxon grows in soils that are seasonally saturated in the rainy season and are not saturated especially later in the dry season (Symonds, pers. obs. 2008).

The known extant occurrence of *Lilium pardalinum* ssp. *pitkinense* at the southern marsh occurs in 10 small colonies encompassing less than three acres within the 19-acre DFG conservation easement area. This easement area includes only a small portion of the historical southern marsh and its watershed and is surrounded by rural residences with some hobby vineyards. Fewer than 100 acres of the marsh remains, although the specific acreage that supports appropriate soil and hydrological characteristics is not known, but likely comprises little more than the currently occupied habitat. Downstream of the lower easement boundary is more freshwater marsh and the largest part of the historical marsh, which likely supported historical records of other rare plant occurrences known from this marsh (Baye 2005).

Changes in Taxonomic Classification or Nomenclature

Lilium pardalinum ssp. *pitkinense* has had no changes in its scientific name or to its taxonomic classification since it was listed in 1997. The last taxonomic change occurred in 1993 when it was classified as a subspecies of *L. pardalinum* (Skinner 1993). However, formal publication of that nomenclatural change was made in 2002 (Skinner 2002), which was required prior to being included in the *Flora of North America* (2003). The publication formally recognized several changes at the subspecies level for *Lilium pardalinum* for taxa that overlapped somewhat morphometrically, but were geographically segregated.

Carex albida has had no changes in scientific name or taxonomic classification since it was listed in 1997.

Genetics

No new genetic information is available for either *Lilium pardalinum* ssp. *pitkinense* or *Carex albida*.

Lilium pardalinum ssp. *pitkinense*

Since before the 1997 listing, both *Lilium pardalinum* ssp. *pardalinum* (leopard lily) and *L. pardalinum* ssp. *pitkinense* had been reported to occur on the northern marsh (Best et al. 1996). The lilies in the lower marsh were found to have characteristics of *L. pardalinum pardalinum* - tall, large-flowered, and with long dark anthers whereas the lilies in the upper marsh were more distinctive and merited the designation as *L. pardalinum* ssp. *pitkinense* (M. Skinner, U.S. Department of Agriculture Natural Resources Conservation Service, in litt. 2008). The plants in the southern marsh were found to be variable, but intermediate between the two, tending more toward *L. p. pitkinense* (Skinner, in litt. 2008). *Lilium pardalinum* is variable throughout its range, as are many plant species. However, the expression around Sebastopol in those two marshes is distinctive. Essentially it is a small-flowered variant with brighter anthers than most *L. pardalinum* (Skinner, in litt. 2008).

Lilium pardalinum pitkinense occurs within the range of and is not geographically isolated from *L. pardalinum* ssp. *pardalinum*, and no known barriers exist to introgression between the two taxa. The region has been heavily modified since at least the mid-1800s and human activities including collection and transplanting of native lily bulbs may have blurred the distinctions between the two taxa (Skinner in litt. 2008).

Natural hybrids of *Lilium pardalinum* and *L. maritimum* have been observed (J. Schwan, consulting botanist, in litt. 2008; Skinner, in litt. 2008). A lily found growing in a local park located between the two marshes but closer to the northern marsh exhibited characters intermediate between the two subspecies (Skinner, in litt. 2008). The lily was thought to have been intentionally planted by the prior owner sometime before it came into public ownership (L. Houser, CNPS, in litt. 2008). Because it is regarded as a hybrid, no further conservation actions are contemplated at this time at this site.

Species-specific Research and/or Grant-supported Activities

Carex albida

In 2007, the Service provided Recovery Program funds to the University of California Botanical Garden located in Berkeley, California (U.C. Botanical Garden), to collect and propagate seeds of *Carex albida*. Approximately 600 seeds were collected from the three largest colonies on the lower northern marsh property. Seeds were collected from 40 flowering stems of the 111 stems counted in the largest colony, from 10 stems out of 40 stems in the southeast colony, and from one stem out of 11 stems counted in the colony closest to the road. The number of stems does not represent a total count as not every spot was searched. Seeds from each individual stem were collected in separate envelopes and labeled as to the colony of origin. There was an observed difference in phenology (stage of seed maturation) from one colony to the other (H. Forbes, U.C.

Botanical Garden, pers. comm. 2007; Symonds, pers. obs. 2007) even though the colonies are separated by only a few hundred meters. Differences in rate of maturation may be a result of microsite differences in hydrology, soils, and aspect, or could reflect subtle genetic differences.

During the winter of 2007-2008, a portion of the 600 seeds was sown in ten pots at the U.C. Botanical Garden greenhouses. The Sonoma Land Trust is developing a management plan for the lower northern marsh. It is anticipated these plants in propagation will be used on the site of origin, with individuals out planted in proximity to the mother plants from which each was collected.

The final listing noted the Berry Botanic Garden in Portland, Oregon entered into a Memorandum of Understanding (MOU) with DFG for research on germination and recovery of this species (DFG 1993). When contacted for this review, the Berry Botanic Garden program managers and staff were not aware of this MOU and they indicated they do not have a collection or a conservation program for *Carex albida* (E. Guerrant, Berry Botanic Garden, in litt. 2008 and A. Raven, Berry Botanic Garden, in litt. 2008). Follow up with DFG indicated the MOU is still in effect (M. Showers, DFG, in litt. 2008). The DFG collected *C. albida* seeds in 2006 and sent to Rancho Santa Ana Botanic Garden for seed storage under a MOU with DFG for such activities. No plans for propagating those seeds are planned at this time (Cooley, pers. comm. 2007).

The permanent protection of the lower northern marsh in fee title by the Sonoma Land Trust provides the first opportunity to conduct ongoing surveys and studies of the marsh. In preparation for developing a land management plan, the Sonoma Land Trust commenced detailed botanical surveys and mapping performed by consulting botanist Peter Warner (Warner 2008). The Sonoma Land Trust is working with resource agencies and organizations to identify restoration, enhancement, and management actions and appropriate educational uses for the property. A management plan is expected in 2009. The Sonoma Land Trust's surveys and management plan is funded in part from \$29,500 in fines levied by the Regional Water Quality Control Board (RWQCB) on the Graton Community Services District for discharging untreated wastewater to the creek downstream as a result of flooding from large storm events (RWQCB, in litt. 2007).

The Service's Partners for Fish and Wildlife Program is working with the Sonoma Land Trust to provide technical and cost share assistance in the development and implementation of the Sonoma Land Trust's management plan and for conducting priority interim actions such as removal of nonnative blackberry and other priority invasive plant species (Service 2007).

During February 2009, staff from the Sonoma Land Trust, the Service, DFG, and CNPS volunteers conducted a trial to determine the feasibility of manually removing above ground biomass of nonnative grasses that had encroached into two of the small *Carex albida* colonies in the southeast portion of the lower marsh property (Symonds, pers. obs. 2009). Nonnative grasses were carefully cut and removed from half of each of the two test patches. Small vegetative *C. albida* "plants" (individuals are difficult to determine) were found hidden in the bases of the grass clumps which would have otherwise obscured their detection if surveys has been conducted that time of year. During June 2009, the two colonies were reexamined and the

number of *C. albida* reproductive culms was counted in each treatment and control area to form a baseline number. Annual follow up surveys will help inform the effects of the grass removal efforts although because sample size is small in each colony, only large effects are likely to be detected. Manual grass removal is labor intensive and is not likely feasible on an ongoing larger scale. However, if it results in a positive response in *C. albida* abundance, it merits consideration as the extent of this species is extremely limited (Symonds, pers. obs. 2009).

Lilium pardalinum ssp. *pitkinense*

The Berry Botanic Garden in Portland, Oregon has stored 128 seeds of *Lilium pardalinum* ssp. *pitkinense* that were collected in 1990, apparently from 25 different individuals from the southern marsh. They have not attempted to germinate any seeds and are willing to accept additional seed to augment their collection (Guerrant, in litt. 2008).

It is not clear how long *Lilium pardalinum* ssp. *pitkinense* seeds will remain viable in storage, and they may lose viability after three to five years (P Baye, Coastal Ecologist, Annapolis Field Station, in litt. 2008). For long term preservation of genetic diversity, and given *Lilium pardalinum* is a clonal perennial that regenerates from bulb scales, consideration should be given to establishing a clone bank as a supplement or alternative to seed storage. A clone bank would be a low-maintenance partial shade garden derived from either seed or bulb scales of the original occurrence (Baye, in litt. 2008).

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 the 1997 listing, threats to *Carex albida* included direct loss of habitat from development, potential alteration of hydrology from changes in land uses, disturbance from a proposed water treatment project, and potential disturbance from repair or alteration of a nearby State Highway (Service 1997).

Carex albida

The marsh had become drier by the time of listing because the addition of wells and other construction had altered the marsh hydrology (Guggolz, in litt. 1993). Drying of the wetland would not only directly impact the species but would encourage the spread of blackberries (*Rubus* sp.), which have become dominant in other parts of the marsh that have been drained (DFG 1993; Guggolz, in litt. 1993; CNDDDB 1996).

The threat of direct loss of historical habitat, particularly in the upper northern marsh continues with the incremental addition of new rural residences, driveways, and new agricultural operations (e.g., vineyards). Indirect effects of the additional impervious or bare surfaces from

residential and agricultural land uses, respectively, accelerate runoff, increases nutrient loading, erosion and sedimentation in the marsh, and result in changes in soil pH and nutrients, in an otherwise acidic nutrient poor soil type. Furthermore, the effects to marsh hydrology and vegetation from the extraction of groundwater to support these expanded land uses remains a concern (Cooley, pers. comm. 2007, Symonds, pers. obs. 2008).

Impacts cited in the 1997 listing from the water treatment facility located approximately 300 meters (328 yards) downstream of the northern marsh included the potential application of recycled treated water on potentially suitable, but unoccupied habitat downstream, but within the historical range, of *Carex albida* through modification of surface hydrology (Environmental Science Associates 1993). The historical range of *Lilium pardalinum* ssp. *pitkinense* also occurs within the treatment facility project boundaries. The use of recycled wastewater has not been implemented (Guggolz, pers. comm. 1996), and apparently remains unchanged. However, during several large storm events over recent years, the treatment facility ponds, located 0.8 kilometer (0.5 mile) downstream flooded resulting in unpermitted discharges to the creeks downstream. Fines levied by the Regional Water Quality Control Board (RWQCB) included payment of \$29,500 to the Sonoma Land Trust toward development of a management plan for the protected marsh property upstream of the facility (RWQCB, in litt. 2007). The Graton Community Services District which operates the facility is seeking to develop a groundwater management plan (R.W. Rawson, Graton Community Services District, in litt. 2006), which at a minimum would increase the understanding of patterns of groundwater extraction and recharge in the watershed and likely the hydrological dynamics in the marsh.

The threat of disturbance from repair or alteration of the nearby State highway remains unchanged. The State highway is located downstream and within 46 meters (150 feet) of the nearest colony of *Carex albida*. County road maintenance crews periodically trim back the willows and other riparian species from the road edges, which leave openings that facilitate invasion of weedy species (discussed further in Factor E). If the highway were ever widened, it would involve encroachment into the wetland area which would impact the hydrology, possibly resulting in the direct loss of occupied habitat, and also facilitate the invasion of nonnative vegetation through ground disturbance. The California Department of Transportation (Caltrans) is currently widening a section of this state highway several miles to the south of Sebastopol, so the potential could exist in the future to extend the widening to the section that borders the lower northern marsh. The Sonoma County General Plan for 2020 (Sonoma County PRMD 2008) identifies traffic reduction measures and a bypass around the town of Forestville which is located approximately one mile from the northern marsh. It is not clear if the northern marsh would be in the affected project area.

Lilium pardalinum ssp. *pitkinense*

At the time of listing, threats to the habitat of this taxon included loss and disturbance of habitat from proposed residential development and changes in hydrology. The status of the two occurrences of *Lilium pardalinum* ssp. *pitkinense* in the upper portion of the northern marsh has not been confirmed since the 1980s at one occurrence (CNDDDB 2009) and since 2001 at the other occurrence (DFG 2001), but are both presumed extant in this review. The threats in that area are virtually identical to those identified for *Carex albida* as that species occurs in the lower

portion of the northern marsh, separated by approximately 1.6 kilometers (1.0 mile), except that neither of the lily occurrences in the upper northern marsh have any conservation protection status, and therefore are highly vulnerable to habitat loss from development.

By the time of listing, the northern marsh had become drier at that time because the addition of wells and other construction had altered the marsh hydrology (B. Guggolz, in litt. 1993). Drying of the wetland would not only directly impact the species but would encourage the spread of blackberries (*Rubus* sp.), which have become dominant in other parts of the marsh that have been drained (DFG 1993; B. Guggolz, in litt. 1993; CNDDDB 1996).

Conservation Measures

Carex albida

In 2007, the Sonoma Land Trust purchased for permanent conservation the 27-acre lower portion of the northern marsh that supports the only known extant occurrence of *Carex albida*. Funding for the acquisition was provided by the Sonoma County Agricultural and Open Space District and the State Wildlife Conservation Board. This major step provided the first reliable access to the lower northern marsh for assessing the ongoing status of the species.

The Sonoma Land Trust is also working with DFG, the Service, CNPS, and other project partners to acquire from willing sellers additional properties in the northern marsh for permanent habitat conservation purposes (W. Eliot, Sonoma Land Trust, in litt. 2008, 2009). One of the priorities would be to pursue acquisition of the historical occurrence in the upper northern marsh for *Carex albida* (Symonds, pers. comm. 2009). The Land Trust has also initiated a hydrological study on the lower marsh and is establishing a hydrological monitoring program to address questions about nutrients levels, runoff, and to characterize surface and subsurface flows to better understand the hydrological dynamics of that property (Nelson 2009).

Lilium pardalinum ssp. *pitkinense*

Lilium pardalinum ssp. *pitkinense* is historically known from the upper northern marsh upstream of the Sonoma Land Trust property described above, and not from the lower protected property itself. The permanent protection of the lower property removes the threat of development thereby continuing to buffer development impacts and abating additional alterations in hydrology if the property had been developed as proposed. The protection of this lower marsh also offers the potential opportunity to consider introducing *Lilium pardalinum* ssp. *pitkinense* from any propagules that may still exist in the upper marsh, provided access is obtained and concerns for introgression with *L. pardalinum* ssp. *pardalinum* on the lower marsh are adequately addressed. A rationale for not translocating plant materials between the two remaining, unique, disjunct marshes is provided in Baye (2005) and discussed in the section in this document on management recommendations.

Since the time of the 1997 listing, the DFG recorded a 19-acre permanent conservation easement a portion of the southern marsh. This easement area includes all the known lilies at the southern marsh, but only a portion of the entire historical marsh, which likely contained other rare plant

species outside the current easement boundaries (Baye 2005). The upper slopes of the watershed are developed with rural residences and vineyards. This easement area has been stewarded by CNPS volunteers for over ten years and grant funding has been obtained in the past three years from the City of Santa Rosa, CNPS, and the Service's Partners for Fish and Wildlife program to address priority vegetation management issues. Despite this protection, the lilies are threatened by ongoing encroachment of invasive nonnative blackberries and nonnative perennial grasses, alteration in surface and subsurface hydrology from private wells, and from random events.

Although the southern marsh is protected by a perpetual conservation easement, the land itself is privately owned and the ability to maintain the habitat is dependant on continued access and funding for monitoring and stewardship activities. The southern marsh is owned by several adjacent landowners and access is granted on a discretionary basis and depends on the goodwill of the surrounding landowners. Currently, there is strong cooperation by the landowners, DFG, CNPS, the Laguna de Santa Rosa Foundation and others for stewardship responsibilities at the marsh. However, because of the need for ongoing active management of invasive vegetation, the lack of a reliable funding source for management could be a potential threat for this occurrence.

The Milo Baker Chapter of CNPS has been responsible for stewardship of the southern marsh and has been leading volunteer work parties to maintain enclosures, remove invasive vegetation, conduct lily counts periodically, and increase diversity of native vegetation on the 19-acre DFG easement area. The Milo Baker Chapter developed a detailed management plan for the southern marsh (Baye 2005) to guide its activities. The CNPS received a grant from the City of Santa Rosa to implement some of the management recommendations in the plan such as planting oak trees and other native trees and shrubs to expand the riparian forest, and removing nonnative blackberry and other invasive vegetation.

After ten or more years as the primary stewardship organization for the southern marsh, in 2008 CNPS turned over its stewardship responsibilities to the Laguna de Santa Rosa Foundation as a way to attract greater resources with its staffing, larger volunteer base, and grant writing capabilities. The Service's Partners for Fish and Wildlife Program is working with the Laguna Foundation and CNPS, and the landowners to support ongoing stewardship activities on the protected area in the southern marsh by providing technical and cost share assistance to further the work and goals in the 2005 management plan for this site (Symonds, pers. comm. 2008).

As described previously, the Sonoma Land Trust is working with DFG, the Service, CNPS, and other project partners to acquire from willing sellers additional properties in the northern marsh for permanent habitat conservation purposes. One of the priorities would be to pursue the historical occurrences in the upper northern marsh for *Lilium pardalinum ssp. pitkinense*. Discussions with the project partners have also occurred to consider an acquisition planning process to expand protected area in for the southern marsh (Eliot in litt 2008 and 2009).

Summary of Factor A

Although the only known extant occurrence where *Carex albida* exists is now permanently protected for conservation, this 27-acre property is surrounded by vineyards, rural residential and other land uses with ever increasing number of private wells. Despite the permanent protection,

C. albida continues to be vulnerable to threats from surrounding land use practices which are or have the potential to adversely alter surface and subsurface hydrology, and from competition from invasive species, and potential disturbance from repair or alteration of a nearby State highway.

In summary, historically both species have experienced severe losses and degradation of habitat and are known from three or fewer occurrences. Each species has one occurrence permanently protected from future residential development or conversion of habitat to intensive agricultural uses by permanent conservation easements. *Lilium pardalinum* ssp. *pitkinense* is still unprotected at its upper marsh occurrences and the permanently protected areas comprise only a portion of each watershed. Each protected area is small (19 and 27 acres) and surface and subsurface alterations in hydrology continue to be a concern with the incremental addition of new houses with septic leach fields, runoff from grazing operations, conversion of pasture to irrigation-dependant agricultural operations, and increased sediment and nutrients from runoff from the upper watersheds of each marsh. Livestock grazing has been removed from both of the protected marsh sites and the dense cover of invasive grasses is thought to result, in part, from release of grazing. Each protected marsh site will need active management, perhaps in perpetuity to maintain suitable habitat.

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

Carex albida

Overutilization for commercial, recreational, scientific, or educational purposes was not known to be a factor in the 1997 final rule for *Carex albida* (Service 1997), and does not appear to be a threat at this time.

Lilium pardalinum ssp. *pitkinense*

Overutilization for commercial purposes was cited as a factor in the 1997 final rule for *Lilium pardalinum* ssp. *pitkinense* (Service 1997), particularly at the northern marsh. This occurrence had been nearly extirpated from uncontrolled collection of plants, seeds, and bulbs for horticultural uses and was down to two plants in the early 1980s. The occurrence had expanded slightly to approximately ten plants by the time of listing. This occurrence has not been surveyed since the species was listed and therefore the extent of this threat or whether the occurrence is still extant is unknown. At the other remaining occurrence, which is protected by a conservation easement, overutilization has not been documented although the potential exists for this threat to occur.

Because of past practices of collecting lilies for propagation for horticultural uses, Pitkin lilies and hybrids with other *Lilium pardalinum* species have reportedly been in the commercial and hobbyists nursery trade as evidenced from the many websites that offer this plant material for sale, ostensibly from descendants from wild stock collected years ago (Symonds, pers. obs. 2008). Material from these individuals is unsuitable for conservation purposes because of likely introgression with other lily species. The U.C. Botanical Garden has Pitkin marsh lily growing

in their public collection. It was collected from seed from plants at the Regional Parks Botanic Garden in 1981. Those plants were collected from the northern marsh by James Roof (Forbes, in litt 2008), probably in the 1960s or 1970s when he served as the Director of the then Tilden Botanic Garden. Unless all wild occurrences are extirpated, such material would be unsuitable for conserving the wild strains because of the potential for genetic impurity through introgression with other lily species and because it no longer represents a wild line.

FACTOR C: Disease or Predation

The Service is not aware of any new information regarding disease since the listing of *Carex albida* and *Lilium pardalinum* ssp. *pitkinense* in 1997. The 1997 listing rule states that these species were not known to be threatened by disease (Service 1997).

Trampling and herbivory by livestock and wildlife was recognized as a threat to *Lilium pardalinum* ssp. *pitkinense* in the original listing rule (Service 1997) (Lozier, in litt. 1990; DFG 1993; Guggolz, pers. comm. 1993, 1996). The colonies of *Lilium pardalinum* ssp. *pitkinense* at the southern marsh were enclosed with two meter high wire mesh fences to keep out herbivores. Although livestock grazing no longer occurs at this occurrence, these fences continue in place today and serve to exclude deer and other large herbivores. During April 2009, approximately eight individual *Lilium pardalinum* ssp. *pitkinense* seedlings were planted outside the exclosures in the southern marsh. To determine if there was a way the lilies could ever persist without exclosures, lilies were intentionally planted amongst other dense native shrubs to deter deer browsing. Follow up monitoring will be conducted over time to evaluate whether this approach is effective in deterring deer or other herbivores.

Grazing and trampling however are no longer considered a threat to either species because neither protected occurrence is grazed currently, and invasive grasses that once served as forage now appear more prevalent (Cooley, pers. comm. 2007). The lower portion of the northern marsh had been grazed since at least the early 1900s with cattle and then later with sheep until their removal when the property was sold in 2004 (Nelson 2009). The southern marsh has not been grazed by livestock in a number of years. Although concern existed that excessive grazing and trampling by cattle could destroy many individuals of the two species, in the absence of grazing, the density and proliferation of nonnative vegetation, grasses in particular, seems to have increased dramatically (Cooley, pers. comm. 2007). Manual control of nonnative vegetation is time consuming and prohibitively expensive to sustain over the long-term (Symonds, pers. obs. 2008), which makes managed livestock grazing a more attractive tool for reducing non-native, aggressive, invasive grasses and forbs (Marty 2005). However, livestock grazing has associated costs with maintaining infrastructure such as fences and watering developments so that grazing in a small preserve, such as either protected area may make livestock grazing cost inefficient unless arrangements can be made with adjacent landowners to allow their livestock to graze at times when grazing is most beneficial to the habitat and the species. To that end, the Sonoma Land Trust is currently developing a grazing management plan for the lower northern marsh.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to provide inadequate protection for *Carex albida* and *Lilium pardalinum* ssp. *pitkinense* included: (1) listing under the California Endangered Species Act (CESA); (2) the California Environmental Quality Act (CEQA); (3) the California Native Plant Protection Act; (4) the Clean Water Act; and (5) the Sonoma County General Plan policies related to riparian corridors. The listing rule (Service 1997) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain currently valid for those laws with the exception of the Clean Water Act, as described below. Despite the many regulatory mechanisms in place to protect habitat, none adequately serve to control the spread of invasive vegetation, or prevent indirect impacts from existing and proposed surrounding land uses.

Besides those identified in the original listing, several State and Federal laws and regulations exist that are pertinent to federally listed species, each of which may contribute in varying degrees to the conservation of federally listed and non-listed species. These laws, most of which have been enacted in the past 30 to 40 years, have not entirely reduced or eliminated the threat of wholesale habitat destruction.

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.

A State law that has the potential to protect marsh and stream habitats that was not mentioned in the 1997 listing is the California Lake and Streambed Alteration Program. The Lake and Streambed Alteration Program (California Fish and Game Code sections 1600-1616) may promote the recovery of listed species in some cases. This program provides a permitting process to reduce impacts to fish and wildlife from projects affecting important water resources

of the State, including lakes, streams, and rivers. This program also recognizes the importance of riparian habitats to sustaining California's fish and wildlife resources, including listed species, and helps prevent the loss and degradation of riparian habitats. However, it does not provide adequate protection from indirect impacts from upslope activities, including alteration of subsurface hydrology and non-point runoff from existing land uses.

In summary, the California and Federal Endangered Species Acts are the primary State and Federal laws, respectively, that provide 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.

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

At the time of listing we stated that both *Carex albida* and *Lilium pardalinum* ssp. *pitkinense* were threatened by competition from invasive plants and extinction or extirpation from a significant portion of their ranges due to random events. The listing rule also noted that *Lilium pardalinum* ssp. *pitkinense* is unlikely to be self-pollinating and that single plants or widely separated plants in sparse populations may not set viable seed. Currently, competition from invasive plants and extinction or extirpation from random events still threatens both species. Both species are potentially threatened by global climate change. Additionally, *Lilium pardalinum* ssp. *pitkinense* is threatened by hybridization.

Invasive Plant Species

At the time of the 1997 listing, invasive vegetation was cited as a threat to both species (Lozier, in litt. 1990; DFG 1993; Guggolz, pers. comm. 1993, 1996). Invasive, nonnative blackberries and grasses as well as native willow have encroached into the habitat of these species and appear to be increasing in density in recent years (Cooley, pers. comm. 2008). Drier marsh conditions in the summer resulting potentially from ground water extraction would tend to facilitate an expansion of nonnative species that otherwise cannot permanently tolerate saturated soils, such as tall fescue and velvet grass, Armenian (or Himalayan) blackberry, and native willow (Cooley, pers. comm. 2007). This increase also appears to be coincident with the removal of livestock grazing on each of the protected marsh sites (Cooley, pers. comm. 2007).

All of the colonies have a heavy infestation of nonnative perennial grasses and observations indicate the cover of nonnative grasses has increased (Cooley, pers. comm. 2007; Symonds, pers. obs. 2009).

The 27-acre property in the lower portion of the northern marsh that supports the only known extant occurrence of *Carex albida* was purchased for permanent conservation in 2007 by the Sonoma County Agricultural Preservation and Open Space District and the Sonoma Land Trust. Although the lower marsh is now permanently protected for conservation, a new threat exists from trampling from increased human foot traffic for scientific, educational, and possibly recreational purposes. *Carex albida* blends with surrounding vegetation and can be difficult to

locate by the untrained eye and stems bend and break easily (Symonds, pers. obs. 2008). Trampling would damage or destroy individuals and compact the soil, particularly when wet, which may impede growth and regeneration. While access is critical to monitor the status of the species and marsh conditions, excessive and inappropriate foot traffic may lead to extirpation of *Carex albida*. As the landowner, the Sonoma Land Trust manages access to the lower marsh and is developing a management plan which will address ways to reduce impacts from such activities (A. Nelson, Sonoma Land Trust, in litt. 2008).

Extinction or Extirpation from Random Events

Unchanged from the time of the 1997 listing is the threat from extinction or extirpation from random events. The habitat for both species is extremely limited and isolated throughout their ranges due to the natural rarity of their habitat. However, losses from rural residential and agricultural uses have further contributed to their fragmentation and isolation from each other. Such occurrences may be highly susceptible to extirpation due to inbreeding depression (Gilpin and Soule 1988; Goodman 1987), the potential for catastrophic wildfire with drier marsh conditions, and the potential for further displacement from introduction of previously unknown invasive vegetation.

Hybridization of *Lilium pardalinum* ssp. *pitkinense*

Hybridization is a potential threat to *Lilium pardalinum* ssp. *pitkinense*. An apparently natural hybrid of *Lilium pardalinum* and *L. maritimum* has been observed (Schwan, in litt. 2008; Skinner, in litt. 2008). A lily found growing in a local park located between the two marshes but closer to the northern marsh exhibited characters intermediate between the two subspecies (Skinner, in litt. 2008). The lily was thought to have been intentionally planted by the prior owner sometime before it came into public ownership (Houser, in litt. 2008).

This taxon is morphologically variable and exhibits overlapping characteristics with other *Lilium pardalinum* subspecies. Its taxonomy is primarily based on geographical location with some morphological characters that are overlapping with other *Lilium pardalinum* subspecies. The showy flowers of *L. pardalinum* ssp. *pitkinense* have horticultural interest resulting in seeds, bulbs, and plants in the horticultural trade, which introduces a high potential for creating cultivars of this taxon, to select for plants with the showiest inflorescences. A retail nursery near Santa Rosa sells a lily they refer to as *Lilium pardalinum* ssp. *pitkinense*, and it is not known whether or not it has been intentionally hybridized with other *Lilium pardalinum* subspecies. The potential exists for these horticultural varieties to be planted within range of *Lilium pardalinum* ssp. *pitkinense*.

The listing rule cited the threat that *Lilium pardalinum* ssp. *pitkinense* is unlikely to be self-pollinating, single plants or widely separated plants in sparse populations may not set viable seed (Skinner, pers. comm. 1994). At that time, the lily had not been observed to have set seed for several years (Skinner, pers. comm. 1994). However in 2004, abundant production of seed capsules with high seed set (apparently filled capsules) was observed by Peter Baye at the southern marsh (Baye 2005) during preparation of the management plan for the easement area. Many seedlings were also observed in July of 2007 and 2008 in the largest lily enclosure

(Symonds, in litt. 2008). Enclosures are established by CNPS volunteers when new seedlings are discovered outside of existing enclosures (Young, pers. comm. 2008), which indicates the occurrence is slowly expanding in area, although apparently not in total overall number in recent years.

Global Climate Change

An additional threat to these species noted since their listing is global climate change. Impacts to these species under predicted future climate change are unclear. A trend of warming in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, and reduce summer stream flows (IPCC 2007). Increased summer heat may increase the frequency and intensity of wildfires (IPCC 2007). While it appears reasonable to assume that these species may be affected, we lack sufficient certainty on knowing how and when climate change will affect them, the extent of average temperature increases in California, or potential changes to the level of threat posed by drought or fire. The most recent literature on climate change includes predictions of hydrological changes, higher temperatures, and expansion of drought areas, resulting in a northward and/or upward elevation shift in range for many species (IPCC 2007) and greater potential of threats from catastrophic wildfires.

Rapid climate change may place native species with long generation times at a disadvantage because they cannot quickly move into newly suitable habitat. However, invasive plants that are capable of rapid dispersal and are tolerant of a wide range of climates will be at an advantage as they will be able to shift ranges quickly (Dukes and Mooney 1999). In addition, invasive species, such as *Bromus tectorum* (cheatgrass), *Pueraria lobata* (kudzu), and *Lonicera japonica* (Japanese honeysuckle) have been shown to respond positively to increased carbon dioxide concentration when grown under controlled conditions (Dukes and Mooney 1999). It is difficult to predict which species now co-occurring with *Carex albida* and *Lilium pardalinum* ssp. *pitkinense* may become invasive and which invasive species may become more severe. Currently several invasive nonnative plants are established in the northern and southern marshes and are already invading the habitat of *C. albida* and *L. pardalinum* ssp. *pitkinense*. These nonnative plants may respond positively to further drying of the marsh and increased atmospheric carbon dioxide concentration. We have no knowledge of more detailed climate change information specifically for these species' ranges.

A modeling study completed by Loarie *et al.* (2008) provides an evaluation of potential trends to California's floristic communities under climate change scenarios. In general, plant diversity will shift in two, divergent directions: toward the coast and northwards and south to higher elevations of the Sierra Nevada. The models suggest that climate change has the potential to break up local floras, resulting in new species combinations, with new patterns of competition and biotic interactions (Loarie *et al.* 2008).

Summary of Factor E

Currently, competition from invasive plants and extinction or extirpation from random events still threatens both species. Both species are potentially threatened by global climate change. Additionally, *Lilium pardalinum* ssp. *pitkinense* is threatened by hybridization.

III. RECOVERY CRITERIA

No Recovery Plans or outlines have been drafted for either species.

IV SYNTHESIS

At the time of listing *Carex albida* was known from a single extant occurrence with approximately 1,000 individuals. Currently, *Carex albida* continues to be known from only one occurrence in Sonoma County with approximately 300 reproductive stems. The acquisition of this property in 2007 for permanent conservation has removed the threat of development and intensive agricultural uses and has provided opportunities to actively monitor and manage the occurrence for the first time for conservation purposes. However, the property continues to support dense stands of nonnative invasive blackberry and perennial grasses that encroach into habitat for this species. Surrounding residential and agricultural land uses in the upper slopes of the watershed continue to potentially impact the hydrology of the marsh. So despite some incremental discoveries of two new patches of *Carex albida* on this property coincident with increasing survey effort and frequency, the total number of plants on this property has apparently dropped dramatically since the time of listing. The occurrence in the upper portion of this marsh has experience drying due to addition of wells and other construction and no access for surveys has been granted since 1976. Therefore, consistent with our final listing designation, we consider the occurrence to be likely extirpated based on low numbers and threats from drying and encroachment of invasive vegetation.

The removal of grazing and the apparent coincident proliferation of nonnative grasses at both protected marsh sites suggest that grazing was not as much of a threat to the species as originally thought at the time of listing, although it is yet to be determined what level of grazing is appropriate. A number of threats remain, including competition with invasive plants, erosion, and alteration of hydrology by surrounding residential and agricultural land uses. Small occurrence size and presumed low genetic diversity may continue to threaten *Carex albida* due to the vulnerability of small occurrences to a range of environmental, demographic, and genetic stochastic factors. Countering some of these threats is the Sonoma Land Trust's preparation and implementation of a management plan for the property that is expected to address these threats and actively manage for the species and its habitat. Despite these efforts, the status of the species remains endangered due to the single known occurrence, relatively low numbers of individuals, competition with invasive plants, and alteration of hydrology in the marsh from surrounding land uses. Therefore, we believe *Carex albida* still meets the definition of endangered, and recommend no status change at this time.

Lilium pardalinum ssp. *pitkinense* continues to be extant at the southern marsh, although its status is only presumed to be extant at the two occurrences in the northern marsh. The two northern marsh occurrences have not been confirmed since the late 1980s (CNDDDB 2009) and as recent as 2001 (DFG 2001), respectively. The original listing indicated there were approximately 10 individuals in the upper part of the northern marsh, although some surveys around that time located only one or two individuals (Skinner in litt. 2008) and up to 19 individuals depending on the occurrence (CNDDDB 2009).

Shortly after the listing, the southern marsh became permanently protected from development by a 19-acre permanent conservation easement held by DFG, although the land still remains in private ownership. The DFG conservation easement has removed the threat of development and has encouraged investment of time and funding to actively manage the site for conservation. The number of naturally occurring lily individuals is apparently declining since the original listing, with annual variation, despite maintenance of the enclosures and weeding by volunteers. Livestock grazing has ceased, however, a number of threats remain, including encroachment by invasive plants (which may be a result of release from grazing), increases in nutrients from livestock and other agricultural uses on surrounding properties in the watershed, and alteration of hydrology by surrounding residential and agricultural land uses. Small occurrence sizes and presumed low genetic diversity may continue to threaten *Lilium pardalinum* ssp. *pitkinense* due to the vulnerability of small occurrences to a range of environmental, demographic, and genetic stochastic factors.

Countering some of these threats is the implementation of several recommendations in CNPS's management plan prepared for the easement area of the southern marsh (Baye 2005). One-time grant funding from various sources has become available the past three years to increase efforts and volunteers have been actively working to improve the lily occurrence there including the recent establishment of three new colony exclosures and outplanting 50 lilies propagated from seed collected on site. Despite some of these successes, the status of the species remains endangered due to it having few occurrences, relatively low numbers of individuals, encroachment by invasive plants, and alteration of hydrology and nutrient levels in the marsh from surrounding land uses. Therefore, we believe *Lilium pardalinum* ssp. *pitkinense* 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:

We recommend no change in the recovery priority number for *Carex albida*. We recommend that the recovery priority number for *Lilium pardalinum* ssp. *pitkinense* be changed to 6C because the taxonomic unit is "subspecies" and has a high degree of threat and a low potential for recovery. The "C" indicates that some degree of conflict exists with urban development. Previously, the recovery priority number was 5C which is for the taxon of "species"

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Increase the size of existing protected habitat for each species through conservation easements or, preferably, fee-title acquisition. Manage these properties to protect and enhance the habitat for and the occurrences of *Carex albida* and *Lilium pardalinum* ssp. *pitkinense* and other historically co-occurring rare and unique plant taxa.
2. Evaluate the genetic status of *Lilium pardalinum* ssp. *pitkinense* to determine the validity or reaffirm the uniqueness of this taxon.
3. Prepare and publish a draft recovery plan and ultimately finalize the recovery plan for *Carex albida* and *Lilium pardalinum* ssp. *pitkinense*.
4. Work with willing landowners in or near historical occurrences to develop access agreements to conduct surveys, monitoring, and habitat enhancements, and provide them assistance to minimize their indirect land use impacts on occupied habitat.
5. Monitor and continue adaptive management of existing protected areas to control invasive vegetation, address excess sediment and nutrients in the marshes, and encourage growth of listed species and co-occurring rare plant taxa within their historical occurrences.
6. Continue to maintain a viable, protected seed collection for *Carex albida* and *Lilium pardalinum* ssp. *pitkinense*. Ensure sufficient seeds exist, preferably in more than one repository, to maintain genetic heterogeneity. For long term preservation of genetic diversity, and given *Lilium pardalinum* is a clonal perennial that regenerates from bulb scales, consideration should be given to having a clone bank as a supplement or alternative to seed storage. A clone bank would be a low-maintenance partial shade garden derived from either seed or bulb scales of the original occurrence.

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

***Carex albida* (White sedge)**

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Kate Symonds, SFWO, Santa Rosa sub-office

FIELD OFFICE APPROVAL:

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

Approve Susan K Moore Date 8/17/09

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

***Lilium pardalinum ssp. pitkinense* (Pitkin marsh lily)**

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Kate Symonds, SFWO, Santa Rosa sub-office

FIELD OFFICE APPROVAL:

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

Approve Susan K Moore Date 8/17/09