

*(Poa atropurpurea)*  
**San Bernardino Bluegrass**

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

**U.S. Fish and Wildlife Service**

**Carlsbad Fish and Wildlife Service Office  
Carlsbad, California**

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**5-YEAR REVIEW**  
***Poa atropurpurea* (San Bernardino bluegrass)**

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## 5-YEAR REVIEW

*Poa atropurpurea* (San Bernardino bluegrass)

### 1. GENERAL INFORMATION

#### 1.1. Reviewers

**Lead Region:** Diane Elam, Deputy Division Chief for Listing, Recovery and Habitat Conservation Planning, Region 8 (916) 414-6464.

**Lead Field Office:** Jim A. Bartel, Carlsbad Fish and Wildlife Office, 760-431-9440

**1.2. Methodology used to complete the review:** This review was compiled by staff of the Carlsbad Fish and Wildlife Office (CFWO). The review was completed using documents from office files as well as available literature on *Poa atropurpurea* (San Bernardino bluegrass).

#### 1.3. Background:

##### 1.3.1. FR Notice citation announcing initiation of this review:

**1.4.** A notice announcing initiation of the Five-year review for this species and the opening of a 60-day comment period was published in the Federal Register on February 14, 2007 (72 FR 7064). No new information or comments were received in response to the Federal Register notice announcing the initiation of this review (72 FR 7064).

##### 1.4.1. Listing history

###### Original Listing

FR notice: 63 FR 49006

Date listed: September 14, 1998

Entity listed: *Poa atropurpurea* (San Bernardino bluegrass), a plant species.

Classification: Endangered

##### 1.4.2. Associated rulemakings

Critical Habitat Designation; August 14, 2008 (73 FR 47705-47767).

##### 1.4.3. Review History

We have not conducted any prior five-year review or other status reviews for this species.

##### 1.4.4. Species' Recovery Priority Number at start of Five-year review

The recovery priority number for this plant is "2" according to the 2006 Recovery Data Call for the Carlsbad Fish and Wildlife Office. This indicates that this plant

is a species facing a high degree of threats but also has high potential for recovery.

#### **1.4.5. Recovery Plan or Outline**

No recovery plan or outline has been completed for this species.

## **2. REVIEW ANALYSIS**

### **2.1.1. Application of the 1996 Distinct Population Segment (DPS) policy**

The Endangered Species Act (the Act, 32 USC 1531 *et seq.*) defines “species” as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing as DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

### **2.2. Recovery Criteria**

No recovery plan has been finalized or approved; therefore recovery criteria are not applicable.

### **2.3. Updated Information and Current Species Status**

#### **2.3.1. Biology and Habitat**

The *Poa atropurpurea* (San Bernardino bluegrass) is a tufted perennial grass in the Poaceae (grass) family that has separate male and female plants (i.e. dioecious), and creeping rhizomes (Hickman 1993; Soreng 1993). It was first described by Lamson-Scribner (1898) from two specimens collected in Bear Valley (now Big Bear Valley), San Bernardino Mountains, San Bernardino County, California.

This species is restricted to montane meadow habitat in San Bernardino and San Diego counties. *Poa atropurpurea* is found in the San Bernardino Mountains in San Bernardino County and in the Laguna and Palomar Mountains in San Diego County. It is an upper elevation plant [1,800 to 2,300 meters (5906 to 7546 feet)] commonly found in the drier margins of vernal moist meadows (Soreng 1993). In Laguna Meadow, relatively high densities of *P. atropurpurea* have been reported from marshy areas and drainages (Hirshberg 1994), indicating percent cover or some other parameter may be more important than soil dryness. *Poa atropurpurea* flowers from April to July depending on local and seasonal weather conditions and elevation (Curto 1992; Soreng 1993).

Co-occurrence of male and female plants is necessary for sexual reproduction. For example, if all remaining individuals in a population were only one sex, the population would eventually be locally extirpated due to senescence of older individual plants (Curto

1992, p. 3; Soreng 2000, p. 1-4). Hirshberg (1994, pp. 1, 2) reported only 4 males out of approximately 1140 total individuals during field surveys of Laguna Meadow, an overall 1:285 male to female ratio. All 5 herbarium specimens from Laguna Meadow reviewed by Curto (1992, p. 3) were female (one from 1978, three from 1981, and one from 1991). Distribution of sexed individuals is an important parameter to understand potential for species retention in suitable habitat; however these data have not been collected to date in other meadows or in subsequent years at Laguna Meadows.

*Poa atropurpurea* has been recognized as a full species since 1898 (Lamson-Scribner 1898), and subsequently supported taxonomically as such (Marsh 1952), to the present day (Soreng 1991; Soreng 1993). No information is available regarding genetics, genetic variation, or trends in genetic variation (e.g. loss of genetic variation, genetic drift or inbreeding) for this monophyletic taxon. Small population size and separation distance between populations suggest that any genetic threats may cause perturbations in *P. atropurpurea* survival, long-term retention, and recovery.

Population demography for the species is unknown; life history parameters (seed set, annual productivity, seed viability, mortality) are also currently unknown. No repeated, systematic population status studies of *Poa atropurpurea* localities (historic or recent) have been conducted, and few recent specifics regarding population status or survival are currently known. We do not have historic or current abundance data for this species.

According to the listing rule (63 FR 49006), *Poa atropurpurea* was known from less than 20 occurrences in the San Bernardino, Laguna, and Palomar Mountains. Survey information recorded in the CNDDDB suggests 21 “occurrences” of *P. atropurpurea* (CNDDDB 2006, pp. 1-21). Information submitted to the CNDDDB comes from surveyors using various methods to record species occurrence information. For example, one surveyor may record an area containing several patches or colonies as a single occurrence while another may record each individual patch as a separate occurrence. Based on our evaluation of reported occurrences, we have determined there are 19 meadows where occupancy has been reported (Table 1). These 19 meadow areas historically and/or currently occupied by *P. atropurpurea* are summarized in Table 1 (see below) and discussed here in terms of meadow areas. Ten of the 19 meadow areas are known to be currently occupied.

**Table 1.** Meadow areas historically and/or currently occupied by *Poa atropurpurea*.

Meadow Name <sup>#1</sup>	USFS identification # <sup>1</sup>	CNDDDB identification # <sup>2</sup>	Recently occupied
<b>San Bernardino County</b>			
Alden Meadow	---	14	
Belleville Meadow	1,2,3,4,5,6,59,54	10	X
Big Bear City Meadow fragments	16,17,18,19,20	19	
Bluff Meadow	10	13	X
China Gardens/Eagle Point	7,8,9,21,22,23,	2	

Meadows	24,25,26,27,28, 30,31,32,57,58,63		X
Cienaga Seca Meadow	62	12	X
East Baldwin Meadow	56	----	
Erwin Meadows	----	24	
Hitchcock Meadow	33,34,35,36,37, 38,39,40,41,42, 43,44,45,46,47, 48,49,50, 51,52, 53,55	11	X
Metcalf /Coldbrook Meadows	----	16	
North Baldwin Meadow	12	1	X
Pan Hot Springs Meadow	13	17	X
	----	"near 17"	
Rathbun Meadow	----	21	
	----	23	
Shay Meadow	60	----	
	14,15,61	18	
Wildhorse Meadow	11	22	
<b>San Diego County</b>			
Bear Valley	----	29	X
Laguna Meadow	----	5	X
	----	27	
	----	28	
Filaree Flats (North of Laguna Meadow)	----	8	
Mendenhall Valley	----	4	X

<sup>1</sup>USFS identification # and meadow nomenclature = occurrence number assigned by the San Bernardino National Forest (SBNF 2000).

<sup>2</sup>CNDDDB identification # = occurrence number assigned by the California Natural Diversity Database (CNDDDB 2006).

According to occurrence information from the San Bernardino National Forest (SBNF) (SBNF 2000, pp. 47-49; SBNF 2002, p. 8) and the CNDDDB database (2006, pp. 1-21), *Poa atropurpurea* has been known to occur in 15 areas in the Big Bear area and four areas in the Laguna and Palomar Mountains of San Diego (Table 1). The current status of *P. atropurpurea* in most of these meadow areas is not well known. The most recent surveys have been conducted in San Bernardino County by the SBNF and biological consultants from 1999 to 2002 (SBNF 2000, 2002; Denslow et al. 2002). Meadow areas within the SBNF that support the most robust populations are Belleville Meadow (part of Holcomb Valley), Hitchcock Meadow (part of Holcomb Valley), North Baldwin Lake Meadow, Bluff Meadow (also known as Bluff Lake), Cienaga Seca meadow (also known as Blue Sky Meadow), and Pan Hot Springs Meadow (Eliason 2007, p.1).

Between 2000 and 2002, much of the meadow habitat on SBNF and surrounding lands was surveyed and mapped by SBNF personnel and private contractors (SBNF 2000, pp.

47-49; SBNF 2002, p. 8; Eliason 2007, p.1). The results were summarized in a Meadow Habitat Management Guide (Management Guide) (SBNF 2002). According to this 2002 Management Guide, a minimum of 4,430 acres (1793 hectares) of meadow habitat has been mapped on SBNF and surrounding lands (SBNF 2002, pp. 8, 13).

The most recent reported *Poa atropurpurea* specific surveys in San Diego County were in 1994 by Hirshberg (1994) on Laguna Mountain, and in Bear Valley and Mendenhall Valley by Volgarino and Winter (also 1994; CNDDDB 2006, pp. 3, 21). Single visits to confirm grazing range readiness (i.e., suitable for grazing) by the Cleveland National Forest (CNF) have been performed annually in Mendenhall Valley to ensure seed-set of *P. atropurpurea* prior to opening areas to grazing (Criley 2006, p.1). However, due to an inability to find *P. atropurpurea* during these grazing surveys, a surrogate species of *Poa* (*Poa pratensis*) has been used (Criley 2006 p.1).

Use of *Poa pratensis*, a nonnative species, as a surrogate may be problematic. The coincidence of the distribution and timing of the life history stages of *P. pratensis* and *Poa atropurpurea* in the mountain areas of San Diego County has not been demonstrated. Specifically, the flowering period of *P. pratensis* is noted as spring to early summer, while that of *P. atropurpurea* apparently does not flower until early summer (Soreng 1993, p. 1287, 1289). Grazing should be allowed, only after *P. atropurpurea* has been shown to have dropped its seeds. Therefore, gauging this event using a nonnative species known to flower earlier and presumably set seed earlier, could preclude seed set in *P. atropurpurea*.

**Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):** In the listing rule we stated, “*Poa atropurpurea* may be threatened with the loss of its genetic distinctiveness due to hybridization with *P. pratensis*.” We are not aware of any paper published or information available since the listing that addresses this topic. *Poa atropurpurea* is dioecious. Reduction of populations suggests long-term genetic issues, and single sex populations precluding genetic recombination are likely to cause decline into a self-reinforcing “extinction vortex” (Gilpin and Soule 1986; Lande 1993; Caughley 1994).

**Taxonomic classification or changes in nomenclature:** We are not aware of any paper published or new information available since the listing of this species that proposes to change the name, the taxonomic status, or systematic position of *Poa atropurpurea*.

**Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):** An unknown proportion of habitat for the species was initially lost in the 1880’s via construction of the water impoundment that created Big Bear Lake. It is estimated that in addition to that initial habitat loss, 91 percent of the remaining historic habitat had been destroyed by 1998 (63 FR 49006-22), leaving just nine percent of its original range extant. Due to development, urbanization, and edge effects in Big Bear Valley since 1998, this remnant nine percent figure is probably an incorrect (high) estimate. In 1998, over 70 percent of the few remaining parcels of habitat for the species

in Big Bear Valley were unprotected, and no populations in San Diego County were considered protected (63 FR 49006-49022).

Disruption of natural fire regime, grazing, development and fragmentation of habitat, have all apparently contributed to degradation of *Poa atropurpurea* habitat, and further loss to the species since listing. Analysis of small and declining population dynamics are necessary to understand population demography (e.g. Caughley 1994), but this is not currently possible due to the paucity of data available on the species. Direct, indirect, and cumulative effects of anthropogenic development of suitable habitat at Big Bear Valley are currently unknown. Based on the human development footprint in Big Bear Valley, and expert opinion (Eliason 2007, p.1), most populations adjacent to the lake appear to have been greatly reduced or eliminated since the time of listing.

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

#### **2.3.2.1. Factor A: Present or threatened destruction, modification or curtailment of its habitat or range:**

*Poa atropurpurea* populations have been and continue to be affected and reduced by grazing (including trampling), urban and residential development, various recreational activities (e.g. off road vehicles and off trail hiking), altered hydrological regimes, telephone line trenching, road maintenance, soil removal, and intentional grading to remove the species (63 FR 49006-22). Six wet meadow areas on the SBNF (Belleville, Hitchcock, North Baldwin Lake, Bluff, Wildhorse, and Cienaga Seca Meadows) host sustainable *P. atropurpurea* populations (Eliason 2007, p.1). These populations, while cumulatively affected by anthropogenic activities, are the most protected sites; however the populations in these habitats have been declining (Stephenson and Calcarone 1999). Grazing continues to be permitted on National Forest managed lands in the CNF. Occupied habitat on the CNF (Stephenson and Calcarone 1999) is exposed to recreation and grazing, as well as altered fire regimes. The joint Service and US Forest Service southern California mountains and foothills assessment indicated that these sites have moderate vulnerability (Stephenson and Calcarone 1999). The southern sites on the CNF may be imperiled due to a high female to male plant ratio (Hirshberg 1994 pp. 1, 2; Soreng 2000, p. 1-4).

Unprotected lands throughout the species' range in San Bernardino County currently host small, remnant populations of *Poa atropurpurea*. Urban encroachment near Big Bear Lake has degraded or eliminated remnant populations known at the time of listing (e.g., Shay Meadow, Metcalf /Coldbrook Meadows and China Gardens/Eagle Point Meadows; Eliason 2007, p.1).

#### **2.3.2.2. Factor B: Overutilization for commercial, recreational, scientific, or educational purposes:**



The listing rule suggested that professional and private botanical collecting could exacerbate the threat to the species due to botanists favoring rare or declining species (63 FR 49006-22). Since the time of listing, the Service has approved at least two permits that allow for scientific collection of the species. Rancho Santa Ana Botanical Gardens applied for and received a permit for removal of *Poa atropurpurea* (66 FR 21172-74, Permit Number 009018). The SBNF applied for and received a permit for removal of *P. atropurpurea* (67 FR 37857; Permit Number 055013). Both permits were for scientific study and were issued for the purpose of enhancing the survival of this species. We have no information that leads us to believe that illegal collection of this species has occurred. The professional botanical collections named here do not appear to be a factor which threatens the species.

#### **2.3.2.3. Factor C: Disease or predation:**

Disease is not known to be a factor affecting *Poa atropurpurea* (63 FR 49006-22). Grazing pressure as a form of predation is discussed below in section 2.3.2.5. Soreng (63 FR 49006-22) suggested thrip damage to *P. atropurpurea* in Big Bear Valley may cause the reduction in seed set. Predation effect by thrips may not be a threat to the species singularly; however additive or synergistic effects of other threats (i.e. grazing, fragmentation of habitat, etc.) may cumulatively eliminate seed production by *P. atropurpurea* in some areas of its range.

#### **2.3.2.4. Factor D: Inadequacy of existing regulatory mechanisms:**

##### **Federal laws**

Currently, *Poa atropurpurea* is listed under the Federal Endangered Species Act as Endangered. Under the Endangered Species Act, recovery is promoted and the species is protected from take by Sections 4, 7, 9 and 10. This law is the primary mechanism for protecting the *P. atropurpurea*.

The Clean Water Act affords some protection to the species since it occurs in wetlands. The Service, as part of the Section 404 review process, provides comments to the U.S. Corps of Engineers on nationwide permits and individual permits, however, the Service's comments are only advisory. In practice, a rare plant species would likely not receive any special consideration with regard to conservation or protection unless it was listed under the Act (62 FR 61916).

The National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.) may afford some protection to populations affected by Federal activities. The NEPA requires all Federal agencies to formally document, consider, and publicly disclose the environmental impacts of Federal actions and management decisions affecting the human environment, but NEPA does not require or guide mitigation for impacts.

The listing rule examined Forest Service management of the species, however the listing rule did not include a specific discussion of the National Forest Management

Act (16 U.S.C. 1600 *et seq.*). As discussed above under Factor A, habitat for this species is found on US Forest Service lands. Each National Forest was required to complete a Land and Resource Management Plan (LRMP) by the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (NFMA). These two acts require that the LRMPs provide for multiple use and sustained yield of the products and services obtained from the National Forests, including wildlife. In 2005, the USFS issued a new Planning Rule and Directive that included a requirement for LRMPs to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plant and animal species in plan areas (36 CFR 219.10(b)). The NFMA has contributed, in part, to maintaining populations of *Poa atropurpurea*.

### **State laws**

The species is not listed by the State of California as threatened or endangered. Thus, the California Endangered Species Act and the California Native Plant Protection Act (Division 2, chapter 10, section 1900 *et seq.* of the California Fish and Game Code) provide no protection for this species. *Poa atropurpurea* is in the Californian Native Plant Society's (CNPS) Inventory on List 1B (Plants Rare, Threatened, or Endangered in California or Elsewhere) (CNPS 2001). Under the California Environmental Quality Act (CEQA) Title 14, Chapter 3, Article 20, Section 15380 (accessed on line June 14, 2007), a plant listed as Endangered or Threatened under the Federal Endangered Species Act, as amended, is presumed to be endangered or threatened by the State and for the purposes of CEQA. Therefore, although CEQA may provide the opportunity for enhanced conservation of *P. atropurpurea*, the protection provided is limited.

Other than the Endangered Species Act, existing laws and regulations provide extremely limited protection for *P. atropurpurea*, such as where the species and/or its habitat may be impacted (i.e., Clean Water Act). These protections are applied sporadically throughout the range of *Poa atropurpurea*, and are currently inadequate to comprehensively address the threats to the species. These laws do not specifically address impacts from competing human recreational use and/or disturbance, grazing, and non-native vegetation, all of which remain primary threats to *P. atropurpurea*.

### **Factor E: Other natural or manmade factors affecting its continued existence:**

The number of *Poa atropurpurea* populations has declined inversely related to increased cumulative effects of anthropogenic factors throughout its range comparable to numerous other southern California species (Tennant et al. 2001).

#### *Grazing*

Grazing and associated trampling were considered to be a continuing threat to *Poa atropurpurea* (Sproul 1977; Sproul and Beauchamp 1979; 63 FR 49006-22), however

the extent of grazing on or near *P. atropurpurea* populations is currently unknown (see section 2.3.1). Eleven of 21 known occurrences were classified as threatened by cattle grazing in a metadata file which contained dated information (CNDDDB 2006). Sproul and Beauchamp (1979) and Painter (1995) showed negative impacts to native plant populations by alien herbivores (including cattle); the latter in California ecosystems. Grazing by an exotic herbivore can create conditions divergent from what grasses evolved during pre-historic periods (see Edwards 1992). Kimball and Schiffman (2003) clearly showed that cattle grazing harmed native species (including *Poa*), negatively affected native plant communities, reduced or removed native plant species from plots (including *Poa*), and promoted invasive species (Belsky and Gelbard 2000). To date, grazing remains an apparent threat to the species; grazing allotments on the Cleveland National Forest overlay all occupied *Poa atropurpurea* habitat. However, grazing allotment policy provides the Forest Service with a tool to manage and maintain habitat conditions favorable to some species. The effects of grazing have yet to be adequately monitored to ascertain if habitat conditions reflect the optimal level for maintenance of *Poa atropurpurea*. For example, the CNF reported that “in FY02, the grazing program only met 50 percent of its standards for permit monitoring.” Grazing also occurs on private lands in the area.

## Climate Change

Climate change is occurring in southern California, as well as throughout the world (Field et al. 1999; CEPA 2006; IPCG 2007). From an ecological context, all available models and current scientific thought suggests southern California within the jurisdiction of the CFWO has started to be and/or will be adversely affected by global climate change (Pierce 2004; Cayan et al. 2006; CEPA 2006). A number of threats cumulatively coalesce to decrease the population of *Poa atropurpurea* under global climate change scenarios. Global warming, correlative climate change, and global ecology (see Schwartz et al. 2006) related effects may cause, or may already be causing (e.g. for the past several decades), major impacts on many species and terrestrial biodiversity (McDonald and Brown 1992; Boggs and Murphy 1997; Parmesan and Yohe 2003; Parmesan 2006; Thomas et al. 2004, 2006) including montane habitat and *P. atropurpurea*. Climate change as it relates to changes in fire and drought are discussed below.

### *Fire*

Fire was not considered a severe threat to the species when this species was listed; however our understanding of fire in meadow and grassland habitat has improved since the listing of the species in 1998 (Dyer 2002). Fire is a natural component for meadow regeneration and maintenance of *Poa atropurpurea* habitat. However, *P. atropurpurea* faces two seemingly diametrically opposed forces; lack of fire, and re-introduction of fire (accidental and purposeful) to the altered landscape.

Threats to the habitat from fire exclusion and effects of correlative processes that created and maintained suitable habitat for the species may cause it to be even more

vulnerable to extinction. The ecological effects of fire exclusion in the montane meadow habitats of southern California has not been specifically studied for their effects on *Poa atropurpurea*, however the processes and structure of montane fire ecology is comparable to other locations in the Rocky Mountains, Cascade Range and Sierra Nevada mountains (Keane et al. 2002). Fire exclusion in montane meadow habitat affects ‘1) nutrient recycling, 2) natural regulation of succession via selecting and regenerating plants, 3) biological diversity, 4) biomass, 5) insect and disease populations, 6) interaction between plants and animals, and 7) biological and biogeochemical processes (i.e. soil property alteration)’ (after Keane et al. 2002). Species that are adapted to fire including grasses such as *Poa atropurpurea* are replaced by species that are able to compete for growing resources in the absence of fire (Keane et al. 2002). Invasive plant species’ incursion into mountain meadows have exacerbated fire danger to meadow plants by creating micro-climates and increased vegetative cover that increase risk of conflagrations during more times of the year (see MALGBC 2007).

Although the meadow habitat occupied by this species is dependent upon some form of disturbance to set back succession [e.g., periodic fire and more recently (within past ca. 100 years) grazing], intense fires at critical times can eliminate populations by killing individual plants through overheating of soils which creates hydrophobic conditions, or intense heat which kills rhizomes or eliminates the seed bank (Agee 1993; Keane et al. 2002; Arno and Fiedler 2005). Although intense fires likely occurred occasionally in the past, it would not have had significant impacts on the species, since there were undoubtedly other adjacent populations that could recolonize depopulated sites. Increased fire frequency can also impact this species through direct effects, increased invasive species incursions, and increased hybridization.

The threat of catastrophic wildfire is high in the Laguna Mountains and in the San Bernardino Mountains, the latter being where the most robust known populations of *Poa atropurpurea* were known to occur. Adjacent forests have been affected by extended drought, severe insect infestation, fire exclusion, and now a high density of dead and dying trees with overgrown ladder fuels. Wildfire in southern California can cause effects over large areas of habitat. A single 10 day fire complex in and near the SBNF (i.e. Sawtooth-Millard-Heart Complex) burned 85,700 acres (34,862 hectares) in 2006 alone (CDFG 2006; COES 2006).

Snyder et al.’s (2002) conservative model suggests higher average temperatures every month in every part of California. Miller and Schlegel (2006) suggest that Santa Ana conditions may significantly increase during fire season under global warming scenarios. Moritz and Stephens’ (2006) risk based management considerations would suggest that fire control in non Wildland Urban Interface (WUI) areas, such as the Laguna Mountains, would be limited due to competing concerns throughout the WUI of California. Extrapolating from their report, and recent policy shift by the National Interagency Fire Center due to the firefighter mortalities of October 2006, it is likely that many wildland fires would be left unchecked except around concentrations of

human habitation such as the Big Bear WUI. At this time, it is probable that in deference to protecting human life, remote habitat may not receive fire protection during a conflagration. Due to lack of resources and concerns for human safety, protection of *Poa atropurpurea* meadow habitat would not likely be a high priority during large scale wildfires. In addition, due to the open and relatively flat nature of the meadow habitat where *P. atropurpurea* occurs, available habitat may be prioritized for use as fire lines, treated with fire retardant chemicals, or used for fire camps/staging areas when wildfires occur in the area.

Climate change is likely to increase the scale and intensity of wildfire in southern California. Conflagrations pose the largest single stochastic risk to the few remaining small and declining concentrations of *Poa atropurpurea*. Small fires in the San Bernardino and Laguna mountains will most likely turn into large conflagrations (size class E-G (300 - + 5,000 acres) due to wind, weather, lack of prescribed fires, invasive vegetation, and wildfire control/prevention response. As an example, the recent fire (Windy Ridge fire), that occurred on March 11, 2007 near Orange, California, turned into a size class F (1,000 – 4999.9 acres) in less than 12 hours.

#### *Drought/Altered hydrological regimes*

Periodic droughts compounded by water table effects were indicated as a threat to *Poa atropurpurea* in the listing rule (63 FR 49012). Periodic and successive droughts are considered an underestimated ecological stress and selection factor that impacts forest and glade biological diversity, and depend on species' specific ability to withstand a drought period (Gutschick and BrassiriRad 2003; Archaux and Wolters 2006). Following the species listing, an extended drought in the region (San Diego County Water Authority 2007) has created unusual habitat conditions. From 1996 to 2005 at the closest precipitation gauge to the southern population (Lake Cuyamaca, San Diego County, CA), seven of 10 years had precipitation significantly below normal for all recorded time (San Diego County Water Authority 2007). Invasive plant species incursion has been exacerbated by the changing water regime, and presence of non-native grazers such as sheep and cattle. The cumulative effect of these threats to *P. atropurpurea* populations is unknown.

The extended drought in the mountains of southern California may be the leading edge of climate change affecting, summarily altering and eliminating lower latitude upper elevation montane habitat, causing additional loss of available habitat. At the foreseeable extreme suggested by climate models, global warming induced climate change has the potential to cause an upward biological elevation shift (see Fleishman et al. 1998; Parmesan 2006), which would establish a different vegetative regime and partial to complete loss of upper elevation vernal meadow habitat for *Poa atropurpurea*. Any significant elevational shift in ecological regimes would likely result in loss of concentrations of this species, resulting in eventual extinction.

### *Small and declining populations*

The listing rule suggested that habitat fragmentation can affect the genetic heterogeneity of small isolated populations (63 FR 49017). While few localities of the species were known at the time of listing, loss of any remaining peripheral populations and individuals may expedite extirpation or extinction events for central/core populations (considered at present to be Laguna Mountains and Big Bear Valley).

Small, declining, (per Caughley 1994) and peripheral (disjunct or connected) populations are more vulnerable to demographic, genetic, and environmental stochastic events, and natural catastrophes. Genetic stochastic events can further influence population demography via inbreeding depression and genetic drift. Allee (1931) suggested small, single populations disappear when opportunities for reproduction dissipate because of reduced opportunity to find each other (Allee effect or depensation). Stephens et al. (1999) and later Dennis (2002) suggest comparable definitions indicating that the Allee effect is a density-dependent event that is inversely related to population size. *Poa atropurpurea* exhibits traits found in small and declining population paradigms [i.e. small numbers, population numbers capped, potential for inbreeding depression, demographic stochasticity, small effective population size, habitat fragmentation and destruction, impact of introduced species and chains of extinction (Caughley 1994)] that suggest immediate action to conserve the species may still result in extinction, as the extinction threshold (vortex) for the species may already have been reached via the aforementioned threats. Because of already small populations in San Diego County have predominantly female plants (Hirshberg 1994 p. 1, 2), and that rhizomatous species may not be able to persist without sexual reproduction (Soreng 2000 p. 1-4), it is unlikely the southern extent of the species range will remain viable. Sex ratio of the northern extent of the populations is not known.

No empirical information is available to determine the finite rate of population change ( $\lambda$ ) or time to extinction for the species, however by all accounts; the species habitat within the range of natural variability and resulting populations have decreased since the time of listing even when locations of new sightings of scattered individuals are considered. Currently, the Service does not have information on the quality or quantity of habitat for this species on the remaining private land parcels in Big Bear Valley or in the Laguna Mountains.

#### **2.4. Synthesis**

*Poa atropurpurea* continues to be affected and reduced by grazing, urban and residential development, various recreational activities, altered hydrological regimes, construction and road maintenance projects, and soil removal (63 FR 49006-22). While grazing may have direct impact on individual plants, it is far overshadowed as a threat to the species by development and climate change related issues such as altered fire and hydrological regimes. We have no new information to indicate that

the significant threats identified at time of listing have been reduced or eliminated. The number of populations known at the time of listing were few; even assuming that these populations are extant, this dioecious grass may not have both sexes available *in situ* for long term survival, suggesting probable loss of the species throughout a significant portion of its already reduced and limited range. *Poa atropurpurea* faces high magnitude threats throughout the majority of its range that are directly and indirectly anthropogenically induced, or augmented by natural conditions affected by human actions, and most populations may be in an extinction vortex. Currently, there is extremely limited and dated information on the species in almost all areas where it has been found in prior years (i.e. number/status of remaining populations) (please refer to section 2.3.1). There have been no recent (within the past 5 years) scientific information and field data published on this species. Therefore, we recommend no change in status for this species.

### 3. RESULTS

#### 3.1. Recommended Classification

- Downlist to Threatened
- Uplist to Endangered
- Delist (Indicate reasons for delisting per 50 CFR 424.11):
  - Extinction
  - Recovery
  - Original data for classification in error
- No change is needed

#### 3.2. New Recovery Priority Number

No Change. The species condition for ascertaining its priority number has not changed since the time of listing.

### 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- 1) Conduct field assay at each known *Poa atropurpurea* site to gather data on a) presence, b) sex ratio and age class structure, c) threats, and d) conservation needs.
- 2) Provide viable seeds from *Poa atropurpurea* to a seed bank operating under the Center for Plant Conservation guidelines
- 3) Foster focused partnership with the Forest Service to promote habitat protection and annual surveys on occupied and suitable *Poa atropurpurea* habitat.

- 4) Determine the nature and needs of seed production to seedling establishment.
- 5) Develop cooperative relationships with private landowners to survey potential habitat, and create land easements to protect extant and potential habitat, and manage or eliminate cattle grazing on known *Poa atropurpurea* habitat in order to assure successful reproduction and seed set.
- 6) Craft and complete critical habitat designation, final recovery plan, and conservation strategy that provide guidance for best management practices and discussion of jeopardy threshold.
- 7) If sex and age class distribution dictate, develop and implement a controlled propagation, reintroduction, and monitoring program to conserve *Poa atropurpurea* from extirpation and/or extinction, consistent with USFWS policy (65 FR 56916-56922).

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### **Personal Communications**

- Memo to file by Lance Criley, Rangeland Management Specialist, Cleveland National Forest, in Alpine California. Subject: Mendenhall Allotment Range Readiness. (May 22, 2006). This document was received as an e-mail attachment from Lance Criley to Alison Anderson, CFWO Entomologist, (May 2, 2007).
- Interview with Scott Eliason, District Botanist, San Bernardino National Forest, California, in Fawnskin, California (March 29, 2007).
- Email from Robert Soreng, PhD, Research Associate, Department of Botany, Smithsonian Institution, Washington D.C., to Gary Wallace, Carlsbad Fish and Wildlife Office, Carlsbad, California (March 22, 2000).

**U.S. FISH AND WILDLIFE SERVICE**  
**5-Year Review of *Poa atropurpurea***

**Current Classification:** Endangered

**Recommendation resulting from the 5-Year Review:**

Downlist to Threatened

Uplist to Endangered

Delist

No change needed

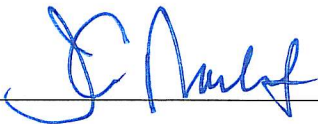
**Appropriate Listing/Reclassification Priority Number, if applicable:**

**Review Conducted By:** Carlsbad Fish and Wildlife Office

**FIELD OFFICE APPROVAL:**

Lead Field Supervisor, Fish and Wildlife Service

Approve \_\_\_\_\_



Date 9-25-08

**REGIONAL OFFICE APPROVAL:**

Lead Assistant Regional Director, Fish and Wildlife Service

Approve \_\_\_\_\_



Date 9-30-08