Piperia yadonii
(Yadon's piperia)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California

August 2009

5-YEAR REVIEW

Piperia yadonii (Yadon's piperia)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

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

Species Overview:

Piperia yadonii (Yadon's piperia) is a slender perennial herb in the orchid family (Orchidaceae). It is endemic to Monterey County and is found within Monterey pine forest and maritime chaparral communities. As observed with other orchids, germination of seeds is believed to involve a symbiotic relationship with a fungus. The blooming season is brief, usually starting in mid-June and ending in early August (Coleman 1995, Doak and Graff 2001). Individuals that flower in one year may not flower the next, and a portion of the population may be completely dormant in any given year.

Methodology Used to Complete This Review:

This review was prepared by the Ventura Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. We used information from the initial listing of the species, the Recovery Plan, survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database maintained by the California Department of Fish and Game. The Recovery Plan and communication with experts were our primary sources of information used to update the species' status and threats. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor

analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

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Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register (FR) on March 25, 2009 (74 FR 12878).

Listing History:

> **Original Listing**
> **FR Notice:** 63 FR 43100
> **Date of Final Listing Rule:** August 12, 1998
> **Entity Listed:** *Piperia yadonii*
> **Classification:** Endangered

Associated Rulemakings:

Critical habitat was proposed October 18, 2006 (71 FR 61545). The Final Rule designating critical habitat was published October 24, 2007 (72 FR 60409).

Review History:

No status reviews have been completed for this species.

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for *Piperia yadonii* is 2C according to the Service's 2008 Recovery Data Call for the Ventura Fish and Wildlife Office, 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). This number indicates that the taxon is a species that faces high levels of threats and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline

Name of Plan: Recovery Plan for Five Plants from Monterey County, California
Date Issued: December 20, 2004

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

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

Information on the Species and its Status

Species Biology and Life History

Piperia yadonii is a slender perennial herb in the orchid family (Orchidaceae). Mature plants typically have two or three lanceolate to oblanceolate basal leaves 4 to 6 inches (in) (10 to 15 centimeters (cm)) long and 0.75- to 1-in (2 to 3 cm) wide. The single flowering stem is up to 20 in (50 cm) tall with flowers arranged in a dense narrow-cylindrical raceme. The flowers consist of three petal-like sepals and three petals, together referred to as tepals. The upper three tepals are green and white and the lower three are white. The lowermost tepal is specialized into a lip that is narrowly triangular and is strongly decurved such that the tip nearly touches the spur of the flower (Morgan and Ackerman 1990). *Piperia yadonii* may occur with *P. elegans*, *P. elongata*, *P. michaelii*, and *P.transversa*, but is distinguished from them in flower by its shorter spur length, particular pattern of green and white floral markings, and its earlier flowering time (Morgan and Ackerman 1990, Coleman 1995).

As in other orchids, germination of *P. yadonii* seeds probably involves a symbiotic relationship with a fungus. Following germination, orchid seedlings typically grow below ground for 1 to several years before producing their first basal leaves. Plants may produce only vegetative growth for several years, before first producing flowers (Rasmussen 1995). In mature plants of *P. yadonii*, the basal leaves typically emerge sometime after fall or winter rains and wither by May or June, when the plant produces a single flowering stem. Consistent with what is known of other orchid species, Allen (1996) observed that only a small percentage of the *Piperia yadonii* plants in a population may flower in any year. Individual orchids that flower in one year may not have the necessary energy reserves to flower in the following year, so size and flowering are not necessarily age-dependent (Wells 1981, Rasmussen 1995). Although *Piperia yadonii* is capable of self-pollination, the rate of production of viable seeds is higher in plants pollinated by insects (Doak and Graff 2001). Doak and Graff (2001) found that pollinators of *Piperia yadonii* are predominantly nocturnal, short-tongued moths. In order to maintain adequate seed production to support long-term persistence of the species, suitable habitat of sufficient size and connectivity for these pollinators also needs to be maintained.

Spatial Distribution

Piperia yadonii is found within Monterey pine forest and maritime chaparral communities in northern coastal Monterey County. Its center of distribution is the Monterey Peninsula where plants are found throughout the larger undeveloped tracts of Monterey pine forest. To the north, the range of *Piperia yadonii* extends to the Los Lomas area, near the border of Santa Cruz County (Allen 1996; Yadon, in litt. 1997).

Since preparation of the listing rule, *Piperia yadonii* has been found at one location about 15.5 miles (mi) (25 kilometers (km)) south of the Monterey Peninsula near Palo Colorado Canyon in maritime chaparral (Norman, in litt. 1995). Maritime chaparral is uncommon along this region of the Big Sur coastline, but a few scattered patches do occur south to Pfieffer Point, located about 25 mi (40 km) from the Peninsula (Norman, pers. comm. 1997). *Piperia yadonii* has been found only 4 to 6 mi (6 to 10 km) inland (Allen 1996; Yadon, in litt. 1997) despite searches of lands farther east (Allen 1996). The current distribution of *Piperia yadonii* is depicted in Figure 1. The final recovery plan lists five geographic areas important for recovery of the species: Monterey Peninsula, the interior of Monterey Peninsula, north County/Elkhorn/Prunedale, Point Lobos, and Palo Colorado Canyon.

Abundance

The Pebble Beach Company funded intensive surveys for *Piperia yadonii*, focusing on the Monterey Peninsula in 1995, and beyond the Peninsula in western Monterey County in 1996. *Piperia yadonii* plants have been counted at known sites, approximately 346 acres (ac) (140 hectares (ha)), throughout the range of this species since 1990 (Morgan, in litt. 1992; Uribe and Associates 1993; Norman, in litt. 1995; Allen 1996; Jones and Stokes Assoc. 1996). Plants are often densely clustered, and may reach densities of 100 to 200 plants in a few square meters (Hale, in litt. 1997). Because size and flowering are not always age-dependent, the age structure of these populations is not known.

Monterey Peninsula

During the 1995 Pebble Beach Company funded surveys, the greatest concentrations of *Piperia yadonii*, approximately 57,000 plants, or 67 percent of all known plants, were found scattered throughout much of the remaining Monterey pine forest owned by the Pebble Beach Company and the Del Monte Forest Foundation on the Monterey Peninsula (Allen 1996). About 8,500 of these plants were in designated open space areas (Allen 1996). Another 2,000 plants, 2 percent of all known, occured on remnant patches of Monterey pine forest in parks and open space areas of Pacific Grove and Monterey (Allen 1996; Jones and Stokes Assoc. 1996). During a 2004 follow-up survey in known occupied habitat, 129,652 plants, a 240% increase from the previous surveys, were identified on lands owned by Pebble Beach Company (Zander Associates 2004). Other populations on the Monterey Peninsula occur on properties owned by the City of Pacific Grove, City of Monterey, U.S. Department of Defense, and California Department of Parks and Recreation. Refer to Table 1 for the most recent estimated number of individuals for each population.

Interior of Monterey Peninsula

East of the Monterey Peninsula, individuals were identified on or near the Monterey Peninsula Airport but the population appears to have been greatly reduced in certain areas of the airport (Leitner, Environmental Science Associates, in litt. 2001; CNDDB 2009). More than 2,350 plants have been identified at the Naval Postgraduate School/Navy Golf Course in Monterey where they continue to be discovered and are expanding due to management efforts (Greening Associates 1999). The population at the former Fort Ord site was believed to be extirpated until an individual plant was discovered in a new location during July 2009 surveys (Collins, U.S. Department of Defense, in litt. 2009). Historically, *Piperia yadonii* was only known to occur in the extreme northern and southern boundaries of Fort Ord.

The remaining populations occur on properties owned by the Pebble Beach Company, Del Monte Forest Foundation, U.S. Department of Defense, County of Monterey, City of Carmel, Monterey Peninsula Regional Park District, and an undetermined number of other private landowners (Jones and Stokes Associates 1996). The largest populations occur on property owned and managed by the Pebble Beach Company (Jones and Stokes Associates 1996). Several of the privately-owned populations continue to be threatened by development. Although some of the populations are protected from development, threats to their long-term survival include non-native species and recreational activities. Refer to Table 1 for the most recent estimated number of individuals for each population.

North County/Elkhorn/Prunedale

Inland to the north of the Monterey Peninsula, about 18,000 *Piperia yadonii* plants, or 21 percent of all known plants, have been found on the chaparral-covered ridges north of Prunedale (Allen 1996). About 8,000 of these plants are on lands that receive some protection at Manzanita County Park, Blohm Ranch, and in a Pacific Gas and Electric utility easement; the remainders are on private lands that are not protected. Refer to Table 1 for the most recent estimated number of individuals for each population.

Point Lobos

South of the Peninsula, about 7,500 plants have been found on California Department of Parks and Recreation properties at Point Lobos Ranch (Big Sur Land Trust, in litt. 1997) and in a smaller parcel that is in private ownership. Considering the current abundance of *Piperia yadonii* in the remaining large tracts of Monterey Forest, this species probably occurred throughout the Peninsula when Monterey pine forests were much more extensive before urbanization. Refer to Table 1 for the most recent estimated number of individuals for each population.

Palo Colorado Canyon

South of Carmel Highlands, near Palo Colorado Canyon, 38 plants were observed in 1995. Plants were identified but not quantified on a return visit to the site in 2004. This site, in private

ownership, was noted to be high quality chaparral with a unique assemblage of species (CNDDB 2009).

Habitat or Ecosystem

Piperia yadonii has been found in two primary habitat types: Monterey pine forest with an herbaceous, sparse understory; and ridges in maritime chaparral growing beneath dwarfed *Arctostaphylos hookeri* (Hooker's manzanita) shrubs in shallow soils (Morgan and Ackerman 1990, Allen 1996, Doak and Graff 2001). In the Monterey pine forest habitat, the species grows through pine needle duff among sparse herbaceous vegetation. *Piperia yadonii* grows in filtered sun on soils (sandy, podzolic, or decomposed granite when associated with Monterey pine and manzanitas) with a shallow clay hard pan that becomes very dry during the flowering season. Overall, this species favors a well-drained sandy soil substrate with podzolic conditions; areas that retain moisture during the rainy season but are not subject to inundation (Yadon, in litt. 1997). In some Monterey pine forest locations, *Piperia yadonii* plants occur among dense stands of the non-native annual grass *Briza maxima* (quaking grass) (Doak and Graff 2001). In maritime chaparral habitat in northern Monterey County, plants grow on sandstone ridges where soils are shallow. They are commonly found under the edges of prostrate mats of *Arctostaphylos hookeri*.

Piperia yadonii can occur in some locations where disturbance has occurred in the past 10 to 15 years and continue to be affected by limited recreation, development, and landscaping, such as abandoned dirt roads or cut slopes created by road construction (Allen 1996). Like other orchid species, *Piperia yadonii* does not appear to be an early successional species but is able to colonize trails and road banks within dwarf maritime chaparral or Monterey pine forest once a decade or more has passed and if light and moisture regimes are favorable (Allen 1996; Yadon, in litt. 1997).

Species-specific Research and/or Grant-supported Activities

Alison Graff was contracted by the Service to develop a long-term monitoring plan for *Piperia yadonii* compatible with the Final Recovery Plan. The final plan was completed October 30, 2006 (Graff 2006). This monitoring plan provides a reference to guide monitoring and management decisions.

To mitigate impacts from proposed development by Pebble Beach Company in the Del Monte Forest, an Adaptive Management Team, directed by the County of Monterey Planning Department, was established to research methods that ensure no net loss of *Piperia yadonii* as outlined in the Final Piperia Plan in the Environmental Impact Report for the proposed development. The Adaptive Management Team, lead by Ecosystems West Consulting Group, guides the proposed research efforts and meets several times each year (Ecosystems West 2008).

Five-Factor Analysis

At the time of listing, the primary threats to *Piperia yadonii* that we discussed included habitat loss from development, habitat fragmentation and isolation, competition from non-native

species, and herbivory. The following five-factor analysis describes and evaluates the current 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

Habitat for *Piperia yadonii* has been altered, destroyed, or fragmented by residential development and conversion to recreational facilities, especially golf courses. At the time of listing, estimates of the loss of Monterey pine forest in California indicated that 40 percent (Huffman and Assoc. 1994) to 50 percent (Jones and Stokes Assoc. 1994) of the Monterey pine forest once found in the Monterey region had been eliminated. On the Monterey Peninsula itself, the proportion destroyed is much greater; on those marine terraces and old dune soils that underlie most of the Peninsula, less than 20 percent of the historical Monterey pine forest is estimated to remain, much of it in fragmented and increasingly-isolated stands (Jones and Stokes Assoc. 1994). Habitat loss and alteration resulting from previous, current, and proposed developments continue to pose substantial threats to *Piperia yadonii*.

Habitat fragmentation, reducing native vegetation to ‘‘islands’’ within a matrix of roads, residences, and golf courses, leads to population declines and extirpations that create more edges to the habitat that may result in changes in light level, wind velocity (resulting in blowdown of trees), moisture availability, and an increase in non-native species. When the habitat fragments are small, these ‘‘edge effects’’ may influence the entire remnant habitat. Other influences from the surrounding environments, such as drifting of pesticides, trampling by humans, dumping of yard waste, and cutting of vegetation for fire control, also can have substantial deleterious effects on the survival of any native species. Effects from habitat fragmentation were a threat at the time of listing and continue to pose a threat to the species.

Other reported threats to habitat for *Piperia yadonii* at the time of listing, and that continue, include competition from non-native plants, mowing of vacant properties, roadside maintenance and a fire directive allowing mowing within 6 to 8 inches (15 to 20 cm) of the ground surface of habitat along roadways in the Pebble Beach area (Yadon, in litt. 2002, Stromberg, in litt. 2002), the potential loss of viable habitat due to changes in vegetative structure within sites following fire suppression (Graff 2006), and loss of plants from potential improvement projects at the Monterey Peninsula Airport. Large portions of the existing population at the airport may be lost from proposed future projects. The fragmented nature of all remaining sites makes management difficult and local extirpations of this species probable.

Urban and recreational developments, specifically golf courses on the Monterey Peninsula, continue to threaten this plant’s existence. Golf course development is less of a threat than at the time of listing due to the Coastal Commission’s denial of Pebble Beach Company’s plans for development of a new golf course on the area containing the largest population of *Piperia yadonii* within the range of the species in 2007.

Acquisition of land and conservation easements have resulted in the preservation of *Piperia yadonii* habitat, but threats to the habitat remain. Protected parcels of habitat are often subject to invasion by non-native plants and other species, increased vegetative growth, and other

conditions that serve to make habitat less suitable for *Piperia yadonii*. Lack of connectivity of the remaining populations of *Piperia yadonii* is a threat to recovery of the species. Inbreeding may affect small or isolated populations if it results in inbreeding depression, typically characterized by lowered seed set, lowered germination rates, and lowered survival and reproduction by offspring.

Of the 29 currently known populations of *Piperia yadonii*, 16 are on privately-owned properties. Two of those are managed for conservation. Twelve populations are publicly (County, State, or Federal government) owned. One population is both privately- and publically-owned and partially in a utility easement. Three of the publicly-owned populations occur on U.S. Department of Defense properties that have management plans, Integrated Natural Resource Management Plans, and Endangered Species Management Plans for *Piperia yadonii*. Five of the publicly-owned populations occur in State and County parks. Refer to Table 1 for a summary of the known populations.

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

Overutilization for commercial purposes was not known to be a factor for the species in the 1998 final listing rule (63 FR 43100). Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

At the time of listing, mule deer (*Odocoileus hemionus*) grazing of flowering stems was identified as a potential threat to *Piperia yadonii* (63 FR 43103). Over the past few decades, the population of mule deer on the Monterey Peninsula has increased substantially. Monitoring of other sensitive plant species indicates that they are being negatively affected by deer browsing on flowering stems. During surveys in 1995 and 1996, a sample of plants both on and off of the Monterey Peninsula were placed under cages to protect them from large mammalian herbivores. About 13 percent of the caged plants flowered, while in the sample of unprotected plants only about 2 percent could be found with flowering stems (Allen 1996). Severe herbivory of leaves, also likely from mule deer, has been noted as well (Yadon, in litt. 1997). A 2005 study by EcoSystems West (2008) found that 26 percent of vegetative *Piperia yadonii* sampled were browsed by mammals and 62 percent that flowered had all or part of the inflorescences removed by herbivores. At least one population of *Piperia yadonii* was browsed so heavily during 2000 that no plants successfully produced seed capsules (Yadon, in litt. 2000). *Piperia yadonii* is also threatened by predators, such as snails, insect larva, slugs, earwigs, aphids, and rabbits (*Sylvilagus* spp.).

Although the Service is not aware of any quantitative data on mule deer populations on the Monterey Peninsula, anecdotal evidence, such as sightings and reports of health, suggest that the number of deer on the Peninsula is high (Matthews, California Native Plant Society, in litt. 1996; Steeck, USFWS, pers. obs. 1996). If the loss of 85 percent of flowering stems calculated by Allen (1996) is close to actual herbivory rates on the Monterey Peninsula, predation could continue to have a substantial effect on the reproductive success of the species, particularly if

populations are reduced by large-scale habitat loss and fragmentation due to development. Graff (2006) suspected that populations of *Piperia yadonii* occurring in forests surrounded by large areas of high-quality habitat may have herbivory rates above 70 percent compared to around 40 percent in populations in chaparral. High rates of herbivory could severely impact *Piperia yadonii* populations by reducing individual plant survivorship as well as reproduction (EcoSystems West 2008).

Ecosystems West (2008) reported that within 54 study plots, 6.7 percent of plants in 2005, 11.5 percent of plants in 2006, and 20 percent of plants in 2007 exhibited signs of disease termed "tip wilt." Tip wilt causes the flower spike to turn brown and wilt. The exact cause of tip wilt is unknown; however, most types of wilts are caused by fungi or bacteria.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to have some potential to protect *Piperia yadonii* included: the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), and the Act in those cases where *Piperia yadonii* occurs and is incidentally protected in habitat occupied by a listed wildlife species. The listing rule (74 FR 12878) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain valid.

The Act is the primary Federal law that provides protection for this species since its listing as endangered in 1998. The California Coastal Commission, in cooperation with Monterey County, conducts periodic reviews of the implementation and effectiveness of Monterey County's Local Coastal Program in carrying out the goals and policies of the California Coastal Act. Corrective actions or recommendations are provided by the Commission to the County and will be integrated into Monterey County's 21st Century General Plan Update. 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 Act.

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

Stochastic extinction

At the time of listing, *Piperia yadonii* was threatened with extinction from natural random acts by virtue of the limited number of individuals and range of the existing populations. Small populations are also vulnerable to extinction by a single human-caused or natural event. Inbreeding may affect small or isolated populations if it results in inbreeding depression. Since the time of listing, the known range of the species and number of individuals and populations has increased as a result of extensive survey efforts. Our current assessment is that the risk of stochastic extinction is less than at the time of listing due to the increase in the size of several of the populations. However, other populations continue to be at risk due to their small size and isolation from surrounding suitable habitat.

Competition with non-native species

The *Piperia yadonii* listing rule states that *Cortaderia jubata* (pampas grass) and *Genista monspessulana* (French broom) are two non-native plant taxa that invade forests and meadows on the Monterey Peninsula. In addition, *Acacia* spp. (acacia) and *Briza maxima* (rattlesnake grass) have been listed as threats in the Del Monte Forest populations (Ecosystems West 2008). The Pebble Beach Company has an on-going eradication program for these taxa (Pebble Beach Co. 2008). Due to aspects of the life history of *Piperia yadonii*, such as dormancy, more monitoring will be necessary to determine the response of the species after non-native species removal (Ecosystems West 2008). Invasion of non-native plants is a continuing threat and could increase in severity if the remaining populations are reduced in size, dissected into many smaller parcels, or become isolated by surrounding development.

Fire prevention and fire suppression activities

At the time of listing, maintenance of firebreak roads in Monterey pine forest was described as providing open habitat for invasive, non-native species. It was believed that these species could never be eradicated from the area due to the necessity of maintaining the firebreak roads. Clearing and maintaining exposed ground that could allow the establishment or persistence of non-native species continues to pose a threat to *Piperia yadonii*.

Fire suppression activities could pose a threat to *Piperia yadonii*. Periodic fire could remove dense vegetation and reduce organic accumulation on the ground to provide better habitat for *Piperia yadonii*.

Climate change

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007). Recently, the potential impacts of climate change on the flora of California were discussed by Loarie et al. (2008). Based on modeling, they predicted that species' distributions will shift in response to climate change, specifically that the species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Species diversity will also shift in response to these changes with a general trend of diversity increases shifting towards the coast and northwards with these areas becoming de facto future refugia. Coastal populations will be particularly vulnerable to habitat loss and degradation due to sea level rise and storm surges. However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to *Piperia yadonii* at this time.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed, by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The Final Recovery Plan (Service 2004) for *Piperia yadonii* states that the recovery objective is reclassification to threatened status. Further loss of existing plants and the species' habitat should be avoided, and threats to its survival should be eliminated. Downlisting for *Piperia yadonii* can be considered when all of the following criteria have been achieved:

a) Secure and protect areas throughout the present range of *Piperia yadonii* that contain populations of sufficient size to ensure the long-term survival and recovery of the species. The Service stated that areas should be established that encompass and protect metapopulations (a collection of spatially divided subpopulations that experience a certain degree of gene flow among them) of the *Piperia yadonii*; however, the information needed to define and delineate metapopulations is not available at this time. Until sufficient information is available for a metapopulation approach to *Piperia yadonii* conservation, we have identified areas and populations of plants that need to be protected to accomplish the goal of downlisting the species. To facilitate the identification of these areas and populations, we have divided the current range of the species into five geographic areas based on the known distribution of the plant (CNDDB 2004): the Monterey Peninsula (Area 1), the area interior of the Monterey Peninsula (Area 2), northern Monterey County-Prunedale-Elkhorn (Area 3), the area east of Point Lobos State Reserve-Point Lobos Ranch (Area 4), and Palo Colorado Canyon (Area 5).

   The goal is to protect self-sustaining populations of *Piperia yadonii* in each of these five areas. By doing so, we will ensure both the preservation of the plant throughout its range and its representation in both Monterey pine forest and maritime chaparral. A minimum of 12 populations will require protection: four in Area 1, three each in Areas 2 and 3, and one each in Areas 4 and 5. The two largest populations of *Piperia yadonii* occur in Area 1, and both of these populations should be protected to the maximum extent feasible. However, if this is not feasible, additional protected areas may be required in Area 1.

These additional areas would be necessary to ensure an adequate number of individuals are protected and that Monterey Pine Forest habitat occupied by *Piperia yadonii* is adequately represented. The protected areas must be of adequate size and configuration to ensure the following: 1) maintenance of ecosystem and community processes and constituent species, such as hydrologic regime, drainage patterns, proximity to pollinator habitat, and Monterey pine forest and maritime chaparral community associates; 2) continued, unimpeded gene flow between populations, either through wind-dispersed seed or animal-mediated pollen exchange; 3) an adequate diversity of sites for population expansion and for colonization of new areas as microhabitat conditions change; and 4) the persistence of *Piperia yadonii* populations throughout the full range of environmental conditions they are likely to encounter, such as extended drought and wildfire. Protected areas should be as large as possible (e.g., hundreds of hectares) and configured such that they preserve ecosystem function and minimize the adverse influences of adjacent development. Protected areas of greater than a hundred hectares will not be feasible at all locations; therefore, the ability of smaller areas to fulfill the criteria should also be considered. Adequate, long-term funding should be available for these protected areas to allow for their maintenance.

This criterion addresses Listing Factors A and E. This criterion is relevant and up-to-date and has only been partially met. Three populations of *Piperia yadonii* having some level of protection occur in Area 3: two privately owned populations are managed for conservation and one is in a utility easement. Six of the publicly owned populations, one population in Area 1, two in Area 2, one in Area 3, and two in Area 4, occur in parks that afford the populations some level of protection but are still exposed to threats associated with recreation activities, such as trampling and trail maintenance. Four populations, two in each Area 1 and Area 2, are on property owned by the U.S. Department of Defense and receive management through Integrated Natural Resource Management Plans; any impacts to the species by development projects would be reviewed through NEPA and section 7 of the Act. Two populations have some degree of protection in Area 2; one is owned by the U.S. Department of Defense and receives management through an Integrated Natural Resource Management Plan. No populations are protected in Area 5. Refer to Table 1 for a summary of the known populations.

b) Protected areas are adequately maintained, such that encroachment by non-native plants, excessive herbivory, edge effects from road maintenance, fuel modification activities, or other threats do not directly or indirectly adversely affect *Piperia yadonii* and its habitat.

This criterion addresses Listing Factors A and E. This criterion is relevant and up-to-date and has only been partially met. Although several populations are managed for conservation purposes, those populations still have threats from non-native plants, high rates of herbivory, and the threat of fragmentation and isolation from development. Many other populations are not protected and receive little or no conservation management activities.

c) Results of monitoring activities have determined that the protected populations of *Piperia yadonii* are of adequate size to be self-sustaining and to ensure their long-term

persistence. This species is a perennial that exhibits dormancy, spending an undetermined period underground between seed germination and emergence of first leaf aboveground. The duration of dormancy specific to *Piperia yadonii* is not known but data on similar species indicate may be up to 4 years (Hutchings 1987). The 2004 Recovery Plan states that a minimum of 10 to 15 years of monitoring will likely be needed in order to define a population trend.

This criterion addresses Listing Factors A and E. This criterion is relevant and up-to-date and has only been partially met. Plots monitored between 2005 and 2007 showed a 15 percent increase in mean vegetative abundance, although this difference was not statistically significant (Ecosystems West 2008). More monitoring is needed to determine true trends in the population from other factors affecting the vegetative expression such as annual precipitation.

IV. SYNTHESIS

At the time of listing in 1994, habitat fragmentation and development were detailed as threats to *Piperia yadonii*. Much of the habitat fragmentation occurred in the past and the resulting effects are still a threat. The potential for further fragmentation of the remaining populations continues to be a threat to the species. Since the time of listing, the threat of development and habitat fragmentation has been reduced somewhat; in particular, some of the densest populations of *Piperia yadonii* on Monterey Peninsula have been set aside in designated Open Space areas by Pebble Beach Company and will likely not be developed in the future. In addition, there are plans to acquire populations of *Piperia yadonii* in the near future for conservation and they will receive an additional level of protection through implementation of management plans. Even so, more populations in permanent protection and managed for conservation are needed to ensure the long-term survivability of the species.

Since the time of listing, extensive surveys have detected an expanded known range, additional populations, and higher numbers of individuals. However, a number of factors have been shown to reduce the reproductive potential of the species. Recent research has shown high rates of herbivory have significantly affected the populations of *Piperia yadonii* over time by reducing the ability of individual plants to survive and reproduce (Doak and Graff 2001). Research has also elucidated the importance of pollinators to achieving viable seed set, which is also crucial for long-term persistence (Doak and Graff 2001). Therefore, although the range is greater and the number of populations and individuals now known is higher than at the time of listing, threats including herbivory, disease, and low rates of seed set may be decreasing the long-term persistence of the species.

Because of the remaining threats from development, invasive species, herbivory, and habitat fragmentation, we believe *Piperia yadonii* 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*
_X_ No Change

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. We recommend land managers continue monitoring of all known populations of *Piperia yadonii* and manage land uses for conservation of the species. More monitoring is necessary to determine any population trends due to the variability in above ground expression of the species. Long-term monitoring will aid in distinguishing between true population trends and changes in dormancy from year to year (Graff 2006).

2. We recommend the County of Monterey develop a set of best management practices to work with private land owners to protect populations of *Piperia yadonii* and manage for the species.

3. We recommend research be undertaken to identify ways to reduce and minimize herbivory on the Monterey Peninsula.

4. We recommend continued efforts by landowners and land managers to reduce and remove non-native species.

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

***Piperia yadonii* (Yadon's piperia)**

Current Classification:

Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Review Conducted By: Christopher J. Diel

OFFICE APPROVAL:

Field Supervisor, U.S. Fish and Wildlife Service

Approve Diane K Noda Date 8/10/09

Figure 1. Distribution of *Piperia yadonii* (Yadon's Piperia) Monterey County, California

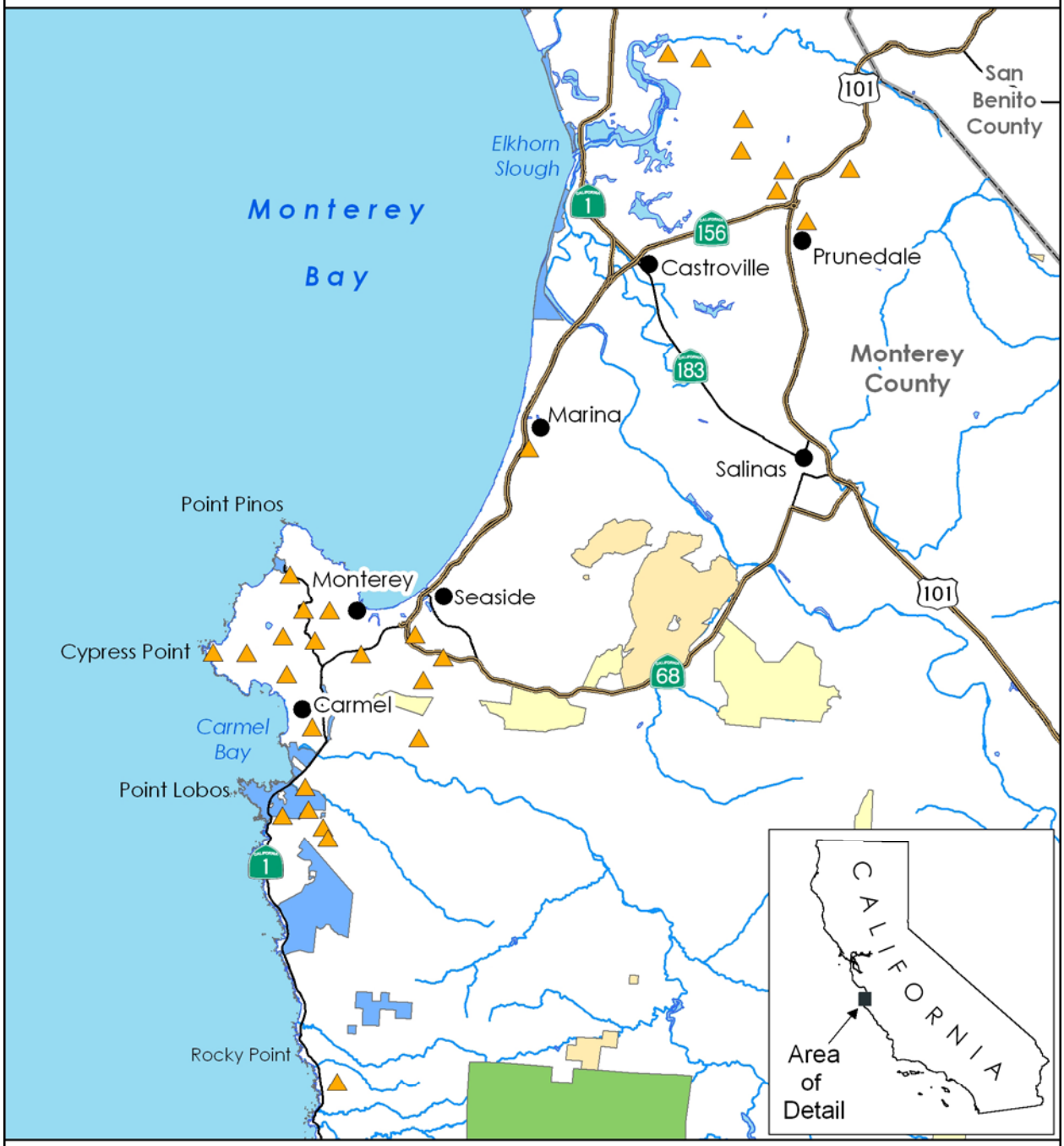

Table 1. Status of populations of *Piperia yadonii*.

Location Name	Owner	Threat/Conservation Efforts	Most Recent Population Estimate**
Recovery Area 1: Monterey Peninsula			**129,652**
Crocker Grove	Private	Mowing and parking along roadside. Potential development of golf courses.	47
Pebble Beach Equestrian Center	Private	Mowing along roadside, residential development, golf course development, and habitat loss to non-native invasive weeds.	14,600
Washington Park and 17 Mile Drive	City of Pacific Grove and Private	Potential threats from development and recreational activities.	282
Veteran's Memorial Park	City of Monterey and U.S. Department of Defense	Recreation trails throughout the small patch of habitat.	50
Huckleberry Hill	Private	Proposed residential and golf course development and inability to maintain a beneficial fire regime.	39,000
Presidio of Monterey	U.S. Department of Defense	Integrated Natural Resource Management Plan includes measures for protection, management, and monitoring.	2
East of Huckleberry Hill	Private	Development.	n/a
Pebble Beach Area	Private	Residential and golf course development and introduction of non-native species and landscaping.	25
Riley Ranch Road Area	California Department of Parks and Recreation	Road development and sediment run-off.	1,078
Recovery Area 2: Interior of Monterey Peninsula			**n/a**
Old Capitol Site	Private	Mowing along roadside, development, and habitat loss to non-native invasive weeds.	2,500
Former Fort Ord	City of Marina and U.S. Department of Defense	Presumed extirpated in areas but recently rediscovered. Commercial development and habitat loss to non-native weeds.	1
Naval Post-graduate School / U.S. Navy Golf Course	U.S. Department of Defense	Integrated Natural Resource Management Plan includes measures for protection, management, and monitoring.	2,350
Monterey Airport	Private	Development.	<5

Jacks Peak County Park	County of Monterey	Protected from development but threatened by recreational activities.	86
September Ranch	Private	Development.	0
West of Highway 1	City of Carmel	City property used as a native plant garden. Development and trampling by people and pets.	63
Palo Corona Regional Park	Monterey Peninsula Regional Park District	Trampling by people and pets and herbivory.	240
Recovery Area 3: North County/Elkhorn/Prunedale			**18,000**
Vierra Canyon	Private	Proposed realignment of Highway 101.	10
Manzanita Park	Monterey County	Protected from development but threatened by recreational activities.	8,000
Blohm Ranch	The Nature Conservancy and Elkhorn Slough Foundation	Inability to maintain a beneficial fire regime. Managed for conservation.	1,000s (not fully quantified)
Long Valley	Private	Development.	1,670
North of Prunedale	Private and Pacific Gas and Electric Company	Fragmentation due to development and habitat loss to non-native invasive weeds.	3,500
East Manzanita Park (upslope of residential area)	Private	Development.	6,486
Whitehead Property	Private	Development.	n/a
Renteria and Brothers	Private	Managed for conservation.	n/a
Recovery Area 4: Point Lobos			**n/a**
Point Lobos Ranch	California Department of Parks and Recreation	Residential development, habitat loss to non-native invasive weeds, and deer herbivory.	7,500
Lobos Ridge (East of State Reserve)	Private	Trampling by people and sediment run-off from road maintenance.	3

Lobos Ridge	California Department of Parks and Recreation	Herbivory, trampling by people, and recreation trail maintenance activities.	1
Recovery Area 5: Palo Colorado Canyon			**38**
Palo Colorado Canyon	Private	Development.	38

** Population estimates are from the most recent information available and may not reflect the current population at each site as some populations have not been surveyed for several years.
n/a = population estimate is not available.

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