Recovery Plan for Seven Coastal Plants and the Myrtle's Silverspot Butterfly: *Chorizanthe valida* (Sonoma Spineflower)

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Original Approved: September 29, 1998
Original Prepared by: U.S. Fish and Wildlife Service, Ventura and Sacramento, California for Region 1 (Portland, Oregon)

RECOVERY PLAN AMENDMENT

We have identified the best available information that indicates the need to amend recovery criteria for this species since the completion of the original recovery plan. In this modification, we synthesize the adequacy of the existing recovery criteria, show amended recovery criteria, describe the rationale supporting the recovery plan modification, and add additional recovery actions (as needed). The modification is an addendum, which supplements the recovery plan, superseding the following pages: from Section I: pp. 25-29, and Section II: pp. 89-90 for Sonoma spineflower (*Chorizanthe valida*)[1].

For
U.S. Fish and Wildlife Service
Region 8
Sacramento, California

September 2019

METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

This review was prepared by the Sacramento Fish and wildlife Office (SFWO), following the National Recovery Program guidance issued in May of 2018. We (The U.S. Fish and Wildlife Service) used information from our files, the original recovery plan (1998a), the most recent 5-year review (2010), information from experts at the National Park Service (NPS), and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game. The Sonoma spineflower only exists on lands owned and operated by the NPS. Information from Sonoma Spineflower (*Chorizanthe valida*) *TE018180-4 Annual Report 2017* compiled by NPS biologists was the primary document relied on to inform decision-making. National Park Service biologists provided much of the documentation, observations, and data used to inform the amended recovery criteria. The amended criteria were peer reviewed in accordance with the OMB Peer Review Bulletin following the publication of the Notice of Availability.

We developed amended recovery criteria by assessing threats to species using the Endangered Species Act's five listing-factors. We used concepts from the Species Status Assessment (SSA)

[1] The superseded material includes only the specific recovery criteria and synthesis described for this species. We do not supersede material other than the recovery criteria with this amendment.

framework (Service, 2016) to augment this process. While a full SSA is beyond the scope of this recovery plan amendment, the Service used the SSA framework to consider what species need to maintain viability by characterizing the status of the species in terms of its resiliency, representation, and redundancy (Wolf et al. 2015; Schaffer and stein 2000):

Resiliency describes the ability of populations to withstand stochastic disturbance. With increasing resiliency comes increased population size and growth rate. Habitat connectivity also increases resiliency. Generally, populations need abundant individuals within habitat patches of adequate area and quality in order to survive and reproduce in spite of disturbance.

Representation describes the ability of a species to adapt to changing environmental conditions over time. Populations with a wide variety of genetic and environmental diversity within and among populations have higher representation.

Redundancy describes the ability of a species to withstand catastrophic events. Generally, species which have adequate individuals within multiple populations, minimize potential loss from catastrophic events. Redundancy is high when multiple, resilient populations are distributed within the species' ecological settings and across the species' range.

ADEQUACY OF RECOVERY CRITERIA

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination…that the species be removed from the list." Legal challenges to recovery plans (see Fund for Animals v. Babbitt, 903 F. Supp. 96 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) have affirmed the need to frame recovery criteria in terms of threats assessed under the five delisting factors.

RECOVERY CRITERIA

See previous version of criteria in the recovery plan for Sonoma spineflower (*Chorizanthe valida*) (Section II, pp. 89-91) in the Recovery Plan for Seven Coastal Plants and the Myrtle's Silverspot Butterfly. [Click Here to View Document]

SYNTHESIS

Background and Status

Sonoma spineflower (*Chorizanthe valida*) is an erect-to-spreading annual herb in the buckwheat family (Polygonaceae). This federally endangered plant is endemic to the Point Reyes Peninsula along central California coast. Currently there is one wild, or natural, population within Point Reyes National Seashore (PRNS) (Reveal and Hardham 1989). Since its listing in 1998, Natural Park Service (NPS) botanists have implemented a number of introductions, at least five of which have been successful at establishing new occurrences (Parsons and Ryan 2018) (Service 1998a). The spatial distribution of the population fluctuates seasonally, but does not appear to be contracting (Williams 2008; Parsons and Ryan 2018). Staff at PRNS have conducted some level of monitoring since the species re-discovery, and efforts were improved in 2004 (Davis 1990; Parsons pers comm). Evidence shows that the surviving wild population of Sonoma spineflower occurs within California's annual coast-prairie grassland on Sirdrak sand. Sirdrak sand is a rare, well-drained Pleistocene soil type found in dunes with a 2-4% slope bearing to the north-

northwest (NRCS 2007; Parsons and Ryan 2018). Most of the successful established populations of Sonoma spineflower have been introduced on Sirdrak soil. It is likely these drier, low nutrient soils exclude competition from perennial species of grasses and forbs (Amelia Ryan pers. comm). Within Marin County, 90% (about 2,300 acres) of the Sirdrak soil lies within PRNS. Outside of PRNS, there are also soils of this type within the vicinity of Dillon Beach and Rodeo Lagoon.

The confirmed historical range of Sonoma spineflower is limited (Service 1998a). The species is further constrained by inhabiting naturally rare habitat within its geographic range (Ryan, pers. comm.). In addition, the species has a poor ability to disperse by natural means (Parson and Ryan 2018). Due to management efforts on the part of the NPS, the populations of Sonoma spineflower have persisted and even expanded since the species' rediscovery. However, habitat loss and degradation are still the main threats to Sonoma spineflower. Non-native plants, trampling from livestock, drought, and climate change all pose a continuing threat to the plant.

Threats

The most significant threat to Sonoma spineflower is degradation to habitat. Non-native and native grasses, herbs, and shrubs compete for sunlight and can, in some cases, alter the nutrient content of dune soils and thereby favor non-native annual species that expand rapidly under high nutrient conditions. PRNS' monitoring indicated that yellow bush lupine (*Lupinus arboreus*; a plant native to some areas of California, although possibly not native to Marin County) and coyotebrush (*Baccharis pilularis*) are threats to the wild population, along with non-native annual grasses in wetter years. Initially, common velvetgrass (*Holcus lanatus*) was thought to be a possible threat, but years of monitoring have shown that this species tends to be restricted to the adjacent soil type, Sirdrak Sand, Variant, which is much wetter. Yellow bush lupine, which is capable of fixing nitrogen, has been shown by researchers to increase nitrogen content of the soils and thereby promote establishment of weedy, non-native annuals (Maron and Connors 1996). Some of the weedy, non-native annuals that are present in the wild population include *Festuca bromoides*, *Bromus hordeaceus*, *Aira caryophyllea*, *Cynosurus echinatus*). Because bush lupine and coyotebrush appear to pose a greater long-term threat to Sonoma spineflower than other non-native and native plants, PRNS staff has focused removal efforts on these species.

Research suggests that grazing might be an effective method for removing invasive plant species in areas occupied by Sonoma spineflower (Davis and Sherman 1992). Sonoma spineflower is probably unpalatable to grazers, unlike many of the invasive grasses (Davis and Sherman 1992). By allowing cattle and other livestock to graze, Point Reyes National Seashore leases federal lands to ranchers for grazing (Parsons and Ryan 2018). Staff at PRNS have worked with lessees to adjust agricultural infrastructure such as two-track ranch roads to benefit Sonoma spineflower populations in recent years (Parsons and Ryan 2018). Grazing by cattle is likely not a direct threat to the Sonoma spineflower. In fact, grazing might be needed to maintain robust, healthy wild populations (Parsons 2019 pers. com.). Populations should still be monitored to ensure threats do not exist from grazing (Service 2010).

Climate change could pose additional threats to the persistence of Sonoma spineflower. Assessing this threat is difficult, as the extent of average temperatures increases in California/Nevada is difficult to predict, as are the likely related changes to the level of threat posed by factors such as drought and fire (Loarie et. al. 2008; Keeley 2002). 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 (Blair et. al 2017; Loarie et. al. 2008).

AMENDED RECOVERY CRITERIA

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered at the point which it might be downlisted to threatened or that the protections afforded by the Act are no longer necessary and Sonoma spineflower might be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from endangered to threaten. The term "endangered species" means any species (species, sub-species, or Distinct Population Segment) which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Revisions to listing decisions, including delisting or downlisting a species, must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is an endangered or threatened entity or not, based on the current scientific knowledge of existing threats. Section 4(b) of the Act requires a determination be made "solely on the basis of the best scientific and commercial data available." Thus, recovery plans provide important guidance and measurable objectives against which to measure recovery progress. However, they serve as guidance for these actions, and are not regulatory documents.

Recovery criteria should help indicate when we would anticipate an analysis of the species' status under section 4(a)(1) would result in a determination in which the species no longer exists in a threatened or endangered status.

We provide both downlisting and delisting criteria for the Sonoma spineflower. These criteria supersede those included in the Recovery Plan for Seven Coastal Plants and the Myrtle's Silverspot Butterfly.

Downlisting Recovery Criteria

In addition to what was included in the original recovery plan (Service 1998a), not in italics below, we have added new recovery criteria revisions, in italics below. Because the appropriateness of delisting is assessed by evaluating the five-factors identified in the Act, the recovery criteria below pertain to and are organized by these factors.

Factor A: ***Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range Protect existing populations and habitats.***

The main threat to the persistence of Sonoma spineflower is habitat change and destruction. These threats must be reduced or eliminated in order to downlist, or delist, the plant. This will be accomplished when the following have occurred:

A/1 *At least six successful populations have been established. These populations will be considered self-sustaining populations after 15 years, which includes a normal precipitation cycle.*

A/2 *The area of each Sonoma spineflower population is maintained at or above approximately 2 acres in size*[2].

A/3 *The cover of invasive native and non-native plants, such as bush lupine, at all sites is controlled at <1% within areas containing Sonoma spineflower.*

A/4 *There are* management measures implemented to address the threats of invasive species and other problems, including pedestrians and off-road vehicles at some sites.

A/5 Monitoring reveals that management actions are successful in reducing threats of invasive non-native species.

Factor B: ***Overutilization for Commercial, Recreational, Scientific, or Educational Purposes***

The only known populations of Sonoma spineflower exist on lands owned and operated by the National Park Service. Although recreation occurs on these lands[3], populations of Sonoma spineflower are probably not threatened by recreational activities. Therefore, no criteria were developed for this factor.

Factor C: ***Disease or Predation***

Cattle rarely graze on Sonoma spineflower (Davis and Sherman 1992). Research suggests grazing might actually benefit populations over time (Davis and Sherman 1992). Because there is little or no threat to the persistence of Sonoma spineflower from grazing, no recovery criteria were developed for this factor.

Factor D: ***Inadequacy of Existing Regulatory Mechanisms***

The inadequacy of existing regulatory mechanisms not considered a threat to Sonoma spineflower at this time. Therefore, no recovery criteria were developed for this factor.

Factor E: ***Other Natural or Manmade Factors Affecting Its Continued Existence***

[2] During prolific years, the wild population of Sonoma spineflower occupies an area of approximately 2 acres (Parsons and Ryan 2018). This is large enough for a population to persist for the foreseeable future.
[3] The mission of the National Park Service is to preserve natural and cultural resources for public benefit.

E/1 *The number of individuals within each Sonoma spineflower population remains at or above 90,000[4] for 15 years[5], which includes cycles of normal precipitation.[6]*

E/2 Seeds are stored in at least two Center for Plant Conservation certified facilities; seed germination, propagation, and out-planting propagation techniques are understood.

Delisting Recovery Criteria

Full recovery of the Sonoma spineflower will occur when the grasslands on ancient dune habitat they inhabit are secure, with evidence demonstrating non-native and, in some cases, native plants and other threats (such as ranch activities) are controlled and managers have shown their ability to keep threats under control. The Sonoma spineflower needs to be secure in their presently-occupied ranges, and opportunities should be taken to introduce these plants to restored habitat in or near historic ranges. The area occupied by the plants should increase commensurate with improving habitat conditions. The determination that delisting is possible must be based on at least 20 years of monitoring for the endangered taxa, to include wet and drought years.

Factor A: *Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range Protect existing populations and habitats*

A/1 *At least eight successful populations have been established* on appropriate habitat [that] has been secured *within the historic range. Populations will be self-sustaining after 15 years, which includes a normal precipitation cycle.*

A/2 *Further invasion or increase in non-native or native invasive plant species has been prevented, including perennial species such as bush lupine and coyotebrush, within all Sonoma spineflower populations.*

A/3 Habitat occupied by the species that is needed to allow delisting has been *voluntarily* secured, with long-term commitments and, if possible, endowments to fund [the] conservation of the native vegetation.

Factor B: *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes*

The only known populations of Sonoma spineflower exist on lands owned and operated by the National Park Service. Although recreation occurs on these lands[3], populations of Sonoma spineflower are probably not threatened by recreational activities. Therefore, no criteria were developed for this factor.

[4] This number is based on expert opinion of NPS biologists managing the only extant population of Sonoma spineflower (Ryan 2018).

[5] 15 years of monitoring is considered sufficient to ensure a population will persist for the foreseeable future (Service 1998a).

[6] A normal precipitation cycle is defined as a series of years that encompass average, above-average, and below-average rainfall conditions, starting and ending with average precipitation. Populations must demonstrate the ability to survive both precipitation extremes (Service, 1998b).

Factor C: *Disease or Predation*

Cattle rarely graze on Sonoma spineflower (Davis and Sherman 1992). Research suggests grazing might actually benefit populations over time (Davis and Sherman 1992). Because there is little or no threat to the persistence of Sonoma spineflower from grazing, no recovery criteria were developed for this factor.

Factor D: Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms is not known to threaten Sonoma spineflower at this time. Therefore, no recovery criteria have been developed for this factor.

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

E/1 *Ensure that seed banking practices, including seed germination, propagation, and out-planting propagation techniques, are understood and implemented as needed.*

E/2 *Seeds at banking facilities are renewed at a rate to ensure that seed stores remain viable in perpetuity.*

All classification decisions consider the following five factors: (1) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; (2) is the species subject to overutilization for commercial, recreational scientific or educational purposes; (3) is disease or predation a factor; (4) are there inadequate existing regulatory mechanisms in place outside the ESA (taking into account the efforts by states and other organizations to protect the species or habitat); and (5) are other natural or manmade factors affecting its continued existence. When delisting or downlisting a species, we first propose the action in the *Federal Register* and seek public comment and peer review. Our final decision is announced in the *Federal Register*.

Rationale for Recovery Criteria

We have amended the recovery criteria for Sonoma spineflower to include delisting criteria that incorporate the biodiversity principles of resiliency, redundancy, and representation (Service 2016) and threats addressed under the five factors. The amended criteria were developed based on the Service's current understanding of the species needs and requirements. This understanding includes information gathered since the original recovery plan was published, such as more recent information about population status and trends, along with an updated understanding of the threats acting on the species, as summarized in the syntheses above. The criteria presented are based on the reduction of threats to the species, ensuring that sufficient redundancy exists to withstand potential catastrophic events, and they include a temporal aspect to ensure that the species are resilient to expected variation within a reasonable timeframe.

ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS

The actions identified below are those that, based on the best available science, are necessary to bring about the recovery off all listed species in this amendment and ensure their long-term conservation. However, these actions are subject to modification as might be indicated by new

findings, changes in species status, and the completion of other recovery actions. The actions listed here are new and should be considered in addition to the actions in the original recovery plan. The most stepped down (detailed) actions have been assigned a priority for implementation, according to our determination of what is most important for the recovery of these species based on the life history, ecology, and threats.

Key to Terms and Acronyms Used in the Recovery Action Narrative and Implementation Schedule:

Priority numbers are defined per Service policy (Service 1983) as:

Priority 1: An action that must be taken to prevent extinction or to prevent a species from declining irreversibly.

Priority 2: An action that must be taken to prevent a significant decline of the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the species.

The following Recovery Actions Narrative provides detail of the actions necessary to achieve full recovery. The priority assigned to each action is specified within parentheses at the end of the description.

The numeric recovery priority system follows that of all Service recovery plans. Because situations change over time, priority numbers must be considered in the context of past and potential future actions at all sites. Therefore, the priority numbers assigned are intended to guide, not to constrain, the allocation of limited conservation resources.

The actions below are based on the best available science and observations, which the Service believes are necessary to move towards the recovery and downlisting of Sonoma spineflower.

1. **Establish or protect additional populations of Sonoma spineflower.**

    1.1 Introduce at least three new self-sustaining populations (**Priority 1**)

    1.2 Research possible insect pollinator species to determine appropriate management strategies for reintroduction sites.

    1.3 Continue work on seedbank dynamics with the goal of using the information to run a population viability analysis on the species (**Priority 2**).

    1.4 Research to determine what might cause population declines within the wild population, focusing on grazing intensity and pollinators (**Priority 1**)

2. **Conduct research to better understand life history and annual establishment.**

    2.1 Determining the extent of Sirdrak Sand outside of the park to help inform the

location of potential introduction sites (**Priority 3**).

2.2 Conduct an analysis of soil type and nutrients/water balance, vegetation cover, disturbance dynamics (grazing, rodents, rabbits) to identify new introduction sites outside of the PRNS to determine if appropriate habitat exists for possible reintroductions (**Priority 3**).

2.3 Research the potential to augment nesting habitat for main pollinators near some of the current and future introduction sites (**Priority 3**).

3. Monitor and manage existing populations on protected lands.

3.1 Maintain shrub cover within existing sites at acceptable levels through removal, as necessary (**Priority 3**).

3.2 Determine where some of the main pollinators identified in the two years of study on Sonoma spineflower nest near these populations (**Priority 3**).

3.3 Research the potential to augment nesting habitat for main pollinators near some of the current and future introduction sites (**Priority 3**).

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APPENDIX A – SUMMARY OF PUBLIC, PARTNER, AND PEER REVIEW COMMENTS RECEIVED

Summary of Public Comments

We published a notice of availability in the *Federal Register* on June 27, 2019 (84 FR 30760-30764) to announce that the draft revisions for 29 recovery plans covering 42 endangered or threatened species were available for public review, and to solicit comments by the scientific community, State and Federal agencies, Tribal governments, and other interested parties on the general information base, assumptions, and conclusions presented in the draft amendments. Electronic versions of the draft revisions were posted on the Service's Species Profile website, including draft revisions for Seven Coastal Plants and the Myrtle's Silverspot Butterfly (https://ecos.fws.gov/docs/recovery_plan/Draft%20Recovery%20Plan%20Amendment%20Chorizanthe%20howellii.pdf). We also developed and implemented an outreach plan that included (1) publishing a news release on our webpage (https://www.fws.gov/sacramento/outreach/2019/06-26/) on June 26, 2019, (2) sending specific notifications to Congressional contacts in Districts 2, and 12, and (3) sending specific notifications to key stakeholders in conservation and recovery efforts. These outreach efforts were conducted in advance of the *Federal Register* publication to ensure that we provided adequate notification to all potentially interested audiences of the opportunity to review and comment on the draft revisions for seven species covered in the Seven Coastal Plant and Myrtle's Silverspot Butterfly.

We did not received any comments in response to our request for public comment.

Summary of Peer Review Comments

We solicited independent peer review between the draft and final amendment in accordance with the requirements of the Act, including local and federal agencies. Criteria used for selecting peer reviewers included their demonstrated expertise and specialized knowledge related to the management of the Sonoma spineflower and its habitat. The qualifications of the peer reviewers are in the decision file and the administrative record for this recovery plan amendment.

In total, we solicited review and comment from four peer reviewers and two partner agencies. We received comments from one partner reviewer, the National Park Service. In general, the draft recovery plan amendment was well received by the peer and partner reviewers and garnered positive comments. Several reviewers provided additional specific information, including documents or citations; we thank the reviewers for these data and we have added the information where appropriate.

We considered all substantive comments, and to the extent appropriate, we incorporated the applicable information or suggested changes into the final recovery plan amendment. Below, we provide a summary of specific comments received from peer and partner reviewers with our responses; however, we addressed many of the reviewers' specific critiques and incorporated their suggestions as changes to the final recovery plan amendment. Such comments did not warrant explicit response, and as such, are not addressed here. We appreciate the input from all

commenters, which helped us to consider and incorporate the best available scientific and commercial information during development and approval of the final recovery plan amendment.

Peer Review:

Peer Review Comment (1): One commenter suggested that we do not have enough quantitative information to say with certainty that the population of Sonoma spineflower is increasing.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (2): One reviewer agreed with the Service's assessment that habitat loss and degradation are the main threats to the species recovery. However, the reviewer pointed out that competition from native and non-native plants, low grazing intensity, extreme climatic cycles (drought and extreme wet years), trampling by livestock and issues with pollinators are also threats.

Response: We acknowledge the comment and agree with the peer reviewer's assessment of the threats to the Sonoma spineflower. For the purposes of assessing the recovery potential of the Sonoma spineflower, it was necessary to create recovery criteria for this species. To help inform this process, it was important to identify the threats which act most strongly on the long-term viability of the species. Therefore, it was important to illustrate which threats the recovery criteria should address. That said, we agree that the other threats listed important for species recovery, and acknowledge the importance of these threats throughout the recovery plan amendment and in our status documents for the species.

Peer Review Comment (3): One reviewer pointed out that there are no sheep currently located on Point Reyes National Seashore, and land managers have not researched the response of Sonoma spineflower to sheep grazing.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (4): One reviewer stated that under-grazing could be a threat to the persistence of Sonoma spineflower.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (5): One reviewer pointed out that some climate change models show different future projections along coastal habitats in California. The reviewer emphasized that models developed for inland California might not be appropriate for coastal plant species.

Response: The U.S. Fish and Wildlife Service uses the best available science to inform our recovery documents. We understand that climate change is difficult to predict and that some models might not be accurate for microclimate-scale changes. However, all climate change scenarios predict changes at some level - even within coastal ecosystems. Within this document,

we have not used climate change models to predict these change with any certainty, only to acknowledge the uncertainty under changing future scenarios.

Peer Review Comment (6): One commenter was unsure what a "normal precipitation cycle" was.

Response: We define a normal precipitation cycle as a series of years that encompass average, above-average, and below-average rainfall conditions, starting and ending with average precipitation. The recovery plan amendment has been updated to reflect this definition.

Peer Review Comment (7): One reviewer pointed out that separate introduction sites have a variety of population dynamics; some sites are composed of individual plants which were introduced on a variety of occasions, so they are treated as separate introductions, but are undoubtedly part of one, functional population.

Response: We agree with this assessment and believe population dynamics are an important part of species recovery. Functional populations, or groups of individuals which interbreed, are necessary for species survival. While we appreciate this comment, a discussion of population-level dynamics is beyond the scope of this recovery plan amendment. This information will be noted for future review of the species life history.

Peer Review Comment (8): One peer reviewer mentioned that bush lupine and coyotebrush are both species which threaten to the long-term survival of the Sonoma spineflower. Both of these plants are native to California, although they might not be native to Marin County, or the grassland-dune ecosystem in which Sonoma spineflower is found.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (9): One peer reviewer maintained that pedestrians are not a threat to Sonoma spineflower. This commenter also admitted that vehicles can be a threat, but measures have been taken to route Park Service roads around existing populations.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (10): One reviewer pointed out that we do not know what the threshold is for a recovered population of Sonoma spineflower. The reviewer stated that the species population numbers fluctuate annually, and with changing climate factors. According to the reviewer, more research is needed to understand what constitutes a viable population.

Response: We understand and agree that it is difficult to accurately quantify the threshold for a recovered species. We also agree that it is important to consider inter-annual variation in population numbers when assessing the long-term viability of a species, and that continuing research should be done on the ecology of the Sonoma spineflower. However, the Service must estimate the potential for recovery using the best available science, which often includes making assumptions based on expert opinion and other available resources. Should more accurate information become available through future research, said information will be incorporated into future recovery decisions regarding the Sonoma spineflower.

Peer Review Comment (11): One peer reviewer stated that Sonoma Spineflower does not inhabit a dune ecosystem, but grasslands formed on ancient dune soils.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (12): One peer reviewer expressed uncertainty about the use of "restored habitat" and suggested that the term "appropriate habitat" might be used instead.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (13): One peer reviewer stated their opinion that the recovery action of highest priority should be to determine what is impacting numbers in the wild population, whether it is related to grazing intensity, and identifying pollinators for the Sonoma spineflower.

Response: Where applicable, the Recovery Plan Amendment was updated to reflect the reviewer's suggestion.

Peer Review Comment (14): One reviewer stated that areas the Service has identified as "populations" have been treated as "introductions" by the Park Service. Within Point Reyes National Seashore, F Ranch has been treated as many introductions, but probably constitutes one, genetic population.

Response: Please see the detailed response to comment 7.

Peer Review Comment (15): One peer reviewer pointed out that soils have already been mapped within Point Reyes National Seashore, and asked the Service to clarify if it is a recovery action priority to conduct soil mapping outside of the National Seashore boundaries.

Response: The language within the recovery amendment was updated to clarify that soils should be mapped outside of Point Reyes National Seashore.