

Malacothamnus fasciculatus var. *nesioticus*
(Santa Cruz Island bushmallow)

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



Photo by: Brent Miller, Foliosus

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

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5-YEAR REVIEW
Malacothamnus fasciculatus* var. *nesioticus
(Santa Cruz Island bushmallow)

I. GENERAL INFORMATION

Purpose of 5-Year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' 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:

Malacothamnus fasciculatus var. *nesioticus* (Santa Cruz Island bushmallow) is a small soft-woody shrub in the mallow (Malvaceae) family. It grows up to 2 meters (6 feet) tall, with slender branches, palmate leaves, and rose-colored flowers. This endemic variety is currently known from only four small populations on Santa Cruz Island, in the northern Channel Islands of southern California, where it occurs on rocky, south-facing slopes in chaparral and coastal scrub vegetation types. Primary threats to the species include low reproduction and stochastic extinction exacerbated by small population size, and competition with nonnative species.

Methodology Used to Complete This Review:

This review was conducted by staff in the U.S. Fish and Wildlife Service (Service), Ventura Fish and Wildlife Office, Ventura, California. The review is based on the following: information available in current published and unpublished literature; discussions with other agency biologists; discussions with species experts; information available on the internet; and the Ventura Fish and Wildlife Office species files; additionally, reports by the U.S. Geological Survey-Biological Resources Division (USGS-BRD) were particularly useful. This 5-year review contains updated information on the taxon's biology and threats, and a re-assessment of the information in the last 5-year review. We focus on current threats to the species that are

attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register (FR) on May 25, 2011 (76 FR 30377). No information was received in response to this request.

Listing History

Original Listing

FR notice: 62 FR 40954

Date listed: July 31, 1997

Entity listed: variety (*Malacothamnus fasciculatus* var. *nesioticus*)

Classification: Endangered

Associated Rulemaking: None

Review History:

The previous 5-year review was published in September 2007. The 5-year review resulted in a recommendation for no change to the listing classification of endangered.

Species' Recovery Priority Number at Start of Review: The recovery priority number for *Malacothamnus fasciculatus* var. *nesioticus* is 3, according to the Service's recovery plan for this species (Service 2000). This number is 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). The recovery priority number 3 indicates the taxon is a subspecies that faces a high degree of threat and has a high potential for recovery.

Recovery Plan or Outline

Name of Plan: Thirteen Plant Taxa from the Northern Channel Islands Recovery Plan.

Date Issued: September 26, 2000.

Dates of previous revisions, if applicable: None.

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 limits listing as distinct population segments to 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 listing of these species is not addressed further in this review.

Updated Information and Current Species Status, Biology, and Habitat

Description and Taxonomy:

Malacothamnus fasciculatus var. *nesioticus* is a small soft-woody shrub in the mallow (Malvaceae) family. It grows up to 2 meters (6 feet) tall, with slender branches, palmate leaves, and rose-colored flowers arranged in panicles on the branch tips. Each flower produces a dry fruit that contains 8 to 10 ovules. It is one of five varieties of *Malacothamnus fasciculatus*, the other four being *nutallii*, *catalinensis*, *laxiflorus*, and the typical variety, *fasciculatus*. All are found within southern and Baja California (Swensen et al. 1995). The varieties differ from each other in the arrangement of flowers on the branches and shape of the leaves.

Distribution:

Malacothamnus fasciculatus var. *nesioticus* is endemic to Santa Cruz Island and is known from only four localities. Approximately 24 percent of Santa Cruz Island is owned and managed by Channel Islands National Park (NPS) and the remaining 76 percent of the island is owned by The Nature Conservancy (TNC). All four localities for *Malacothamnus fasciculatus* var. *nesioticus* (see USGS map, p. 6) are on lands owned by TNC, which has entered into a cooperative agreement with NPS to manage Santa Cruz Island as a single ecological unit (TNC 2003).

Malacothamnus fasciculatus var. *nesioticus* was first collected by E.L. Greene in 1886 at an unspecified location. Specimens were collected near Christy Ranch in 1927 by H. L. Mason and again at the same location in 1930 by R. Hoffmann (Christy Ranch site). At the time of listing, there were only two known populations consisting collectively of 42 plants (Wilken and McEachern 2009). One population was located on the west shore of the island near the historical Christy Ranch. The second population was discovered in 1993 in the Central Valley near the University of California Field Station (from here on referred to as the Central Valley site). In May of 1997, Wilken collected specimens at this site and at a newly discovered third site located on the ridge between the Horqueta and Alamos drainages (Horqueta-Alamos Ridge site) (D.

Wilken, *in litt.* 2006a). A fourth population was discovered in 1997 by J. Howarth (D. Wilken, *in litt.* 2006b) on the ridge between Cañada Cebada and Cañada de los Sauces (from here on known as the Cebada Ridge site). Since the last 5-year review, no new populations have been discovered.

Reproduction and Seed Characteristics:

In the early 2000's, the USGS initiated research to investigate the causes of the species' apparently very low natural reproduction. Data collected by Wilken (D. Wilken, *in litt.* 2006b) suggested that seed production varied with site and year. The Cañada Cebada population showed relatively high seed set in 2001, 2002, and 2003, whereas the Christy Ranch population rarely produced seeds in any year that Wilken visited it. In addition, the population in the island's central valley, by the University of California (UC) Field Station, always produced seeds but the number varied from year to year. Under controlled growing conditions at the Santa Barbara Botanic Garden (SBBG), such as using hand pollination techniques, strains derived from each of these natural populations have always produced seeds and Wilken has routinely seen 6 to 8 seeds per fruit with more than 80 percent of all hand-pollinated flowers setting fruit. Plants in the control group at SBBG that were not hand-pollinated showed much lower fruit set and anywhere from 2 to 6 seeds per flower, although 90 percent of fully formed seeds showed high viability. Based on their research, Wilken and McEachern (2009) concluded that *Malacothamnus fasciculatus* var. *nesioticus* has a self-compatible breeding system but for maximum fruit and seed set, plants require insect visitation to augment pollination.

Habitat:

Each locality of *Malacothamnus fasciculatus* var. *nesioticus* on Santa Cruz Island differs from the others in steepness, slope aspect, and plant community type. The Christy Ranch population occurs on a gentle west-facing ridge top surrounded by California sagebrush (*Artemisia californica*) and lemonade berry (*Rhus integrifolia*). The Central Valley population is found on steep, west-southwest-facing canyon walls in rocky outcrops composed of the Santa Cruz Island Volcanics Formation (volcanics) (Junak et al. 1995). The volcanics are dark brown to black in color with a vesicular texture (meaning there are circular holes or pores in the rock that make it look like a sponge) (Longinotti and Bartolomeo 2010) that forms crevices where *Malacothamnus fasciculatus* var. *nesioticus* can become established. The Central Valley population is surrounded by California sagebrush, island mountain mahogany (*Cercocarpus betuloides* subsp. *blancheae*), and toyon (*Heteromeles arbutifolia*). The Horqueta-Alamos Ridge site is found on colluvium from the volcanic Blanca Formation on a south-southwest-facing slope surrounded by California sagebrush and Santa Cruz Island buckwheat (*Eriogonum arborescens*) (Junak et al. 1995). The Cebada Ridge population is found on consolidated Quaternary alluvium along a flat ridge top surrounded by *Quercus pacifica* (Channel Island scrub oak) (Wilken et al. 2009).

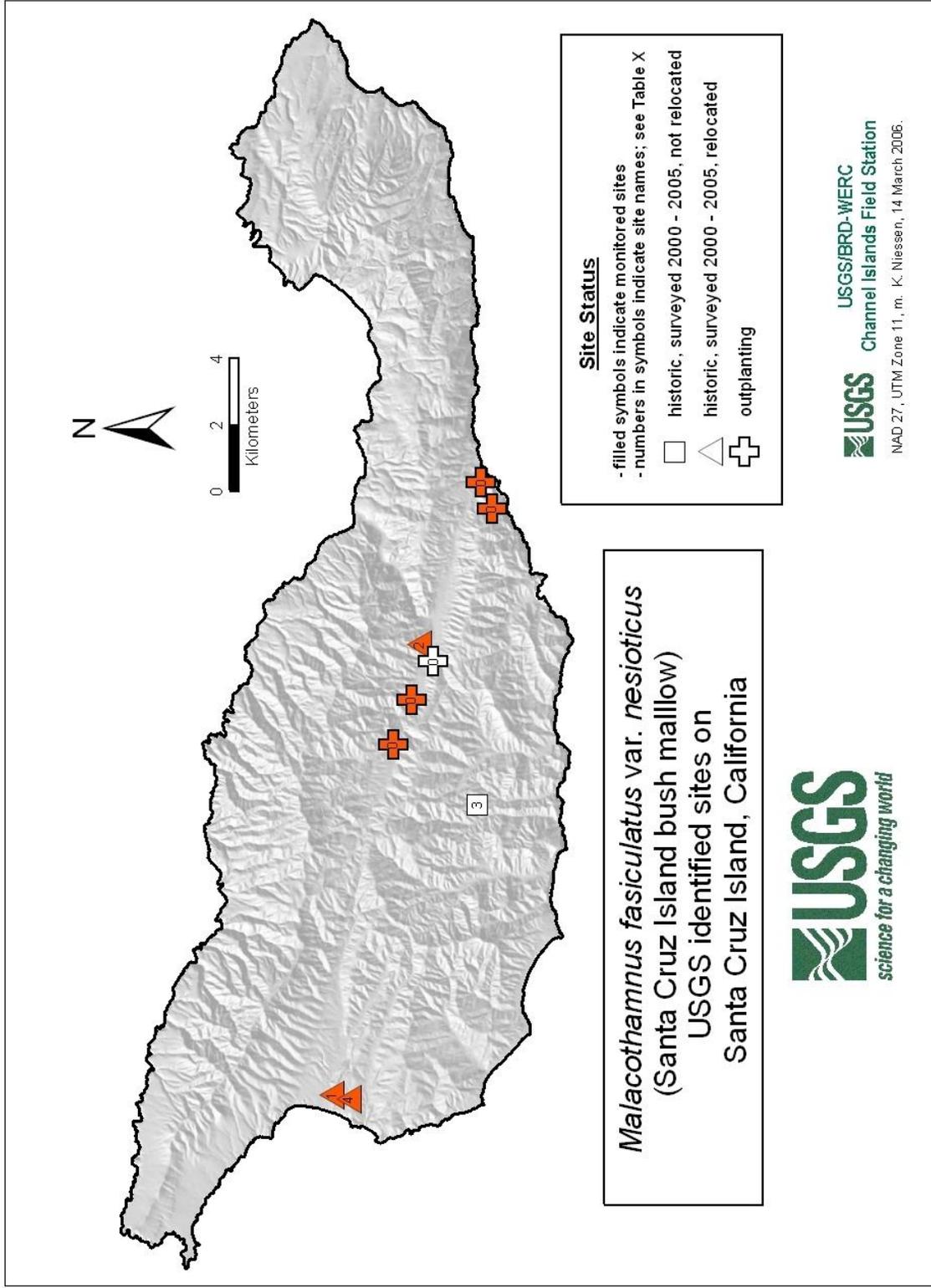


Figure 8

Abundance, Population and Demographic Trends:

Results from genetic studies indicate that each population of *Malacothamnus fasciculatus* var. *nesioticus* on Santa Cruz Island is made up of clones from a few individual plants (Swensen et al. 1995; McEachern and Chess 2006). This is because new shoots sprout from underground rhizomes, so that many stems actually represent the genotype, or genetic clone, of one plant. For example, at the time listing, the Central Valley population appeared to comprise 19 individual plants but it was found to consist of clones of only 3 plants. Likewise, the Christy Ranch population consisted of less than 50 stems that represented only 10 plants.

All four known populations of *Malacothamnus fasciculatus* var. *nesioticus* were surveyed during the 2004, 2005, and 2006 growing seasons by the USGS-BRD (McEachern et al. 2010). Results of demographic surveys in 2004 and 2006 are as follows (McEachern et al. 2010):

Table 1: Stem counts and estimated number of individuals in four natural populations of *Malacothamnus fasciculatus* var. *nesioticus*.

Site Number	Site Name	Area (m ²)	2004		2006	
			Stems	Est # individuals	Stems	Est number of individuals
1	Christy Ranch	300	20-40	--	64	3
2	North of Field Station (Central Valley)	50	18-20	--	Not surveyed	--
3	*Horqueta-Alamos Ridge	1,100	Not surveyed	--	166	3
4	Cebada Ridge	1,500	831	7	1,137	10

* None of the original 3 plants (50-60 stems) (Service 2000) were found at the Horqueta-Alamos Ridge site, even after searching three different times, during each of the 2004 and 2005 growing seasons (McEachern and Chess 2006). It was later realized that inconsistencies of details and a transcription error had made the site elusive. When the site was revisited in June 2006, 1,137 individual stems representing 10 plants were located by the surveyors (D. Wilken, *in litt.* 2006b).

At the time of the last 5-year review, the three plants at the Horqueta-Alamos Ridge site appeared much healthier and more robust than plants at the other localities (K. Chess, *in litt.* 2006). Chess reports the middle plant resembled a dense thicket of at least 42 stems, many of which were approximately 2 meters (6 feet) tall. Chess speculated on the reasons for the robustness of these plants. One possibility is that because the Horqueta-Alamos Ridge is very steep and hard to access, the site has been visited less often than the other sites. Consequently there may have been less compaction of the soil around the plants and less disturbance to the plants themselves from collecting stems for cuttings and samples. Another possibility is that because the vegetation at the site consists of grassland with scattered native shrubs rather than the more dense vegetation at the other sites, there is less competition from other plants. Chess recommends that more research be focused on the community level because the species is surviving at localities that differ so much from each other in steepness, slope aspect, and plant community type.

In 2008, USGS visited the four known natural populations of *Malacothamnus fasciculatus* var. *nesioticus* on Santa Cruz Island; they were last visited in 2006 and were still there but have not been monitored since then (K. McEachern *in litt.* 2012). Observations of the Christy Ranch population indicate its vegetative reproductive strategy may be different from the other three natural populations. While three of the four appear vigorous, the Christy Ranch population appeared to be shrinking – shoots were dying back at the upslope verges of the clump. The Christy Ranch population establishes a vigorous shrub that puts out root sprouts up to several meters away. The central, older shrub grows vigorously for about 5 or more years, and then slowly dies while the root sprouts remain vigorous and establish more sprouts at the verges of the clump. Three of the four population genotypes (including the Christy plants) are represented in cultivation at the Santa Barbara Botanic Garden (McEachern and Rodriguez 2008).

Outplanting Trials:

1996-2005: Before 2005, a total of 26 plants had been transplanted into 6 fenced exclosures on Santa Cruz Island at: Portezuela, Cascada, European Field, Stanton Airstrip, Valley Anchorage, and Alberts Ridge (D. Wilken, *in litt.* 2006a). Plants were grown at SBBG from cuttings from the natural Christy and Central Valley populations. Four 1-gallon plants (two of each strain) were planted at each of the six enclosures except Alberts Ridge, at which six plants were planted. Only one of these plants survived and it is located between Valley Anchorage and the Main Ranch airstrip (McEachern and Chess 2006). This plant has been doing very well in the exclosure, putting up at least a dozen stems a year since 2004. In early 2006, the USGS-BRD (McEachern and Chess 2006) reported seeing several new stems from this plant emerging outside the exclosure.

2005: In December 2005, 51 plants were out-planted into four of the exclosures: Portezuela, European Field, Albert’s Ridge, and Valley Anchorage (Table 2). These plants were grown from cuttings taken from wild populations at three sites: Cebada Ridge, Horqueta-Alamos Ridge, and the Central Valley site (D. Wilken, *in litt.* 2006a).

Table 1. Survivorship: number of surviving plants in each year and overall proportion of survivors at each experimental site after 31 months. Plants were placed into sites during December 2005 (modified from Wilken and McEachern 2009).

Site Name	Dec-05	Jul-06	Jun-07	Jul-08	Overall Survivorship
Albert’s Ridge	13	13	7	7	0.54
European Field	13	13	11	10	0.77
Portezuela	13	13	8	3	0.23
Valley Anchorage	12	12	11	11	0.92
TOTALS	51	51	37	31	0.61

2011: The USGS, in collaboration with the UC Reserve, Growing Solutions, Inc. and The Nature Conservancy, established a plant nursery on Santa Cruz Island in 2008 (McEachern and Rodriguez 2008). Kathryn McEachern, USGS Research Plant Ecologist, and colleagues from the Channel Islands National Park collected cuttings from the Cebada Ridge and Central Valley populations and propagated them in the Santa Cruz Island nursery. Nineteen plants were set out

in April, 2011, on the south side of the creek across from the nursery facility. Survival as of January, 2012, is 100 percent (K. McEachern *in litt.* 2012).

In December, 2011, 120 plants were set out in five locations within the zones of argentine ant infestation: (1) near the UC Reserve Field Station (3 locations), and (2) between the airstrip and Valley Anchorage (2 sites on the south side of the road). Plants were clustered in groups of 20 to 50 stems, in a mix of different genetic parents. These were plants grown from cuttings from native populations at the Horqueta-Alamos Ridge, the Cebada Ridge, and the Christy Ranch, as well as seeds collected from plants growing in the nursery from the Horcheta-Alamos parent stock. As of January, 2012, survival is 100 percent. The December outplantings were watered through June 2012; watering was then suspended for the year (K. McEachern *in litt.* 2012).

Other Conservation Measures Undertaken:

The NPS, in collaboration with the USGS-BRD and the Service, developed a Conservation Strategy to help guide landscape level actions that would indirectly aid in recovery of *Malacothamnus fasciculatus* var. *nesioticus* and other threatened and endangered species on the northern Channel Islands (Coonan et al. 1996). The Conservation Strategy calls for specific island-wide conservation measures for all threatened and endangered plant species on the northern Channel Islands. For each individual taxon, the goals are to:

1. Immediately increase reproductive effort and recruitment of new individuals into populations;
2. Achieve increasing population growth rates over the next 10 to 15 years; and
3. Expand population boundaries.

In 2003, the USGS-BRD began a research program on Santa Cruz Island to aid in developing conservation plans. The program includes field surveys and monitoring to determine population status, field and greenhouse experiments to identify techniques for propagation, and out-planting trials. In 2005, the USGS-BRD continued surveys for population locations not found in 2003-2004, completed annual demographic monitoring, collected seed for banking at the SBBG, and began research on breeding system, seed viability and out-planting in collaboration with Wilken at the SBBG. All four sites were visited again in 2008 and cuttings were collected from the Christy Ranch site to be reared in the Santa Cruz Island nursery. Seed was collected for viability analysis; as of March 2011, those seeds have not yet germinated. An additional outplanting was also conducted in May 2010 and no mortality has been reported as of March 2011 (McEachern 2011).

Five-Factor Analysis

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

At the time of listing, *Malacothamnus fasciculatus* var. *nesioticus* was threatened by soil loss, habitat alteration, and feral pig rooting. Historically, large-scale habitat alteration caused by

large numbers of nonnative mammals on the islands resulted in significant loss of soils, as well as changes in the structure, composition, and richness of plant communities (Service 2000). By the time the recovery plan was published in 2000, sheep had been removed from all the northern Channel Islands. TNC and NPS initiated a feral pig removal effort in 2005; as of September 2006, nearly all the pigs had been removed from the wild (C. Cory, TNC, pers. comm., 2006). The last pig was removed from Santa Cruz Island in 2007 (Parkes et al. 2009), so active disturbance by feral pigs is no longer a threat. Although the threat to the species from habitat disturbance by feral pigs has been eliminated, the residual effects of habitat alteration, such as erosion and the dispersal of nonnative species, remain.

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

At the time of listing, this was not known to be a factor threatening *Malacothamnus fasciculatus* var. *nesioticus*. However, USGS-BRD data and observations since then point to the possibility that over-collecting in the past could have adversely affected the reproductive robustness of the plants, particularly at the Christy Ranch site (K. Chess, *in litt.* 2006). For many decades, the only known population of *Malacothamnus fasciculatus* var. *nesioticus* was near the buildings at Christy Ranch and was visited frequently by researchers. Records from the 1920s and 1930s indicate that cuttings and samples were taken exclusively from these plants and this may have caused loss of vigor and low-seed set. Twenty-three of the 26 herbarium specimens listed in the Consortium of California Herbaria (CCH) database were collected prior to listing of the taxon (CCH 2012).

Voucher specimens of *Malacothamnus fasciculatus* var. *nesioticus* were collected at the Christy Ranch and Cebada Ridge sites during 2004 surveys. Because of low seed production, no fruit or seed were collected from wild populations in 2004 or 2005 (McEachern and Chess 2006). Because of strict controls on collecting, we do not believe overcollection is currently a threat.

FACTOR C: Disease or Predation

At the time of listing, predation resulting from sheep grazing was considered a major threat to *Malacothamnus fasciculatus* var. *nesioticus* on Santa Cruz Island. Between 1983 and 1986, TNC removed over 30,000 sheep from the portion of the island within their ownership; by 1999, NPS had removed the remaining 2,000 sheep from the eastern end of the island (Schoenherr et al. 1999). Grazing is no longer considered a major threat to *Malacothamnus fasciculatus* var. *nesioticus*.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms:

At the time of listing, we discussed that regulatory mechanisms thought to have some potential to protect *Malacothamnus fasciculatus* var. *nesioticus* included: (1) state listing within California; (2) local land use laws and policies; and (3) the Federal Endangered Species Act (Act) in those cases where *Malacothamnus fasciculatus* var. *nesioticus* occurs and is incidentally protected in habitat occupied by a listed wildlife species. The listing rule (62 FR 40954) provides an analysis

of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain valid.

Local Regulations

Santa Cruz Island falls within the jurisdictional boundaries of Santa Barbara County. While no county regulations have provided specific protection to *Malacothamnus fasciculatus* var. *nesioticus*, the county's Agricultural Commissioner's Office has partnered with TNC to remove invasive weeds from the island. *Malacothamnus fasciculatus* var. *nesioticus* occurs on the portion of Santa Cruz Island that is managed and owned by TNC, which is a non-profit conservation organization that was established to help preserve the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. TNC works cooperatively with NPS and USGS to monitor and manage populations of listed species on their lands (TNC 2003).

State Regulations

Malacothamnus fasciculatus var. *nesioticus* was listed as endangered by the State of California in 1979 (California Department of Fish and Game 2005). The California Endangered Species Act prohibits the "take" of state-listed plants on private and state lands, except under permit. In general, these state regulatory mechanisms are not invoked because major changes in land use, such as development projects, are not likely to be proposed on Santa Cruz Island.

Federal Regulations

Although the four native populations are on lands privately owned by The Nature Conservancy, the NPS is closely involved with management of the federally listed plant species through a cooperative agreement, and thus, applicable federal laws and NPS policies and regulations apply to this species. We did not discuss any particular concerns regarding the adequacy of existing regulatory mechanisms at the time of listing, and it is not currently a concern.

The National Park Service Organic Act became law on August 25, 1916 (39 Stat. 535, 16 U.S.C. 1) and has been amended twice. The NPS Organic Act, as amended, states that the NPS "shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations ... to conserve the scenery and the national and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." Furthermore, the NPS Management Policies (NPS 2006a) indicate that NPS will "meet its obligations under the NPS Organic Act and the Endangered Species Act to both pro-actively conserve listed species and prevent detrimental effects on these species." This includes working with the Service and undertaking active management programs to inventory, monitor, restore and maintain listed species habitats, among other actions.

In summary, the application of available regulatory mechanisms under Factor D is infrequently invoked because the most significant threats to the species are not those that are ameliorated through regulation.

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

The major threat under Factor E at the time of listing concerned the high number of nonnative plants on Santa Cruz Island that were disrupting native habitat, preventing recruitment, and displacing native plant species. The listing rule discussed that the risk of extinction for *Malacothamnus fasciculatus* var. *nesioticus* from random events was exacerbated by small population size and competition with nonnative plants, which we discussed in the last 5-year review. In addition to these threats, since the time of the last 5-year review, we now recognize climate change as a potential threat.

Small Population Size

Today *Malacothamnus fasciculatus* var. *nesioticus* is threatened by the risk of stochastic extinction due to small population size and limited distribution, which was a threat at the time of listing and continues to be a threat. The conservation biology literature commonly notes the vulnerability of taxa known from one or very few locations and/or from small populations (e.g., Shaffer 1981, 1987; Primack 1998; Groom et al. 2006). In particular, small population size makes it difficult for this species to persist while sustaining the impacts of soil loss, shrub canopy loss, and competition with annual plants.

Low rates of seed production also restrict the ability of populations to grow in size. To this day, the Christy Ranch population has very low seed production and has not produced any seeds in the last several years. In addition, the possibility of low insect visitation, as suggested by Wilken (*in litt.* 2006a), may be another factor contributing to the Christy Ranch population's low seed production.

Competition with Nonnative Species

The disruption of native habitats and displacement of native species by nonnative plants, particularly sweet fennel (*Foeniculum vulgare*) and nonnative grasses, was considered a major threat at the time of listing (62 FR 40954). Fennel is particularly invasive because its leaves and stems contain chemicals that inhibit the growth of native plants (Schoenherr et al. 1999). Ironically, nonnative grazers seemed to control the spread of fennel by keeping a check on its abundance. Consequently, once the sheep had been removed, a program to manually remove sweet fennel was initiated due to concerns that it would take over vast areas of the island (Schoenherr et al. 1999).

Since listing, NPS and TNC have identified nonnative feral pigs and sweet fennel as the most significant disturbances to native plant communities, rare plant species, and archaeological sites on Santa Cruz Island (Schoenherr et al. 1999; NPS 2006b). Consequently, in October 2005, the NPS and TNC began a feral pig eradication program and as stated earlier, disturbance by feral pigs is no longer a threat.

With the removal of all feral pigs from the island, The Nature Conservancy began a weed abatement program in 2007 that consists of a plan to eradicate approximately 20 different species of nonnative plants within about 600 different populations on Santa Cruz Island. Most are

woody species and all pose a threat to native plants with which they compete. In addition to this general weed abatement program, TNC conducts annual sweet fennel eradication along drivable roads within TNC property lines. Since 2008, TNC has applied herbicide to all sweet fennel populations within 3.3 meters (10 feet) of drivable roads. This process has been proven to be very efficient in controlling the spread of invasive fennel plants (C. Cory, TNC, pers. comm. 2011).

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, Intergovernmental Panel on Climate Change (IPCC) 2007). In addition, an increase in the rate of sea level rise has been predicted for the coast of California (California Coastal Commission (CCC) 2001, California Climate Change Center 2006).

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 and that the species will "move" to higher elevations and northward, depending on the ability of each species to do so. In the case of smaller island ecosystems, such as the Channel Islands, opportunities to move to higher elevations or further north are limited. We lack adequate information to make specific and accurate predictions regarding how climate change, in combination with other factors such as limited geographical distribution, will affect federally listed species; however, small-ranged species are more vulnerable to extinction due to these changing conditions (Loarie et al. 2008); we consider *Macoathamnus fasciculatus* var. *nesioticus* to be a small-ranged species.

In summary, the combination of threats associated with soil loss and habitat degradation (discussed in Factor A), limited range, and existence of only four populations of *Malacothamnus fasciculatus* var. *nesioticus* make this species particularly vulnerable to substantial declines as a result of human-caused or natural events.

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 (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

In the recovery plan (Service 2000), general delisting criteria for the suite of 13 covered plants involve increasing the number of known populations either through surveying historical sites and potential habitat within the historical range to locate currently unknown populations, or repatriating or introducing several additional populations of the species. The plan suggests that until research demonstrates otherwise, downlisting for long-lived species should target a trend with increasing numbers of individuals and populations. The number of populations and the number of individuals will vary depending on the biology and life history of each taxon as well as the amount of suitable habitat available. The probability of population persistence over the long-term is expected to be higher for larger populations and taxa with a large number of populations because large size decreases the likelihood of reduced viability or population extirpations due to random naturally occurring events.

Downlisting criteria specific to *Malacothamnus fasciculatus* var. *nesioticus* are included as follows:

1) Establish five viable populations on Santa Cruz Island (addresses Listing Factors A, C, and E.) Only four natural populations are known at this time. Although surveys in historical and other suitable habitat have been conducted, other natural populations have not been found. In addition, no reintroduced populations are yet viable. Therefore, this criterion has not been met. We believe this criterion is adequate and appropriate with respect to the recovery of the species.

2) Maintain populations as stable or increasing with evidence of natural recruitment for a period of 15 years that includes the normal precipitation cycle (addresses Listing Factors A, C, and E). This criterion has not been met as not all populations on Santa Cruz Island are stable or increasing. We believe this criterion is adequate and appropriate with respect to the recovery of the species.

In the recovery plan, general delisting criteria for the suite of 13 covered plants involves increasing the number of populations, either through surveying historical sites and potential habitat within the historical range to locate currently unknown populations, or repatriating or introducing several additional populations of the species.

Delisting criteria specific to *Malacothamnus fasciculatus* var. *nesioticus* comprise the following:

1) Discover or establish five additional populations (addresses Listing Factors A, C, and E). This criterion has not been met. Given the showy nature of the plant, it is unlikely that there are other natural populations yet to be discovered. However, we believe that establishing five

additional populations is a more realistic goal.

2) No decline after downlisting for 10 years (addresses Listing Factors A, C, and E).

This criterion has not been met. Although we believe the intent of this criterion is appropriate, we think it should be refined in the future to focus more on long-term trends, rather than a short-term, absolute decline, once additional information about the life history of the species and its response to recovery actions are better understood.

Factors B and D are not relevant to this taxon. Factor C was relevant at the time of listing, but is no longer considered relevant.

IV. SYNTHESIS

At the time of listing, two populations of *Malacothamnus fasciculatus* var. *nesioticus* were known; currently there are four known natural populations. Since 2003, the USGS-BRD and NPS have developed and implemented a research and monitoring program on Santa Cruz Island that includes field survey and monitoring of *Malacothamnus fasciculatus* var. *nesioticus* to determine population status, field and greenhouse experiments to identify techniques for propagation, and out-planting trials on Santa Cruz Island (McEachern and Chess 2006). Research will continue through 2011 with current funding from the Santa Cruz Island pig eradication program and NPS Natural Resource Preservation Program. The pig eradication program has been completed and has alleviated the threat due to predation and trampling. Despite these efforts, the status of the species remains endangered due the low numbers of individuals, low numbers of populations, and low reproductive success in the field. Therefore, we are not recommending any change to the status of *Malacothamnus fasciculatus* var. *nesioticus* at this time.

V. RESULTS

Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No Change

New Recovery Priority Number: N/A

VI. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Seek additional funding beyond 2011 to continue field surveys and monitoring, demographic monitoring, conduct additional outplantings, and conduct further investigations into recovery prescriptions.
2. Continue nonnative vegetation removal on Santa Cruz Island.
3. Refine the generalized downlisting criteria to take into consideration new information regarding the limited number of genotypes that currently exist. Attaining the recovery objective of securing several populations containing a minimum of 2,000 plants each is unrealistic for this species.
4. Refine delisting criteria to emphasize long-term population trends rather than short-term gains or declines.
5. Investigate the community-level factors that influence population abundance, distribution, and demographic trends (e.g., slope steepness and aspect, vegetation type, temperature, precipitation).

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**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
Malacothamnus fasciculatus var. *nesioticus*
(Santa Cruz Island bushmallow)**

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No Change

Appropriate Listing/Reclassification Priority Number: N/A

Review Conducted By: Lauren Kehiayan and Della Snyder-Velto

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve Diane K. Nade Date 11/20/12