Hickman's potentilla (*Potentilla hickmanii*)

5-Year Review: Summary and Evaluation

Todd Lemein

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

August 2020

GENERAL INFORMATION:

Species: Hickman's potentilla (*Potentilla hickmanii*)
Date listed: August 12th, 1998
FR citation(s): 63 FR 43100
Classification: Endangered

BACKGROUND:

Most recent status review:

U.S. Fish and Wildlife Service (Service). 2009. *Potentilla hickmanii* (Hickman's potentilla) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service Ventura Fish and Wildlife Office. Ventura, CA. 18 pp.

FR Notice citation announcing this status review:

84 FR 36116-36118. Initiation of 5-Year Status Reviews of 58 Species in California, Nevada, and the Klamath Basin of Oregon; Notice of initiation of reviews; request for information. July 26, 2019.

Critical Habitat Designation:

No critical habitat has been designated.

State Listing:

Listed as endangered by the State of California in 1979 (CDFW 2019, p. 10).

ASSESSMENT:

Hickman's potentilla occurs in very small numbers (<80) at Indian Village in Monterey County and a larger population (~5,000) occurs on land managed by the Golden Gate National Recreation Area near Montara in San Mateo County. The Montara population is larger in acreage and abundance than the Indian Village population. At the time of listing, habitat loss due to development, vandalism and recreation, invasive species, and small population effects were identified as the primary threats to Hickman's potentilla (*Potentilla hickmanii*) (Service 1998, 63 FR 43109-43112). Herbivory was recognized as an additional threat in the Recovery Plan (Service 2004, p. 32-33). In the 2009 5-year review, climate change was added as a potential threat while vandalism was considered to no longer be a threat (Service 2009, pp. 8-11). Protections for existing populations, outplanting efforts, and reevaluation of threats are updated from the 2009 5-year review.

Data Review

This 5-year review was conducted by the Service's Ventura Fish and Wildlife Office. Data for this review were solicited from interested parties through a Federal Register notice announcing

this review on July 26, 2019 (84 FR 36116). We also conducted a literature review and contacted local botanists, consultants, federal and state partners, and land trusts. In 2015, the Service provided funding for invasive species control and outplanting at the Indian Village population.

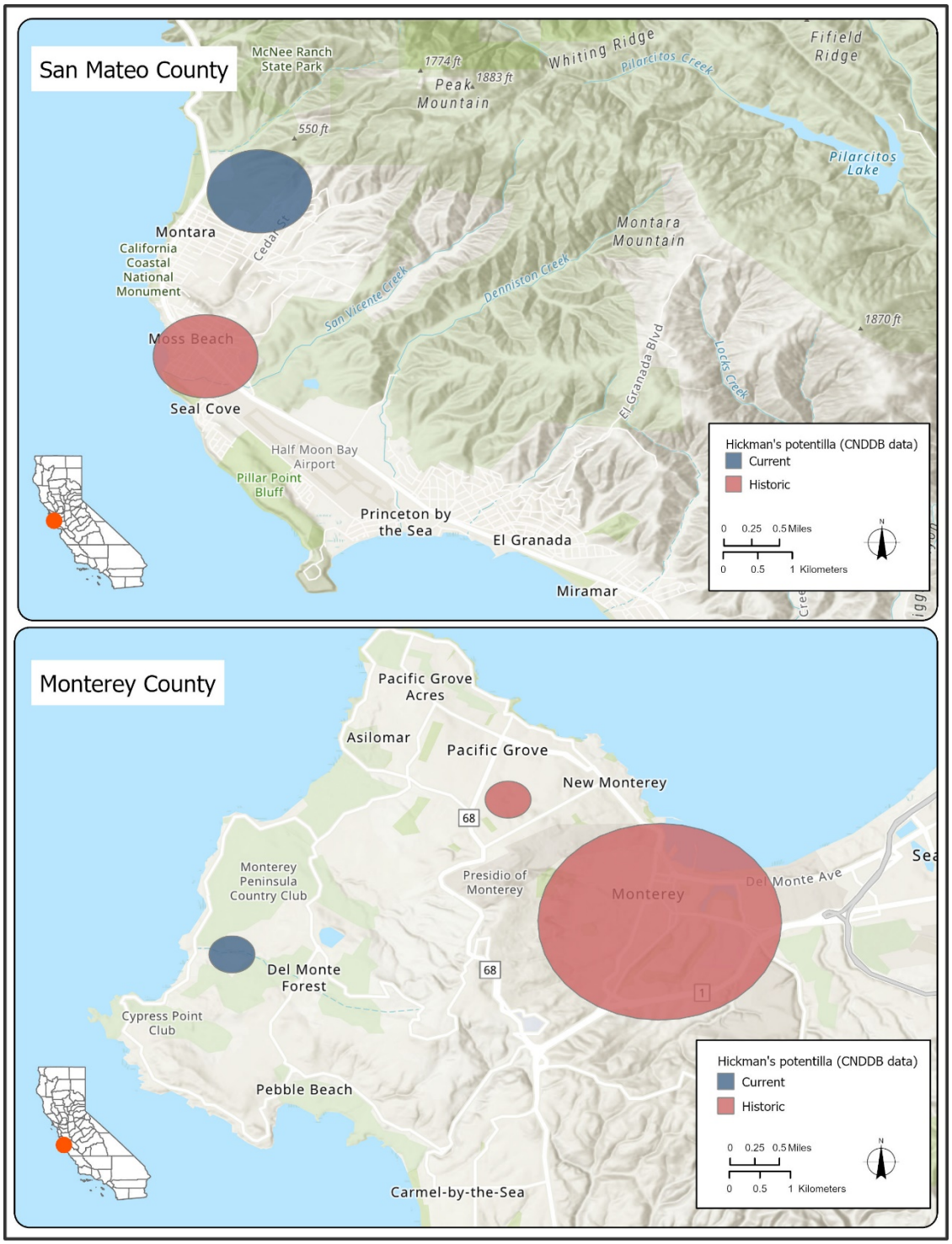

Figure 1. Approximate locations of historical and current Hickman's potentilla occurrences (CNDDB 2020).

Habitat

Hickman's potentilla is known from coastal terraces and hillsides within one mile of the coast in San Mateo and Monterey Counties (CNDDB 2020, data; Service 2009, pp. 6-7; Van Fleet Brown 2015, pp. 16-27). The vegetation communities are grass dominated with forb and shrub components. Commonly associated native grasses include *Danthonia californica, Festuca rubra*, and *Stipa pulchra*. The native grass component has decreased in abundance and cover as competition from non-native grasses has increased. Typical non-native grass species associated with Hickman's potentilla include *Avena* spp., *Bromus diandrus*, *B. hordeaceus*, *B. mollis*, *Briza* spp., *Lolium* spp., *Festuca arundinaceae*, *Holcus lanatus*, and *Phalaris aquatica*. Native forbs include *Viola* spp., *Sidalcea* spp., *Camissonia* spp., and *Acaena* spp. The grasslands where Hickman's potentilla occurs are interspersed or bordered by coastal scrub (characterized by *Artemisia californica*, *Baccharis pilularis*, *Toxicodendron diversilobum*, *Rhamnus californica*) and Monterey pine forest (*Pinus radiata*).

Population Data

We consider there to be two extant populations of Hickman's potentilla, the Indian Village population in Monterey County, and the Montara population in San Mateo County (Figure 1). Historical occurrences are known from additional areas in San Mateo and Monterey Counties but have been extirpated due to development. The Indian Village population occurs within approximately 0.33 acres (ac) (0.13 hectares (ha)) of grassland habitat managed by the Del Monte Forest Conservancy (DMFC) bordered by Monterey pines, a golf course, and residential development. The site was originally maintained as a day-use area for the surrounding residential community that may have prevented habitat succession from a grass dominated community to Monterey pine forest (Service 2009, p. 5). The Montara population consists of a series of subpopulations covering approximately 50 ac (20 ha) within coastal prairie, grassland, and coastal scrub habitat managed by the National Park Service (NPS) as part of the Golden Gate National Recreation Area (GGNRA). The subpopulations are separated by changes in topography and habitat type.

Since listing in 1998, the Indian Village population has been very small, with as few as eight individuals and as many as 79 following outplanting efforts (Table 1) (Service 2009, pp. 5-6; DMFC 2016, p. 5; Vaughan 2020, pers. com.; McCorkle 2020, pers. com.). Outplanting, weed management, and herbivore control have been implemented since the early 1990s and again in 1998, 2004, and 2005 to prevent loss of the population (Service 2009, p. 5). These early efforts did not lead to increased numbers of individuals but did likely aid in preventing the loss of the population entirely. In 2015, the Service provided funding to DMFC for management, monitoring, and outplanting of the Indian Village population lasting through 2020 that has resulted in increased numbers of individuals, and herbivory and weed control (DMFC 2016, entire; Vaughan 2020, pers. com.). Despite management efforts, herbivory and mortality following supplemental planting continue to inhibit expansion, although some natural recruitment has been observed (Vaughan 2020, per. com.). The current status of the Indian Village population is best characterized as conservation reliant. Recent increases in the population size are a direct result of aggressive management and outplanting efforts, but if those efforts decrease, then the population is likely to decrease as well.

The Montara population occurs on land that was formerly owned by the Peninsula Open Space Trust and transferred to the NPS in 2011 (NPS 2011). Prior to the transfer to NPS, the population was unmanaged without formal population monitoring (CNDDB 2020). Monitoring and weed control have increased since NPS began management of the population. The previous 5-year review stated that the average number of individuals within the Montara population was between 2,000 and 3,000, but noted that differences in data collection between independent observers made estimation of population trends difficult (Service 2009, p. 5). Monitoring by the NPS since 2013 suggests that the average population size is closer to 6,000 individuals. Although monitoring has been more regular, there have been differences between years in which areas are surveyed or how surveys were conducted, leading to variations in the reported abundance (Chasse et al 2020, pp. 38-40; Wrubel 2020, pers. com.). Based on years when data collection methods were the same (2015, 2017, 2018, 2020) the population appears stable around a mean of 5,908 individuals with a low of 5,081 in 2020 and a high of 6,975 in 2017. The abnormally high abundance reported in 2013 is believed to be an overestimate (Wrubel 2020, pers. com.).

Table 1. Number of individuals observed at Monterey and San Mateo County populations since 2011.

	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Montara	NA	14,838	71[1]	5,272	2,176[2]	6,975	6,304	>1000[3]	5,081
Indian Village	NA	NA	NA	8	14	14	66	42	79

[1]Montara population consists of nine monitoring areas. In 2014 the two areas with the highest abundance were not surveyed.
[2]In 2016 one of the areas with the highest abundance was not surveyed.
[3]Method of reporting count data changed in 2019

Point Lobos Introduction

In 2006, the Service funded an effort to establish a population of Hickman's potentilla at Point Lobos State Park (Service 2009, p. 7; Doak et al. 2008, pp. 6-12). Approximately 800 plants were planted at Point Lobos between December 2006 and February 2007 (Doak et al. 2008, pp. 6, 12). Initial survivorship in 2007 was high but declined throughout 2008 and 2009 (Doak et al. 2008, pp. 12-14; unpublished data). Survivorship information is not available following 2009, and by 2012 monitoring had ceased and the plants were presumed dead. In 2019, the Service in collaboration with California State Parks, attempted to relocate the original planting transects and found two plants growing in heavily overgrown non-native grasses (Bonnette 2019, pers. com.). In 2020, an early season survey found a potential plant that could not be conclusively identified because of the lack of identifying characteristics (Bonnette 2020, pers. com.). Additional surveys and weed management were planned for 2020, but were canceled due to a shelter in place order resulting from the Covid-19 pandemic.

Despite the general failure of the introduction, the two surviving plants that were found in 2019 and the single potential individual found in 2020 suggest that the habitat could still support the species, although persistent weed management and monitoring would be required. With very few possible introduction locations in Monterey County, a second reintroduction at Point Lobos should be considered and long term funding and monitoring should be secured.

Ex Situ Plants and Seed Banking

Individuals for the Point Lobos introduction were grown from seed collected from the Indian Village population at the University of California, Santa Cruz (UCSC) (Doak et al. 2008, pp. 4-6). Some of the plants that were grown from this seed have been maintained since 2005 in containers in greenhouses originally at UCSC and currently at University of California, Davis (UCD) (Werner 2020, pers. com.). Only five plants remain at UCD, but the effort to preserve them has demonstrated that maintaining an *ex situ* population is possible and may be used to preserve the lineage if they are thought to be in danger of extirpation.

In 2020, the NPS partnered with the University of California Botanical Garden to establish a seed bank of the Montara population. Seed collection began in 2020 with seed collected from approximately 80 plants (Wrubel 2020, pers. com.). The goal of this effort is to collect and store 3,000 seed and is expected to take multiple years. As part of this partnership, seed will also be collected from the Indian Village population by DMFC and possibly the *ex situ* plants at UCD, although the total seed collected at either of those locations is expected to be relatively low due to the small number of plants.

Threats

At the time of listing, habitat loss due to development, vandalism and recreation, invasive species, and small population effects were identified as the primary threats to Hickman's potentilla (Service 1998, 63 FR 43109-43112). Herbivory was recognized as an additional threat in the Recovery Plan (Service 2004, pp. 32-33). In the 2009 5-year review climate change was added as a potential threat while vandalism was considered no longer to be a threat (Service 2009, pp. 8-11).

Since the 2009 5-year review both populations have become protected from direct loss due to development. The Montara population is owned and managed by the NPS as part of the GGNRA and the Indian Village population is owned and managed by the DMFC. While direct loss of habitat due to development is no longer possible at either location, the Indian Village population is still subject to indirect effects of adjacent land uses including golf course management, potential housing construction, and forest management. The 2009 5-year review noted that changes to the adjacent lands had negatively affected the hydrology of the Indian Village population and this threat remains a concern (Service 2009, pp. 7-8). The efforts of the DMFC to manage the Indian Village population have resulted in increases in the abundance of Hickman's potentilla and continued management is needed to ensure that the recent gains made are not lost.

Vandalism remains a low threat at both populations. The Indian Village population is on private property and fenced to discourage trespassing. The Montara population has no known history of vandalism, and while there are no physical protections from vandalism, it is not believed to be an issue currently or in the future. Conversely, recreation is a low threat at the Indian Village population because of the fencing and management actions of the DMFC at that location, while the Montara population is subject to accidental trampling by foot traffic, horses, or bikes. The topography of the area where the Montara population occurs discourages wandering so it is unlikely that recreation activities would ever affect all of the subpopulations. The subpopulations

near popular trails could be affected directly and indirectly, but this use has been occurring since the 1990s, and if existing use patterns continue, then the threat is not expected to increase in severity.

Competition from invasive or non-native species represents the greatest current threat to Hickman's potentilla at both the Montara and Indian Village populations. Invasive and non-native grass species comprise the majority of the annually produced biomass at both locations. Without management, invasive and non-native grasses are likely to cause a decline in abundance at both populations through competition for resources, including light and water. Similarly, the conversion of grasslands (either native or non-native) to shrub dominated or forested communities represents a similar threat. Management actions to reduce competing vegetation cover are occurring at both the Montara and Indian Village populations. The NPS has been removing non-native grasses and encroaching Monterey pine trees from the Montara population since acquiring the land from the Peninsula Open Space Trust (Wrubel 2020, pers. com.). NPS is currently developing a long term management strategy that will include control of non-native species and reintroduction of native species as well as experimental outplanting of Hickman's potentilla (Bennett et al. 2015, entire; Wrubel 2020, pers. com.). The Indian Village population is much smaller and each plant occurring there has had competing vegetation removed by hand and has been caged to exclude herbivory (DMFC 2016, entire). The current efforts to control competing vegetation at both populations have promoted the survivorship of Hickman's potentilla, but will be need to be conducted into the foreseeable future until natural ecosystem processes reduce the need for external management.

Stochastic effects resulting from small population size are a threat specifically for the Indian Village population. The relatively large number of individuals within the Montara population provide a reasonable buffer from random events that may lead to extirpation. The management efforts at Indian Village, which include supplemental watering if needed, hand weeding, herbivory exclusion, and monitoring, provide some buffer against stochastic events. Still, the small population size leaves the population open to sudden and unforeseen events that could result in a complete loss of the population.

Gophers, deer, snails, and slugs are known herbivores that negatively affect the survival and reproduction of Hickman's potentilla (Van Fleet Brown 2015, pp. 13-16; Service 2009, p. 9; DMFC 2016, pp. 5-6). The effects of herbivory are pronounced at the Indian Village population due to the small population size. In response to herbivory, cages have been placed around each plant at Indian Village to exclude deer browsing and this has resulted in increased survivorship (DMFC 2016, p. 5). The effects of burrowing animals has been assumed to be the cause of some observed mortality at Indian Village, although the increase in the population suggests that the management effort is greater than the herbivory pressure. At the Montara population, deer are likely the dominant herbivore. The current levels of observed herbivory do not appear to be a significant threat at the Montara population, and there are no plans for herbivory control.

The effects of climate change on populations of Hickman's potentilla are unknown. Declines in abundance are assumed to occur during drought years. Correlations between drought severity and abundance are difficult to make because complete count data from the Montara population is not available for the most recent year of drought (2014) (Table 1) and the Indian Village

population occurs under artificial conditions (individual plant caging, hand weeding, supplemental water since 2015). Changes in the timing of precipitation is also likely to affect the species. Precipitation occurring earlier or later in the season compared to historical averages may have effects on flowering, pollination, and seed set. Changes in minimum and maximum temperatures also have the potential to affect Hickman's potentilla through altering germination cues or increasing a plant's susceptibility to desiccation.

Current modeling suggests that average annual precipitation may increase by 2 to 3 inches under all future scenarios of carbon emission by 2099 (Table 2). The average minimum and maximum temperatures are also predicted to increase under the same time period (CalAdapt 2020). The timing of precipitation coupled with changes in temperature is predicted to lead to more variability with greater frequency extreme droughts and, conversely, more extreme wet years (Ackerly et al. 2018, p. 17).

Table 2. Changes in precipitation, minimum average temperature, and maximum average temperature for low and high emission scenarios compared to historical averages for the Montara and Indian Village Hickman's potentilla populations.

	Precipitation (inches)		**Min Avg. Temp. (degrees F)**		**Max Avg. Temp. (degrees F)**	
Population	Historical Average	RCP 4.5 (RCP 8.5)	Historical Average	RCP 4.5 (RCP 8.5)	Historical Average	RCP 4.5 (RCP 8.5)
Montara	23.3	25.8 (26.5)	48.0	50.9 (52.6)	64.1	66.9 (68.4)
Indian Village	16.0	17.4 (17.7)	48.5	51.4 (53.0)	66.4	69.2 (70.8)

Reported values for the modeled futures are based on the average of the HadGEM2-ES (warmer and drier) and CNRM–CM5 (cooler and wetter) future scenarios. The Representative Concentration Pathway (RCP) 4.5 scenario refers to a future scenario where emissions peak near 2040 and then decline, while RCP 8.5 refers to a scenario where emissions continue to rise strongly through 2050 and plateau near 2100. The historical average is based on the years 1950–2005 as reported by cal-adapt.org. The modeled values are estimates from the years 2020–2100. Reported values are from 6 x 6 km grid cells where each population occurs.

In summary, the threat of development has been removed at both populations due to changes in ownership. Indirect effects of adjacent land use are still possible at the Indian Village population, but may be managed for by the DMFC. The amount of land owned by the NPS surrounding the Montara population protects against indirect effects from adjacent land use. Invasive and non-native species and conversion of grasslands to shrub or tree dominated communities is currently the greatest threat to Hickman's potentilla at both populations. Current efforts to reduce that threat are ongoing at both populations and will likely need to continue until competition from those species is shown to no longer be a threat. The Indian Village population remains susceptible to stochastic events and herbivory because of the small population size, while the Montara population is large enough to be able to withstand current levels of herbivory and is unlikely to experience complete loss of individuals from an unexpected event both due to the amount of individuals present and their distribution across the landscape. Vandalism and recreation are not currently considered significant threats at the Indian Village population due to ongoing management, fencing, and exclosures by the DMFC. Direct and indirect effects of

recreation are possible at the Montara population, but the threat remains low with current use levels. Climate change represents the greatest potential threat. Current modeling suggests high variability in amount and timing of precipitation that may lead to periods of sudden loss of individuals followed by periods of favorable years.

Evaluation of Recovery Action Progress

Downlisting criteria for Hickman's potentilla are listed in the Recovery Plan for Five Plants from Monterey County, California (Recovery Plan) (Service 2004, pp. 53-54). Delisting criteria were developed as an amendment to the Recovery Plan in 2019 (Service 2019, pp. 9-10). The downlisting criteria may be summarized as:

1. At least five populations are stable or have increasing abundance based on 10 years of monitoring in suitable habitat;

2. All five populations (inclusive of the Indian Village and Montara populations) occur on land protected from detrimental disturbance where the conservation of the species is a focus of management with adequate funding to allow for appropriate long-term management. The populations occur on land of adequate size to allow from ecosystem and community processes to occur;

3. Invasive species and herbivores are controlled so that their presence does not negatively affect the persistence of Hickman's potentilla;

4. Populations have been managed such that monitoring demonstrates that each population is stable or increasing, based on size, density, and number;

5. An *ex situ* seed bank has been established at a facility recognized by the Center for Plant Conservation.

Delisting criteria for Hickman's potentilla may be considered following the achievement of downlisting criteria and may be summarized as:

1. Threats are reduced or eliminated so that protected populations are capable of persisting without significant human intervention, or, perpetual endowments are secured for management necessary to maintain the continued existence of the species;

2. Unoccupied habitats in Monterey and San Mateo Counties have been assessed for suitability for reintroduction efforts leading to the establishment and protection of two additional populations;

3. All protected populations remain viable for at least 10 years.

Monitoring of the two populations suggest that the Montara population may be stable and that recent efforts to augment and manage the Indian Village population has resulted in increased numbers of individuals. However, monitoring at both populations has not occurred for a long enough period of time without management to determine if the downlisting criteria for

population stability or growth has been met. Only one introduced population has been attempted at Point Lobos and it failed, potentially due to a lack of management following planting. The existing populations in Montara and at Indian Village both occur on land that is protected from development or other direct habitat loss. Currently, both of these populations have some funding to manage the species but this funding is not guaranteed past 2020 and it is unknown if funding will be available in the future. Invasive and non-native grasses and encroaching shrubs and trees, are currently the focus of weed management efforts at both populations. The current efforts have shown positive results, but continued management is needed to maintain the gains made. Beginning in 2020, seed collection efforts at both populations began with the goal of having at least 3,000 seed stored for long term preservation. This effort is expected to last several years.

SUMMARY

Hickman's potentilla remains a highly restricted species known from only two populations in San Mateo and Monterey Counties. While both of these populations occur on protected land they are susceptible to invasive and non-native grasses and shrub and tree encroachment, herbivory, and the effects of climate change. The Indian Village population is additionally susceptible to stochastic events because of the small population size while the Montara population faces a low threat from the current levels of recreation.

Currently, both populations are managed to reduce the effects of competing species and herbivory. The management efforts have been beneficial with increased abundance at Indian Village and a presumed stable population in Montara. However, management actions are dependent upon funding that is not guaranteed and a reduction in management effort may result in a reversal of recent gains. Both populations have also experimented with outplanting from locally collected and grown seed that has contributed to increasing or stabilizing the population.

To date, only one introduction has been attempted at Point Lobos in Monterey County that did not succeed. The failed introduction was likely due to lack of funding and subsequent management. Point Lobos is still considered a potential site for future population establishment attempts.

CONCLUSION:

At the time of listing, habitat loss due to development, vandalism and recreation, invasive species, and small population effects were identified as the primary threats to Hickman's potentilla (Service 1998, 63 FR 43109-43112). Herbivory was recognized as an additional threat in the Recovery Plan (Service 2004, pp. 32-33). In the 2009 5-year review, climate change was added as a potential threat while vandalism was considered to no longer to a threat (Service 2009, pp. 8-11). Currently, invasive and non-native grasses, as well as habitat conversion to shrub or tree dominated vegetation communities, herbivory, stochastic events, recreation, and climate change are the greatest threats to Hickman's potentilla. In consideration of the very low abundance in Monterey County, and the identified threats, we find that Hickman's potentilla is in danger of extinction throughout all or a significant portion of its range and, thus, remains an endangered species.

RECOMMENDATIONS FOR FUTURE ACTIONS:

The following actions are recommended based on the current 5-Year Review:

1. Continue management of herbivory and competing species at the Indian Village population.
2. Continue outplanting efforts at Indian Village to increase population size so that adequate natural recruitment is possible.
3. Restore associated native species to the Indian Village site to promote natural ecosystem processes.
4. Finalize and implement the National Park Service plan to manage and restore habitat and outplant Hickman's potentilla at the Montara population.
5. Resurvey and monitor the Point Lobos introduction sites.
6. Evaluate additional introduction sites in San Mateo and Monterey Counties.
7. Continue seed banking efforts until adequate seed from both populations have been stored.

APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approved STEPHEN HENRY Digitally signed by STEPHEN HENRY Date: 2020.08.24 12:42:50 -07'00' Date _____

REFERENCES

Ackerly, D. A. Jones, M. Stacey, and B. Riordan. 2018. San Francisco Bay Area Summary Report. California's Fourth Climate Change Assessment. Publication number: CCCA4-SUM-2018-005. 114 pp.

Bennett, S., A. Forrestel, D. Hatch, C. Lehnertz, and J. Wullschleger. 2015. Detailed Implementation Plan Protection of Endangered Hickman's potentilla at a new National Park site. PMIS# 195863. August 21, 2015. 20 pp.

Cal-adapt. 2020. Annual Averages Data Viewer. Available on the internet at <https://cal-adapt.org/tools/annual-averages>. Accessed July 2020.

[CDFW] California Department of Fish and Wildlife. 2019. State and Federally Listed Endangered, Threatened, and Rare Plants of California. State of California Natural Resources Agency, Department of Fish and Wildlife Biogeographic Data Branch, California Natural Diversity Database. October 3, 2019. 13 pp.

Chasse, M., A. Pai, B. Stevenson, and A. Forrestel. 2020. Threatened and Endangered Vascular Plant Species Activities within the Golden Gate National Recreation Area Calendar Year 2019 Permit #: TE036499-9. Report prepared for the Endangered Species Division Sacramento and Ventura Offices U.S. Fish and Wildlife Service. February 2020. 45 pp.

[CNDDB] California Natural Diversity Database. 2020. Element occurrence reports of *Potentilla hickmanii*. California Department of Fish and Game, Natural Heritage Division.

Doak, D., M. Goldman, S. Langridge. 2008. Propagation and establishment of a new population of Potentilla hickmanii, final report. Prepared for U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. January 2008. 22 pp.

[DMFC] Del Monte Forest Conservancy. 2016. Hickman's Potentilla (*Potentilla hickmanii*) Management Project at Indian Village, Pebble Beach, Monterey County. Report prepared for work conducted under U.S. Fish and Wildlife Service Award F15AP00699 and California Department of Fish and Wildlife Permit 2081(a)-15-006-RP. December 30, 2016. 10 pp.

[NPS] National Park Service. 2020. Press release on web: Rancho Corral de Tierra Transferred to Golden Gate National Recreation Area. Published on December 12, 2011 at https://www.nps.gov/goga/learn/news/rancho-release.htm. Accessed July 17, 2020.

[Service] U.S. Fish and Wildlife Service. 1998. Endangered and threatened wildlife and plants; final rule listing five plants from Monterey County, CA, as endangered or threatened. 63 FR 43100-43116.

[Service] U.S. Fish and Wildlife Service. 2004. Recovery Plan for Five Plants from Monterey County, California: *Astragalus tener var. titi* (coastal dunes milk-vetch), *Piperia yadonii* (Yadon's piperia), *Potentilla hickmanii* (Hickman's potentilla), *Trifolium trichocalyx*

(Monterey clover), *Cupressus goveniana ssp. goveniana* (Gowen cypress). U.S. Fish and Wildlife Service, Portland, Oregon. xii + 159 pp.

[Service] U.S. Fish and Wildlife Service. 2009. *Potentilla hickmanii* (Hickman's potentilla) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service Ventura Fish and Wildlife Office. Ventura, CA. 18 pp.

[Service] U.S. Fish and Wildlife Service. 2019. Initiation of 5-Year Status Reviews of 58 Species in California, Nevada, and the Klamath Basin of Oregon. Federal Register 84: 36116-36118. July 26, 2019.

[Service] U.S. Fish and Wildlife Service. 2019. Recovery Plan for Five Plants from Monterey County, California: Amendment 1. U.S. Fish and Wildlife Service Pacific Southwest Region Ventura, CA. September 2019. 18 pp.

Van Fleet Brown, J. 2015. Plant dynamics and soils influencing ecological restoration of *Potentilla hickmanii* at Rancho Corral de Tierra, San Mateo County, California. Report prepared in partial fulfillment of the requirements for a Bachelor of Arts degree from Carleton College, Northfield, Minnesota. March 11, 2015. 115 pp.

Personal Communications

Bonnette, A. 2019. Email from Anna Bonnette to Todd Lemein, Matthew Allen, and Jodi McGraw regarding survey for Hickman's potentilla at Point Lobos introduction sites. May 8, 2019.

Bonnette, A. 2020. Email from Anna Bonnette to Matthew Allen, Todd Lemein, and Jodi McGraw regarding early survey for Hickman's potentilla at Point Lobos. January 30, 2020.

McCorkle, D. 2020. Email from Dennis McCorkle to Todd Lemein regarding counts of Hickman's potentilla at Indian Village. July 25, 2020.

Vaughan, B. 2020. Email from Bill Vaughan to Todd Lemein regarding counts of Hickman's potentilla at Indian Village. July 20, 2020.

Werner, B. 2020. Email from Bill Werner to Todd Lemein regarding *ex situ* plants and seed collection. July 16, 2020.

Wrubel, E. 2020. Email from Eric Wrubel to Todd Lemein regarding management efforts for Hickman's potentilla on Golden Gate National Recreation Area property. July 21, 2020.