5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Neraudia sericea* (ma‘aloa)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawaii, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewers:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Gregory Koob, Conservation & Restoration Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning in August 2017. The review was based on a review of current, available information since the last 5-year review for *Neraudia sericea* (USFWS 2012). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, Conservation and Restoration Team Manager.

Background:

For information regarding the species listing history and other facts, please refer to the Fish and Wildlife Service’s Environmental Conservation On-line System (ECOS) database for threatened and endangered species (*http://ecos.fws.gov/tess_public*).

Review Analysis:

Please refer to the previous 5-year review for *Neraudia sericea* published in the Federal Register on August 28, 2012 (available at *https://ecos.fws.gov/docs/five_year_review/doc4074.pdf*) for a complete review of the species’ status, threats, and management efforts. We are not aware of any significant new information regarding the species biological status since listing to warrant a change in the Federal listing status of *N. sericea*.

This short-lived perennial shrub in the Urticaceae (nettle) family is endangered and known from Maui, Moloka‘i, Lāna‘i, and Kaho‘olawe. The current status and trends for *Neraudia sericea* are provided in the tables below.

New Status Information:

- A new population was discovered on west Maui at Launiupoko (PEPP 2014). Currently there are about five populations totaling 14 individuals on east and west Maui (Keir *et al.* 2016; PEPP 2013, 2014, 2015, 2016, 2017). There are two populations totaling about 16 individuals on Molokaʻi (Keir *et al*. 2016; PEPP 2013, 2014, 2015, 2016, 2017a).
- In 2012, five critical habitat units were proposed in two ecosystems (lowland dry and dry cliff) on Lānaʻi for *Neraudia sericea* (11,540 ac, 4,670 ha) (77 FR 34464, June 11, 2012). In the final rule the Service excluded critical habitat for this species on the island of Lānaʻi because, as demonstrated by the ongoing conservation activities by the private landowner, their commitment to develop the Lānaʻi Natural Resources Plan, and a memorandum of understanding with the Service, exclusion from critical habitat would provide greater long-term benefits to the species than designation of critical habitat (USFWS 2015; 81 FR 17790, March 30, 2016). In 2016, nine critical habitat units in the lowland dry, montane mesic, and dry cliff ecosystems were designated on east and west Maui (33,289 ac; 13,470 ha); two critical habitat units in the lowland mesic and montane mesic ecosystems were designated on Molokaʻi (9,586 ac; 3,879 ha); and two critical habitat units in the lowland dry ecosystem were designated on Kahoolawe (4,425 ac; 1,791 ha) (81 FR 17790, March 30, 2016).

New Threats:

- Drought loss or degradation of habitat—Drought is noted as a threat to populations of *Neraudia sericea* on west Maui (PEPP 2014, 2015). Over the last 100 years, the Hawaiian Islands have experienced an annual decline in precipitation of over 9 percent, increasing to as much as 15 percent within the last 20 years (US-NSTC 2008; Chu and Chen 2005; Diaz 2005). Drought affects plants directly by desiccation. The increase in drought frequency and intensity leads to a self-perpetuating cycle of increase in cover of nonnative plants, increase in the number of fires, and an increase of erosion (US-GCRP 2009; Warren 2011). Recent episodes of drought have also driven deer farther into urban and forested areas in search of food, increasing their negative impacts to native vegetation from herbivory and trampling (Waring 1996, in litt; Nishibayashi 2001, in litt.).
- Climate change loss or degradation of habitat—We previously reported that climate change may pose a threat to this species, anticipating an analysis by 2013. The assessment conducted by Fortini *et al*. (2013) concluded that *Neraudia sericea* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.751 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions may be needed to conserve this taxon into the future.

New Management Actions:

- Surveys and inventories—The Plant Extinction Prevention Program (PEPP) surveys for and monitors individuals of *Neraudia sericea* on Maui and Molokaʻi (PEPP 2013, 2014, 2015, 2016, 2017a).
- Invasive plant monitoring and control—PEPP monitors all known populations on Maui and Molokaʻi and removes invasive nonnative plants.
- Captive propagation for genetic storage and reintroduction—
    - In 2017, Lyon Arboretum reported 15 containers of propagules of *N. sericea* from populations at Launiupoko (west Maui) and Mākolelau (Molokaʻi) in storage. The Lyon Seed Conservation Laboratory reports 58 seeds in storage from the same populations (Lyon Arboretum 2017).
    - The Plant Extinction Prevention Program (PEPP) has collected from one founder at Kalaʻe (Molokaʻi), six founders from one subpopulation at Mākolelau (Molokaʻi) and from four founders at a second subpopulation at Mākolelau (PEPP 2017b).
    - PEPP collects seeds, cuttings, and vouchers from all known populations (PEPP 2013, 2014, 2015, 2016, 2017a).
    - The National Tropical Botanical Garden (NTBG) continues to store over 1,000 seeds collected from individuals on Molokaʻi in 2002 (NTBG 2017). The viability of these collections is uncertain.
    - Olinda Rare Plant Facility (ORPF) reports propagation of plants from cuttings and fruit taken from individuals on west Maui at Lihau, Manawainui Gulch, Launiupoko, and ʻĪao Valley; from east Maui at Manawainui Gulch; and from Molokaʻi at Makolelau (ORPF 2013, 2014, 2015, 2017).
- Stochastic events—Build resiliency and redundancy—
    - PEPP has augmented populations or created new sites for reintroduction of *N. sericea* and reintroduced nearly 100 individuals. Of those outplanted, the current survivors on west Maui are at Launiupoko (six individuals), Kauaʻula (eight individuals), ʻĪao Valley (10 individuals), and Olowalu (six individuals); and on east Maui at five sites at Waiʻōpai Gulch (12 individuals) (PEPP 2016, 2017a). On Molokaʻi, PEPP has reintroduced one individual at Kalae, five individuals at east Kawela, and 14 individuals at Mākolelau (PEPP 2016, 2017a).
    - ORPF has distributed at least 23 propagated plants for reintroduction into Olowalu Valley, ʻĪao Valley, Kauaʻula, and west Mākolelau (ORPF 2013, 2014, 2015, 2017).
- Habitat and natural process management and restoration—Pūlama Lānaʻi provides conservation benefits to plant and animal species on Lānaʻi, as demonstrated by the ongoing conservation efforts on the island, the commitment to develop the Lānaʻi Natural Resources Plan (LNRP), and a memorandum of understanding (MOU) with the Service (USFWS 2015). The fenced area at Lānaʻihale may provide suitable habitat for reintroduction of *N. sericea* to Lānaʻi once fence repairs are made, ungulates are removed, and nonnative plant control is conducted.

Synthesis:
Currently, there are seven populations of *Neraudia sericea* on Maui and Molokaʻi, totaling as many as 30 individuals. No plants are currently known on Lānaʻi or Kahoʻolawe. A landscape-based assessment of climate change vulnerability for native plants of Hawaiʻi using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *N. sericea* is highly vulnerable to the effects of climate change, in that there will be a smaller area of suitable habitat available for the species in the near future. Populations on Maui and Molokaʻi may be provided protection by nonnative plant control. The collection of seeds and cuttings and outplanting are ongoing.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Multi-Island Plants (USFWS 1999), and have been updated according to the draft revised recovery objective guidelines developed by the Hawaiʻi and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Neraudia sericea is a short-lived, dioecious (male and female flowers occur on different plants) perennial shrub. To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections. In addition, a minimum of three populations should be documented on Lānaʻi and Molokaʻi. Each of these populations must be naturally reproducing (*i.e.*, viable seeds, seedlings, saplings) and increasing in number, with a minimum of 100 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met as there are no populations of at least 100 individuals, genetic representation is incomplete (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Neraudia sericea* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
Habitat destruction by drought and herbivory by slugs are reported to be threats to this species; however, we are not aware of any significant new information regarding the species' biological status since the last 5-year review in 2012. Thus, the following recommendations for future actions are added or reiterated for 5-year review for 2018.

- Surveys and inventories—Continue to survey for additional populations of *Neraudia sericea* in areas of potentially suitable habitat on Lānaʻi and Molokaʻi. Regularly monitor known populations.
- Ungulate monitoring and control—Complete the Lānaʻihale summit fencing project and remove all feral ungulates from the fenced area to protect *N. sericea* from the impacts of feral ungulates.
- Invasive plant monitoring and control—
    - Control established ecosystem-altering nonnative invasive plant species around all populations.
    - Control invasive nonnative species that compete with the species around all populations, especially focusing on *Clidemia hirta* (Koster's curse), *Hedychium gardnerianum* (kāhili ginger), *Leptospermum scoparium* (Australian tea tree), *Morella faya* (firetree), *Psidium cattleianum* (strawberry guava), and *Tibouchina herbacea* (glorybush).
- Predator and herbivore monitoring and control—Develop and implement effective control methods for the black twig borer and slugs.
- Captive propagation for genetic storage and reintroduction—
    - Continue collection of genetic resources for storage, propagation, and reintroduction into protected suitable habitat within historical range.
    - Explore alternate methods of propagation (e.g., cuttings, air-layering, and tissue culture).
- Reintroduction and translocation—Continue reintroduction of individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species to determine future landscape needed for recovery of the species.
- Alliance and partnership development—Continue to work with land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

Table 1. Status and trends of *Neraudia sericea* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1994 (listing)	>50–100	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1999 (recovery plan)	>50–100	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	50–100 (Molokaʻi) > 5 (Maui) 0 (Lānaʻi)	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2012 (5-year review)	22 (Molokaʻi) 5 (Maui)	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2016 (critical habitat)	0 (Molokaʻi) 5 (Maui)	ca 34	All threats managed in all three populations	No
			Complete genetic storage	No

			Three populations with 50 mature individuals each	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2018 (5-year review)	ca 16 (Molokaʻi) ca 14 (Maui)	ca 100, ca 60 remain	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Reproduction (*i.e.* viable seeds, seedlings) at all three populations	No
			Three populations with 100 mature individuals each	No

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second after Preventing Extinction).

Table 2. Threats to *Neraudia sericea* and ongoing conservation efforts.

Threat	**Listing factor**	**Current Status**	**Conservation/ Management Efforts**
Ungulate degradation of habitat	A	Ongoing	None
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, some monitored areas
Landslides or flooding loss or destruction of habitat	A	Ongoing	None
Drought loss or destruction of habitat	A	Ongoing	None
Fire loss or destruction of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Rodent and invertebrate predation or herbivory	C	Ongoing	None

References:
See the previous 5-year review for a full list of references (USFWS 2012). Only references for new information are provided below.

Chu, P-S. and H. Chen. 2005. Interannual and interdecadal rainfall variations in the Hawaiian Islands. Journal of Climate 18: 4796–4813.

Diaz, H.F., P-S. Chu, and J.K. Eischeid. 2005. Rainfall changes in Hawai‘i during the last century. 16th Conference on Climate Variability and Change, abstract.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawai‘i Cooperative Studies Unit, University of Hawai‘i at Hilo, Hawai‘i. 134 pp.

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Keir, M., L. Weisenberger, M. Sporck-Koehler, S.M. Gon, V.L. Caraway, M. Bruegmann, J. Kwon, and N. Sugii. 2016. *Neraudia sericea.* The IUCN Red List of Threatened Species 2016: e.T80173437A115504355. *http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T80173437A80173442.en.*

Lyon Arboretum. 2017. Micropropagation and seed conservation laboratory databases.

[NTBG] National Tropical Botanical Garden. 2017. Controlled propagation report.

Nishibayashi, E. 2001, in litt., The wild, wide-ranging herds also are blamed in 36 road collisions, article in Honolulu Star-Bulletin, G.T. Kubota, 28 AUG 2001.

[ORPF] Olinda Rare Plant Facility. 2013. Controlled propagation report.

[ORPF] 2014. Controlled propagation report.

[ORPF] 2015. Controlled propagation report.

[ORPF] 2017. Controlled propagation report.

[PEPP] Plant Extinction Prevention Program. 2013. PEPP annual report fiscal year 2013 (July 1, 2012-June 30, 2013). 207 pp.

[PEPP] 2014. PEPP annual report fiscal year 2014 (July 1, 2013-June 30, 2014). 185 pp.

[PEPP] 2015. PEPP annual report fiscal year 2015 (July 1, 2014-June 30, 2015). 179 pp.

[PEPP] 2016. Plant Extinction Prevention Program FY 2016 Annual Report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.

[PEPP] 2017a. Plant Extinction Prevention Program FY 2017 annual report (Oct 1, 2016-Sep 30, 2017), US FWS CFDA program #15.657; Endangered species conservation-recovery implementation funds, Cooperative Agreement F14AC00174, December 12, 2017, UH Manoa, PCSU, PEPP. 235 pp.

[PEPP] 2017b. Statewide species totals *ex situ*, excel table.

[US-GCRP] US GCRP Advisory Committee. 2009. Global climate change impacts in the United States. Karl, T.R., J.M. Melilo, and T.C. Peterson (eds.), Cambridge University Press. 189 pp.

[USFWS] U.S. Fish and Wildlife Service. 2012. *Neraudia sericea* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4074.pdf.*

[USFWS] 2012. Endangered and threatened wildlife and plants; listing 38 species on Molokai, Lanai, and Maui as Endangered and designating critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; proposed rule. Department of the Interior, Federal Register 77 (112): 34464–34775, June 11, 2012.

[USFWS] 2015. Memorandum of understanding between Lanai Resorts, LLC, Castle & Cooke Properties, Inc., and U.S. Department of the Interior, Fish and Wildlife Service. 36 pp.

[USFWS] 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawai‘i, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573, February 12, 2016.

[USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; final rule. Federal Register 81 (61): 17790–18110, March 30, 2016.

[US-NSTC] US National Science and Technology Council. 2008. Scientific assessment of the effects of global change on the United States. Committee on Environment and Natural Resources. 261 pp.

Waring, G.H. 1996, in litt., Preliminary study of the behavior and ecology of axis deer on Maui, Hawai‘i. 9 pp.

Warren, R. 2011. The role of interactions in a world implementing adaptation and mitigation solutions to climate change. Philosophical Transactions of the Royal Society A 369: 217-241.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Neraudia sericea* (ma‘aloa)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

_____	Delisting
_____	Reclassify from Endangered to Threatened status
_____	Reclassify from Threatened to Endangered status
X	No Change in listing status

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

GREGORY KOOB Digitally signed by GREGORY KOOB
Date: 2018.10.23 09:11:32 -10'00'