

## 5-YEAR REVIEW

### Short Form Summary

**Species Reviewed:** *Cyanea copelandii* subsp. *haleakalaensis* (hāhā)

**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 *Cyanea copelandii* subsp. *haleakalaensis* (USFWS 2011). 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](http://ecos.fws.gov/tess_public)).

#### **Review Analysis:**

Please refer to the previous 5-year review for *Cyanea copelandii* subsp. *haleakalaensis* published in the Federal Register on August 2, 2011 (available at [https://ecos.fws.gov/docs/five\\_year\\_review/doc3825.pdf](https://ecos.fws.gov/docs/five_year_review/doc3825.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 *C. copelandii* subsp. *haleakalaensis*.

This short-lived perennial vine-like shrub in the Campanulaceae (bellflower) family is endangered and endemic to Maui. The current status and trends for *Cyanea copelandii* subsp. *haleakalaensis* are provided in the tables below.

#### New Status Information:

- Additional, new occurrences of *Cyanea copelandii* subsp. *haleakalaensis* were found at Kūhiwa Valley (about 10 individuals), Kawaipapa (at least one individual), and at ‘Ohe‘o (Kīpahulu; large patches) (Oppenheimer 2018, in litt.). Including those populations last monitored in 2007 (Wailua Iki and east Makaīwa), the total number of individuals remains around 300 to 500 (Bruegmann *et al.* 2016; Oppenheimer 2018, in litt.).
- In 2016, 11 critical habitat units were designated for *Cyanea copelandii* subsp. *haleakalaensis* in four ecosystems (lowland mesic, lowland wet, montane wet, and wet cliff) on east Maui (41,421 ac, 16,762 ha) (81 FR 17790, March 30, 2016).

#### New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this subspecies. Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013) was conducted at the species level and concluded that *Cyanea copelandii* is vulnerable to the impacts of climate change, with a vulnerability score of 0.447 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future.
- Lack of adequate hunting regulations—Three populations of *Cyanea copelandii* subsp. *haleakalaensis* occur in state hunting areas (Puohokamoa, Waiokamilo to Wailua Iki, and Kawaipapa). Nonnative feral ungulates pose a major ongoing threat to all native species, including *C. copelandii* subsp. *haleakalaensis*, through destruction and modification of habitat, and through direct herbivory or predation. Feral pigs have been noted as a threat to the species. Public hunting areas are not fenced and game mammals have unrestricted access to most areas across the landscape, regardless of underlying land use designation; therefore, any unfenced populations are at risk (DLNR 2010).
- Lack of adequate biosecurity legislation—Invasion of the State of Hawai‘i by invasive nonnative plant species, and destruction of habitat and competition by nonnative plants are threats to *Cyanea copelandii* subsp. *haleakalaensis*. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, is authorized to prevent the introduction or dissemination of animal and plant pests on all ships, aircraft, and their cargo and baggage arriving in the U.S. and its territories; however, pest species continue to enter the State. In addition, Federal import regulations do not address many species that could be pests in Hawai‘i (CGAPS 2009; Ikuma *et al.* 2002).
- Invasive species—Established invasive plant species competition—Nonnative plant species, particularly *Clidemia hirta* (clidemia), compete with *Cyanea copelandii* subsp. *haleakalaensis* for water, light, and nutrients (HNP 2012). *Clidemia hirta* is widespread and naturalized in forests throughout Hawai‘i.

- Reduced viability due to low numbers—Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species’ capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence (Barrett and Kohn 1991; Newman and Pilsen 1997). The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as anthropogenic impacts like habitat loss from human development or predation by nonnative species. Very small plant populations may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression. Small numbers are noted as a cause of loss of reproductive vigor of *Cyanea copelandii* subsp. *haleakalaensis* (Bruegmann *et al.* 2016).

#### New Management Actions:

- Ungulate monitoring and control—Individuals of *Cyanea copelandii* subsp. *haleakalaensis* within Haleakalā National Park and in fenced portions of Hanawā NAR are provided protection from feral ungulates. A fence was completed in 2006 extending from the Hanawā NAR west to Ko‘olau Gap, and protects an additional 7,000 ac (2,833 ha) of native forest. This area is divided into five units (Honomanū, Ko‘olau Gap, Wailua Nui, Wailua Iki, and Kopiliula) which are managed through the East Maui Mountains Watershed Partnership (81 FR 17790, March 30, 2016). Some individuals of *C. copelandii* subsp. *haleakalaensis* occur within this fenced enclosure; however, any unfenced individuals are subject to habitat destruction and degradation, and predation, by feral ungulates.
- Captive propagation for genetic storage and reintroduction—
  - One founder of *Cyanea copelandii* subsp. *haleakalaensis* from Kailua, not observed since the 1990s, is represented in a collection (PEPP 2017). Four founders from ‘Ohe‘o, 20 founders from Puohokamoa, and one founder from Waikamoi are all represented in collections (separate from those that occur within Haleakalā National Park (HNP), below) (PEPP 2017).
  - Lyon Arboretum Micropropagation Laboratory reports over 1,000 containers of propagules of *Cyanea copelandii* subsp. *haleakalaensis* collected between 2008 and 2016. Lyon Seed Conservation Laboratory reports over 4,000 seeds collected in 2007 from individuals at Kūhiwa (Lyon Arboretum 2017).
  - Olinda Rare Plant Facility (ORPF) reported five potted plants sourced from Waikamoi Stream (ORPF 2017).
  - In 2012, Haleakalā National Park (HNP) reported that individuals of *Cyanea copelandii* subsp. *haleakalaensis* were recovering dramatically from more stringent management, and determined that reintroductions in the Park were no longer necessary. However, HNP did find a need to continue to control the nonnative invasive plant, *Clidemia hirta* (HNP 2012). By 2017, the Park had mapped 130 new individuals of *C. copelandii* subsp. *haleakalaensis*, took 271 cuttings from 100 founders, and collected one fruit that was sent to Lyon Arboretum for tissue culture (HNP 2017).

- Research and outcrossing between propagated individuals is ongoing to determine if reproductive vigor can be improved (NTBG 2014).

### **Synthesis:**

Surveys conducted since completion of the last 5-year review for this subspecies located new populations of individuals at Kūhiwa Valley, Kawaipapa, and ‘Ohe‘o. Seed and cuttings collections are ongoing. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *Cyanea copelandii* is vulnerable to the effects of climate change. Approximately one-third of the founders are represented in collections.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Addendum to the Recovery Plan for the Multi-Island Plants (USFWS 2002), and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i 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.

*Cyanea copelandii* subsp. *haleakalaensis* is a short-lived perennial vine-like 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 Maui where they now occur or occurred historically. Each of these populations must be naturally reproducing (*i.e.*, viable seeds, seedlings, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this subspecies have not been met as there is only one population of at least 50 individuals (it is not clear whether these individuals have been actively reproducing during this time period), genetic representation is incomplete (approximately one-third of the founders are represented in collections) (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Cyanea copelandii* subsp. *haleakalaensis* meets the definition of Endangered as it remains in danger of extinction throughout its range.

### **Recommendations for Future Actions:**

Limited distribution and small population size, along with continued habitat destruction and herbivory by feral ungulates, are additional threats to this subspecies. We are not aware of significant new information regarding the subspecies’ biological status since the

last 5-year review in 2011. 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 *Cyanea copelandii* subsp. *haleakalaensis* in areas of potentially suitable habitat.
- Ungulate monitoring and control—Continue to construct and maintain fenced enclosures to protect individuals from the negative impacts of feral ungulates. Protect all occurrences against browsing and habitat disturbances from 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.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this subspecies, and determine future landscape needed for the recovery of the subspecies.
- Captive propagation for genetic storage and reintroduction—Continue propagation efforts for maintenance of genetic stock.
- Reintroduction and translocation—Reintroduce individuals into suitable habitat within historic range, and outside of Haleakalā National Park, that is being managed for known threats to this subspecies.
- Predator and herbivore monitoring and control—
  - Implement effective control methods for rodents at the last known location.
  - Develop and implement an effective method of slug control
- Stochastic events—Build resilience and redundancy—Increase numbers of populations and individuals scattered through historic range to reduce impacts from landslides and flooding.

**Table 1. Status and trends of *Cyanea copelandii* subsp. *haleakalaensis* from listing through current 5-year review.**

<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>Stability Criteria identified in Recovery Plan</b>	<b>Stability Criteria Completed?</b>
1999 (listing)	235	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2002 (recovery plan)	204	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	204	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2011 (5-year review)	> 300	30	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2016 (critical habitat)	> 600**	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially

			Three populations with 50 mature individuals each	No
<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>*Preventing Extinction Criteria identified by HPPRCC</b>	<b>*Preventing Extinction Criteria Completed?</b>
2018 (5-year review)	300–500	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Reproduction ( <i>i.e.</i> viable seeds, seedlings) at all three populations	No
			Three populations with 50 mature individuals each	Partially, one population > 50

\* 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).

\*\* The number of individuals estimated at Kīpahulu Valley was higher than previously provided for the 2010 5-year review, leading to a higher overall estimate.

**Table 2. Threats to *Cyanea copelandii* subsp. *haleakalaensis* and ongoing conservation efforts.**

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, fencing at HNP and Hanawī NAR
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control at HNP
Landslides and flooding destruction or degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	Partial, fencing at HNP and Hanawī NAR
Rodent predation or herbivory	C	Ongoing	None
Invertebrate predation or herbivory	C	Ongoing	None
Stochastic events—Reduced viability due to low numbers	E	Ongoing	Partial, propagation and seed storage efforts are ongoing

**References:**

See the previous 5-year review for a full list of references (USFWS 2011). Only references for new information are provided below.

Barrett, S.C.H. and J.R. Kohn. 1991. Genetic and evolutionary consequences of small population size in plants—implications for conservation. *In* Genetics and Conservation of Rare Plants, D.A. Falk and K.E. Holsinger (eds.), Oxford University Press, New York and Oxford, Pp. 3–30.

Bruegmann, M., Caraway, V.L. & Keir, M. 2016. *Cyanea copelandii* subsp. *haleakalaensis*. The IUCN Red List of Threatened Species 2016: e.T44142A83797363. <http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T44142A83797363.en>.

[CGAPS] Coordinating Group on Alien Pest Species. 2009. <http://www.Hawaii'invasivespecies.org/cgaps>.

[DLNR] Department of Land and Natural Resources. 2010. Hawai‘i administrative rules, title 13, subtitle 5, part 2, chapter 123, rules regulating game mammal hunting. 78 pp.



- 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.
- [HNP] Haleakala National Park. 2012. Information for programmatic section 7 consultation, Haleakalā National Park, Maui, Hawai'i. National Park Service, June 1, 2012. 171 pp.
- [HNP] 2017. Annual report for threatened and endangered species permit T#14497-15, Haleakala National Park, Resource Management, Vegetation Management, 2017.
- [HPPRCC] Hawai'i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Ikuma, E.K., D. Sugano, and J.K. Mardfin. 2002. Filling the gaps in the fight against invasive species. Report No. 1, Legislative Reference Bureau, Honolulu. 122 pp.
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- Newman, D. and D. Pilson. 1997. Increased probability of extinction due to decreased genetic effective population size: experimental populations of *Clarkia pulchella*. *Evolution* 51: 354–362.
- [ORPF] Olinda Rare Plant Facility. 2017. Controlled propagation report.
- Oppenheimer, H. 2018, in litt. GIS data and population information for *Cyanea copelandii* subsp. *haleakalaensis*.
- [PEPP] Plant Extinction Prevention Program. 2017. Statewide species totals *ex situ*, Excel table.
- [USFWS] U.S. Fish and Wildlife Service. 2011. *Cyanea copelandii* subsp. *haleakalaensis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI.  
[https://ecos.fws.gov/docs/five\\_year\\_review/doc3825.pdf](https://ecos.fws.gov/docs/five_year_review/doc3825.pdf).
- [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.

**U.S. FISH AND WILDLIFE SERVICE**

SIGNATURE PAGE for 5-YEAR REVIEW of *Cyanea copelandii* subsp. *haleakalaensis*  
(hāhā)

**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
- No Change in listing status

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