

Cyanea superba subsp. *superba*

- **Scientific name:** *Cyanea superba* (Cham.) A. Gray subsp. *superba*
- **Hawaiian name:** *Haha, ohawai*
- **Family:** Campanulaceae (Bellflower family)
- **Federal status:** Listed endangered September 11, 1991
- **MIP Requirements for Stability**
 - 4 Population Units (PU)
 - 50 reproducing individuals in each PU (long-lived perennial with a history of precipitous decline, extirpated in the wild, and extremely low genetic variability)
 - Threats controlled
 - Stable population structure
 - Complete genetic representation in storage of all PUs
- **Description and biology:** *Cyanea superba* subsp. *superba* is a tree 4-6 m tall with a single major stem, or occasionally two or more major stems arising from the base of the plant. Two of the basal-branching plants formerly growing at Kahanahaiki each had about 8-10 major stems (Lau pers. comm. 2000). The taxon's leaves measure 0.5-1.0 m long, and are clustered at the stem tips. The inflorescences hang below the leaves, and terminate in a cluster of 5-15 flowers. The corollas are whitish to cream, curved, and measure 5.5-8.8 cm long. The berries are yellow to orange, egg-shaped, and measure 16-22 mm long (excerpt from MIT 2003).

Cyanea superba subsp. *superba*

- **Description and biology cont.:** This taxon reportedly flowers from September through October. It was probably originally pollinated by nectar-feeding birds, as is thought for *Cyaneas* in general, with their long tubular flowers. *Cyanea superba* subsp. *superba* is capable of self-pollination, as evidenced by the production of fertile seeds in the Kahanahaiki population unit in years when only a single plant had flowered. Fruit-eating birds presumably dispersed the seeds. Based on growth rates and the size of mature plants, *C. superba* subsp. *superba* may live for up to 20 years or more (Lau pers. comm. 2000).
- **Known distribution:** The few documented locations for *C. superba* subsp. *superba* are all in the northern Waianae Mountains. These locations are the eastern slope of Mt. Kaala, Makaleha Valley, Pahole Gulch, and Kahanahaiki Valley. After the original collections prior to 1870, no plants were known until its rediscovery in 1971 in Pahole. The Kahanahaiki site was discovered in 1987. By 1991, a total of less than 20 plants were known from Pahole and Kahanahaiki. The Pahole plants were gone by 1994 and the last Kahanahaiki plant died in 2002.
- **Habitat:** The historic sites in Kahanahaiki Valley and Pahole Gulch, are on the lower to upper gulch slopes. These slopes are fairly steep. The vegetation at these sites consists of mesic forest comprised of a mix of various native and alien tree species.
- **Taxonomic background:** *Cyanea superba* is endemic to Oahu. It is comprised of two subspecies: subsp. *superba* of the northern Waianae, and subsp. *regina* of the southeastern Koolau Mountains. *Cyanea superba* subsp. *regina* was last recorded in 1960. In 1913, Joseph Rock wrote in [The Indigenous Trees of the Hawaiian Islands](#), "The queen of all is the lobeliaceous *Cyanea superba* var. *regina*, an exceedingly beautiful plant found only on Oahu, in the gulches of Wailupe and Niu, and in Makaleha of the Kaala range."

Reproductive Biology Table

| Population Unit | Observed Phenology | | | Reproductive Biology | | Seeds | |
|-----------------|--------------------|----------------|--------------|----------------------|----------------------|---------------------|-------------|
| | Flower | Immature Fruit | Mature Fruit | Breeding System | Suspected Pollinator | Average # Per Fruit | Dormancy |
| ALL | Sept-Oct | Oct-Jan | Oct-Jan | Hermaphroditic | Bird* | 112 ± 80 | Not Dormant |

*Smith, T.B. L.A. Freed, J.K. Lepson, J.H. Carothers. 1995. Evolutionary Consequences of Extinctions in Populations of a Hawaiian Honeycreeper. Conservation Biology 9: 1, 107-113.

*Lammers, T.G. & C.E. Freeman. 1986. Ornithophily among the Hawaiian Lobelioideae (Campanulaceae): evidence from nectar sugar compositions. American Journal of Botany 73: 1613-1619.





**Map removed,
available upon request**

Population Units

| Manage For Stability Population Units | PU Type | Which Action Area is the PU inside? | Management Units for Threat Control |
|---------------------------------------|----------------|-------------------------------------|-------------------------------------|
| Kahanahaiki | Reintroduction | MMR | Kahanahaiki |
| Central and East Makaleha | Reintroduction | None | East Makaleha |
| Makaha | Reintroduction | None | Makaha Subunit I |
| Pahole to Kapuna | Reintroduction | MMR | Pahole and Kapuna |
| Genetic Storage Population Units | | | |
| None | | | |

Population Structure

- Seedlings or immature plants were never observed when OANRP was monitoring the Kahanahaiki in situ site from 1995-2002.
- In 2009, regeneration of seedlings under outplanted individuals was first observed. After a few more years of continued recruitment and survival through larger age classes, the reintroduction sites may begin to have a population structure that would maintain at least 50 mature plants.
- OANRP will continue to monitor and record population structure trends. If the observed population structure will maintain the stabilization goal of 50 mature plants, no further planting may be needed. If monitoring shows that survivorship may not be sufficient to maintain the stability goal, the management strategy will be adapted.
- OANRP will develop techniques to increase seedling establishment at all sites. Particularly at sites where slug control with Sluggo may not be possible due to the presence of rare snails, trials may include collecting mature fruit and applying fruit to adjacent substrates.

| Population Unit Monitoring History | | | | | | | | | |
|------------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Population Unit | 1998 Mat/Imm/ Seedling | 2000 Mat/Imm/ Seedling | 2001 Mat/Imm/ Seedling | 2002 Mat/Imm/ Seedling | 2005 Mat/Imm/ Seedling | 2006 Mat/Imm/ Seedling | 2007 Mat/Imm/ Seedling | 2008 Mat/Imm/ Seedling | 2009 Mat/Imm/ Seedling |
| Kahanahaiki in situ | 5/0/0 | 2/0/0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kahanahaiki outplanted | 0/8/0 | 0/50/0 | 0/58/0 | 0/75/0 | 0/62/0 | 17/108/0 | 19/92/0 | 18/126/0 | 33/127/193 |
| Pahole to Kapuna outplanted | 0 | 32/42/0 | 18/176/0 | 18/177/0 | 29/148/0 | 72/84/0 | 72/68/0 | 92/85/0 | 91/100/255 |
| Makaha outplanted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0/42/0 |

Monitoring Plan

- All PUs will be monitored annually for population structure, trends and threats.
- All individuals at outplanting sites will be monitored twice annually for reproductive status, vigor and growth.
- All sites with reproductive plants will be monitored every December in order to time the installation of rodent protection as the fruit develops.
- Sites with reproductive plants will also be monitored in the spring for new seedlings. Monitoring will focus on areas under fruiting plants. Seedlings at all sites will be counted and areas with seedlings will be delineated on sketch maps. New immature plants at all sites will be tagged and monitored for vigor and growth.
- Sites with seedlings will be examined and a profile of micro-site requirements will begin to be developed.
- Seedlings will be monitored to track survivorship and growth. Slug impacts will be documented as another focus of the searches. The sites with seedlings in the Pahole to Kapuna PU have no ongoing slug control. These sites will be used as an experimental control to document the impact of slug control on seedlings in the Kahanahaiki PU.
- Records from the annual census of seedlings and growth rates and survivorship of immature plants, projections of population structure may be developed.

Genetic Storage Plan

| What propagule type is used for meeting genetic storage goal? | What is the source for the propagules? | What is the Genetic Storage Method used to meet the goal? | What is the proposed re-collection interval for seed storage? | Is seed storage testing ongoing? | Plan for maintaining genetic storage. |
|---|--|---|---|----------------------------------|--|
| Seeds | Reintroductions | Seed banking (5c or -80C / 20% RH) | > 10 years | Yes | Collections will be made from reintroductions as needed. |

Genetic Storage Plan Comments:

- As no wild plants remain collections are made from reintroductions. Founders are tracked and collections made appropriately.
- When F1s become reproductive collections will be made to represent these individuals as they may represent new founders and have undergone selective pressures at the seed, seedling, and immature stages.
- Collection procedures changed in December 2006 to improve longevity of seeds in storage. Thorough storage testing began in January 2007. Five year results will be available in 2012. Data from older collections suggest that re-collection efforts may be between every 10-20 years.

Reintroduction Plan

| Population Unit | Reintroduction Site(s) | Number of Plants to be planted* | Propagule Type | Propagule Population(s) Source | Number of Founders in Source Population | Plant Size | Pot Size |
|---------------------------------|---|---------------------------------|-----------------|----------------------------------|---|------------|------------|
| Kahanahaiki | MMR-E | 100 (166%) | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Kahanahaiki | MMR-H | 100 (166%) | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Kahanahaiki | MMR- B, D, F, G | 0 | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Pahole to Kapuna | Pahole: PAH-A | 100 (137%) | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Pahole to Kapuna | Pahole: PAH-B** | 0 | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Pahole to Kapuna | Kapuna: KAP- A,B** | 0 | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Makaha | MAK- A | 150 | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Central and East Makaleha | East Makaleha: LEH- A – Not yet established | 150 | Immature Plants | Kahanahaiki and Pahole to Kapuna | 3 | > 25cm | 1-2 gallon |
| Genetic Storage Population Unit | | | | | | | |
| None | | | | | | | |


*Number of plants to be planted: The target number for each site is listed followed by a percentage for sites with existing plantings. The total number planted (adjusted for time to mature after planting) was divided by the number of these plants that are mature. The percentage displayed is the multiplier needed to compensate for the survivorship of mature plants calculated for each site. The target number is multiplied by this percentage to get the number of plants to be planted. For sites with no existing or recently planted plants, the baseline 150 plants (50 of each of the three founders) will be planted initially, and more will be added if needed.

**Older state reintroduction will be monitored and collected from by OANRP but not planted into.

Reintroduction Plan Comments

- The reintroduction of *C. superba* into Kahanahaiki was the first endangered species in the nation to be reintroduced onto Army managed lands.
- The MMR-B, D, F, G sites in Kahanahaiki are no longer supplemented due to poor performance when compared with MMR-E and MMR-H.
- The sites in the Pahole to Kapuna PU at KAP-A, KAP-B and PAH-B are Oahu NARS reintroductions planted from 1995 to 1999. They are monitored but not used.
- Reintroduction protocols for *C. superba* are well developed and will be followed for the Makaleha reintroduction. The propagule type, plant and pot size are standardized.

5 Year Action Plan

| |  | | | | |
|---|---|---|---|---|---|
| Population Unit | MIP YEAR 6 October 1, 2009 – September 31, 2010 | MIP YEAR 7 October 1, 2010 – September 31, 2011 | MIP YEAR 8 October 1, 2011 – September 31, 2012 | MIP YEAR 9 October 1, 2012 – September 31, 2013 | MIP YEAR 10 October 1, 2013 – September 31, 2014 |
| Kahanahaiki | <ul style="list-style-type: none"> •Reintroduce •Monitor •Slug control | <ul style="list-style-type: none"> •Reintroduce •Monitor & Collect •Slug control •Seed sowing trial | <ul style="list-style-type: none"> •Reintroduce •Monitor & Collect •Slug control •Seed sowing trial | <ul style="list-style-type: none"> •Monitor •Slug control | <ul style="list-style-type: none"> •Monitor •Slug control |
| Central and East Makaleha | None | <ul style="list-style-type: none"> • Begin fence construction | <ul style="list-style-type: none"> • Complete fence construction •Begin propagation | <ul style="list-style-type: none"> •Reintroduce | <ul style="list-style-type: none"> •Reintroduce |
| Makaha | <ul style="list-style-type: none"> •Reintroduce •Monitor | <ul style="list-style-type: none"> •Reintroduce •Monitor | <ul style="list-style-type: none"> •Reintroduce •Monitor | <ul style="list-style-type: none"> •Monitor •Slug Control | <ul style="list-style-type: none"> •Monitor •Slug Control |
| Pahole to Kapuna | <ul style="list-style-type: none"> •Reintroduce •Monitor | <ul style="list-style-type: none"> •Reintroduce •Monitor & Collect | <ul style="list-style-type: none"> •Reintroduce •Monitor & Collect •Slug Control | <ul style="list-style-type: none"> •Monitor •Slug Control | <ul style="list-style-type: none"> •Monitor •Slug Control |
| Genetic Storage Population Units | | | | | |
| None | | | | | |

2008-2009 Stabilization Goals Update

| MFS Population Units | PU Stability Target | | MU Threat Control | | | | | | Genetic Storage |
|---------------------------|--|---|-------------------|---------|---------|------|---------|------------------|---|
| | Has the Stability Target for mature plants been met? | Does the PU have observed structure to support the stability target in the long-term? | Ungulates | Weeds | Rodents | Fire | Slugs | Black Twig Borer | Are there enough propagules in Genetic Storage? |
| Kahanahaiki | NO | NO | YES | YES | YES | NO | PARTIAL | NO | YES |
| Central and East Makaleha | NO | NO | N/A | N/A | N/A | N/A | N/A | NO | N/A |
| Makaha | NO | NO | YES | YES | NO | NO | NO | NO | N/A |
| Pahole to Kapuna | YES | NO | YES | PARTIAL | NO | NO | NO | NO | N/A |

2008-2009 Highlights

Major Highlights/Issues MIP Year 5

- The stability goal of 50 reproducing individuals is met for the Pahole to Kapuna PU.
- Naturally occurring seedlings were observed in several locations in the last year. At the Kahanahaiki PU over 300 in total were found under 8 separate plants. An additional 300 seedlings were observed under two plants in the Pahole to Kapuna PU. In addition, one immature plant was observed under a reintroduced plant at Puu Palikea that had been planted by TNCH.
- There are now a total of nearly 200 immature plants in the Kahanahaiki PU beneath four separate reintroduced individuals (Figure 2.7.1). As slugs are known to attack seedlings of this species, the organic molluscicide, Sluggo, was applied under an Experimental Use Permit valid through February 2010. Sluggo application coincided with seedling counts.
- The Mahaka fence was declared pig free in the summer of 2009 and reintroductions began in the last year.
- A large-scale rat control grid was established in the Kahanahaiki MU protecting maturing fruit from rats.
- UH Botany graduate student, R. Pender, began a study of pollination biology at the Kahanahaiki PU.

Plans for MIP Year 6

- Continue to supplement the reintroduction at Makaha.
- Pursue fencing plans for East Makaleha with the State of Hawaii.
- Conduct seedling searches under all mature plants in January and February 2010.
- Continue to track seedlings at both the Kahanahaiki PU and the Pahole to Kapuna PU and monitor for potential benefits of slug control.
- Pursue Special Local Needs (SLN) labeling of Sluggo for use in natural areas devoid of *Achatinella*.
- Develop plans for a seed sowing trial that will seek to identify microhabitats that will support germination

2008-2009 Taxon Status Table

Action Area: In

TaxonName: Cyanea superba subsp. superba

TaxonCode: CyaSupSup

| Population Unit Name | Management Designation | Current Mature (Wild) | Current Immature (Wild) | Current Seedling (Wild) | Current Augmented Mature | Current Augmented Immature | Current Augmented Seedling | NRS Mature 2008 | NRS Immature 2008 | NRS Seedling 2008 | Total Mature | Total Immature | Total Seedling | Population Trend Notes |
|-------------------------|------------------------|-----------------------|-------------------------|-------------------------|--------------------------|----------------------------|----------------------------|-----------------|-------------------|-------------------|--------------|----------------|----------------|---|
| Kahanahaiki | Manage for stability | 0 | 0 | 0 | 33 | 127 | 193 | 18 | 126 | 0 | 33 | 127 | 193 | More plants were added to the reintroduction sites and many seedlings were observed |
| Total for Taxon: | | 0 | 0 | 0 | 33 | 127 | 193 | 18 | 126 | 0 | 33 | 127 | 193 | |

Action Area: Out

TaxonName: Cyanea superba subsp. superba

TaxonCode: CyaSupSup

| Population Unit Name | Management Designation | Current Mature (Wild) | Current Immature (Wild) | Current Seedling (Wild) | Current Augmented Mature | Current Augmented Immature | Current Augmented Seedling | NRS Mature 2008 | NRS Immature 2008 | NRS Seedling 2008 | Total Mature | Total Immature | Total Seedling | Population Trend Notes |
|---------------------------|-------------------------------------|-----------------------|-------------------------|-------------------------|--------------------------|----------------------------|----------------------------|-----------------|-------------------|-------------------|--------------|----------------|----------------|---|
| Central and East Makaleha | Manage reintroduction for stability | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | This reintroduction will begin when the MU fence is complete |
| Makaha | Manage reintroduction for stability | 0 | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 42 | 0 | The reintroduction was established in the last year |
| Pahole to Kapuna | Manage reintroduction for stability | 0 | 0 | 0 | 91 | 100 | 255 | 92 | 85 | 0 | 91 | 100 | 255 | More plants were added to the reintroduction sites and many seedlings were observed |
| Total for Taxon: | | 0 | 0 | 0 | 91 | 142 | 255 | 92 | 85 | 0 | 91 | 142 | 255 | |

2008-2009 Genetic Storage Status Table

| Population Unit Name | # of Potential Founders | | | Partial Storage Status | | | Storage Goals Met |
|--------------------------------------|-------------------------|--------------|--------------|--|---|--|-------------------------------------|
| | Current Mature | Current Imm. | NumWild Dead | # Plants >= 10 in Seedbank | # Plants >= 1 Microprop | # Plants >= 1 Army Nursery | # Plants that Met Goal |
| Cyanea superba subsp. superba | | | | | | | |
| Kahanahaiki | 0 | 0 | 6 | 3 | 3 | 3 | 3 |
| | | | | Total # Plants w/ >=10 Seeds in Seedbank | Total # Plants w/ >=1 Microprop | Total # Plants w/ >=1 Army Nursery | Total # Plants that Met Goal |
| | | | | 3 | 3 | 3 | 3 |

