

and rock slides, and/or reduced reproductive vigor due to the small number of existing individuals; predation by introduced slugs and rodents (roof rats (*Rattus rattus*) and mice (*Mus musculus*)); and habitat degradation by feral pigs (59 FR 9304).

Cyanea recta (haha)

Cyanea recta, a member of the bellflower family (Campanulaceae), is an unbranched shrub with densely hairy flowers. This short-lived perennial species is distinguished from other species in the genus that grow on Kauai by the following characteristics: horizontal or ascending inflorescence; narrowly elliptic leaves 12 to 28 cm (4.7 to 11 in) long; flat leaf margins; and purple berries (Lammers 1990).

Little is known about the life history of *Cyanea recta*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998a).

Historically, *Cyanea recta* was found in upper Hanalei Valley, Waioli Valley, Hanapepe Valley, Kalalau cliffs, Wainiha Valley, Makaleha Mountains, Limahuli Valley, Powerline Trail, and the Lehua Makanoe-Alakai area on the island of Kauai. Currently, there is a total of eight occurrences, with approximately 198 to 208 individuals, on State and private lands in the following areas: Waioli Valley, the left and right branches of Wainiha Valley, Makaleha Mountains, and Puu Eu, including areas in Halelea Forest Reserve, Kealia Forest Reserve, and the Lihue-Koloa Forest Reserve (GDSI 2000; HINHP Database 2000).

Cyanea recta grows in lowland wet or mesic *Metrosideros polymorpha* forest or shrubland, usually in gulches or on slopes, and typically at elevations between 234 and 1,406 m (768 and 4,613 ft). Associated native plant species include *Antidesma platyphyllum*, *Cheirodendron platyphyllum* (lapalapa), *Cibotium* spp. (hapuu), *Dicranopteris linearis*, *Diplazium* spp. (NCN), or *Psychotria* spp. (61 FR 53070; K. Wood, pers. comm., 2001).

The major threats to this species are bark removal and other damage by rats; habitat degradation by feral pigs; browsing by goats; unidentified slugs that feed on the stems; and competition with the nonnative plant species *Blechnum occidentale* (blechnum fern), *Clidemia hirta* (Koster's curse), *Crassocephalum crepidioides* (NCN), *Deparia petersenii* (NCN), *Erechtites valerianifolia* (fireweed), *Lantana camara*, *Melastoma candidum* (NCN),

Paspalum conjugatum (Hilo grass), *Rubus rosifolius* (thimbleberry), *Sacciolepis indica* (Glenwood grass), or *Youngia japonica* (Oriental hawkbeard) (61 FR 53070).

Cyanea remyi (haha)

Cyanea remyi, a member of the bellflower family (Campanulaceae), is a shrub with generally unbranched, unarmed (lacking prickles) stems which are hairy toward the base. This short-lived perennial species is distinguished from others in the genus that grow on Kauai by its shrubby habit; relatively slender, unarmed stems; smooth or minutely toothed leaves; densely hairy flowers; the shape of the calyx lobes; length of the calyx and corolla; and length of the corolla lobe relative to the floral tube (Lammers 1999).

Little is known about the life history of *Cyanea remyi*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown.

Currently, there are seven known occurrences with approximately 394 to 484 individuals among them on the island of Kauai. *Cyanea remyi* is reported from Pali Elele, Waioli Valley, Makaleha, Blue Hole, Kawaikini, and Kapalaoa on privately and State-owned lands, including the Halelea and Lihue-Koloa Forest Reserves (GDSI 2000; HINHP Database 2000; Lammers and Lorence 1993; K. Wood, *in litt.* 1999).

Cyanea remyi is usually found in narrow drainages and wet streambanks in lowland wet forest or shrubland at elevations between 215 and 1,167 m (704 and 3,829 ft). Associated native plant species include various "finger ferns" (in the Grammitidaceae family) and "filmy ferns" (in the Hymenophyllaceae family), *Adenophorus* spp. (NCN), *Antidesma platyphyllum*, *Bidens* spp., *Broussaisia arguta*, *Cheirodendron* spp., *Cyrtandra* spp., *Diplazium sandwichianum*, *Eragrostis grandis* (kawelu), *Freycinetia arborea* (ieie), *Hedyotis terminalis*, *Machaerina angustifolia*, *Metrosideros polymorpha*, *Perrottetia sandwicensis* (olomea), *Pipturus* spp. (mamaki), *Psychotria hexandra* (kopiko), *Syzygium sandwicensis* (ohia ha), *Thelypteris* spp. (palapalaia), *Touchardia latifolia* (olona), or *Urera glabra* (opuhe) (61 FR 53070; K. Wood, pers. comm., 2001).

The major threats to this species are competition with the nonnative plant species *Erechtites valerianifolia*, *Melastoma candidum*, *Paspalum conjugatum*, *Psidium cattleianum*, or *Rubus rosifolius*; habitat degradation by feral pigs; browsing by feral goats; predation by rats; unidentified slugs

that feed on the stems; and a risk of extinction from naturally occurring events, such as landslides or hurricanes, due to the small number of remaining populations (61 FR 53070).

Cyanea undulata (haha)

Cyanea undulata, a member of the bellflower family (Campanulaceae), is an unbranched (or the stem is occasionally forked) shrub or subshrub with fine rust-colored hairs covering the lower surface of the leaves. Its undulating leaf margins distinguish the species from other Kauai members of the genus (Lammers 1990, 1999).

Native members of the Campanulaceae (bellflower) family, including the genus *Cyanea*, are generally believed to be adapted to pollination by native nectar-eating passerine birds, such as the Hawaiian "honeycreepers." The long, tubular, slightly curved flowers of *C. undulata* fit this model, but field observations are lacking. The fleshy orange fruits of this species are adapted for bird dispersal like other species of *Cyanea*. Although recognized as a short-lived perennial species, specific details of the life history of this species, such as growth rates, age plants begin to flower, and longevity of plants, are unknown (Lorence and Flynn 1991; Service 1994).

Historically, *Cyanea undulata* was known only from the Wahiawa Bog area on Kauai. Currently, one occurrence with a total of 28 individuals is reported on privately owned land along the bank of a tributary of the Wahiawa Stream in the Wahiawa drainage (GDSI 2000; HINHP Database 2000).

Cyanea undulata typically grows in narrow drainages and wet streambanks in *Metrosideros polymorpha* dry to montane wet forest or shrubland at elevations between 145 and 1,066 m (476 and 3,497 ft). Associated native species include various grammitid and filmy ferns, *Adenophorus* spp., *Antidesma platyphyllum*, *Broussaisia arguta*, *Cheirodendron* spp., *Diplazium sandwichianum*, *Dryopteris glabra*, *Eragrostis grandis* (kawelu), *Bidens* spp., *Freycinetia arborea*, *Machaerina angustifolia*, *Mariscus* spp. (NCN), *Melicope feddei* (alani), *Perrottetia sandwicensis*, *Pipturus* spp., *Psychotria mariniana*, *Psychotria hexandra*, *Sadleria pallida* (amau), *Sadleria squarrosa* (apuu), *Smilax melastomifolia* (pioi), *Sphenomeris chinensis* (palaa), *Syzygium sandwicensis*, or *Thelypteris* spp. (Service 1994; K. Wood, pers. comm., 2001).

The primary threats to this species include competition with the nonnative plant species *Clidemia hirta*, *Cyathea*