

Species		Historic range	Family	Status	When listed	Critical habitat	Special rules
Scientific name	Common name						
<i>Schiedea stellarioides</i>	None	U.S.A.(HI)	Caryophyllaceae—Pink	E	590	NA	NA
<i>Viola kauaensis</i> var. <i>wahiawaensis</i>	Nani wai'ale'ale	U.S.A.(HI)	Violaceae—Violet	E	590	NA	NA

Dated: September 24, 1996.
 John G. Rogers,
 Acting Director, Fish and Wildlife Service.
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 BILLING CODE 4310-55-P

50 CFR Part 17

RIN 1018-AD50

Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Twenty-five Plant Species From the Island of Oahu, Hawaii

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The U.S. Fish and Wildlife Service (Service) determines endangered status pursuant to the Endangered Species Act of 1973, as amended (Act), for 25 plant taxa—*Chamaesyce herbstii* ('akoko), *Chamaesyce rockii* ('akoko), *Cyanea acuminata* (haha), *Cyanea humboldtiana* (haha), *Cyanea koolauensis* (haha), *Cyanea longiflora* (haha), *Cyanea st.-johnii* (haha), *Cyrtandra dentata* (ha'iwale), *Cyrtandra subumbellata* (ha'iwale), *Cyrtandra viridiflora* (ha'iwale), *Delissea subcordata* ('oha), *Eragrostis fosbergii* (No common name (NCN)), *Gardenia mannii* (nanu), *Labordia cyrtandrae* (kamakahala), *Lepidium arbuscula* ('anaunau), *Lobelia gaudichaudii* ssp. *koolauensis* (NCN), *Lobelia monostachya* (NCN), *Melicope saint-johnii* (alani), *Myrsine juddii* (kolea), *Phyllostegia hirsuta* (NCN), *Phyllostegia kaalaensis* (NCN), *Pritchardia kaalae* (loulu), *Schiedea kealiae* (NCN), *Trematolobelia singularis* (NCN), and *Viola oahuensis* (NCN). All 25 taxa are endemic to the island of Oahu, Hawaiian Islands. The 25 plant taxa and their habitats have been variously affected or are currently threatened by one or more of the following—competition, predation, or habitat degradation from alien species; human impacts; fire; and natural disasters. This

rule implements the Federal protection provisions provided by the Act for these plant taxa.

EFFECTIVE DATE: This rule takes effect November 12, 1996.

ADDRESSES: The complete file for this rule is available for inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, 300 Ala Moana Boulevard, Room 3108, P.O. Box 5088, Honolulu, Hawaii 96850.

FOR FURTHER INFORMATION CONTACT: Brooks Harper, Field Supervisor, Ecological Services (see **ADDRESSES** section) (telephone: 808/541-3441; facsimile 808/541-3470).

SUPPLEMENTARY INFORMATION:

Background

Chamaesyce herbstii, *Chamaesyce rockii*, *Cyanea acuminata*, *Cyanea humboldtiana*, *Cyanea koolauensis*, *Cyanea longiflora*, *Cyanea st.-johnii*, *Cyrtandra dentata*, *Cyrtandra subumbellata*, *Cyrtandra viridiflora*, *Delissea subcordata*, *Eragrostis fosbergii*, *Gardenia mannii*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Lobelia gaudichaudii* ssp. *koolauensis*, *Lobelia monostachya*, *Melicope saint-johnii*, *Myrsine juddii*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, *Pritchardia kaalae*, *Schiedea kealiae*, *Trematolobelia singularis*, and *Viola oahuensis* are endemic to the island of Oahu, Hawaiian Islands.

The island of Oahu is formed from the remnants of two large shield volcanoes, the younger Koolau volcano on the east and the older Waianae volcano to the west (Department of Geography 1983). Their original shield volcano shape has been lost as a result of extensive erosion, and today these volcanoes are called mountains or ranges, and consist of long, narrow ridges. The Koolau Mountains were built by eruptions that took place primarily along a northwest-trending rift zone (Macdonald *et al.* 1983) and formed a range now approximately 60 kilometers (km) (37 miles (mi)) long (Foote *et al.* 1972). Median annual rainfall for the Koolau Mountains varies from 130 to 640

centimeters (cm) (50 to 250 inches (in.)), most of which is received at higher elevations along the entire length of the windward (northeastern) side (Taliaferro 1959).

Nineteen of the plant taxa in this final rule occur in the Koolau Mountains—*Chamaesyce rockii*, *Cyanea acuminata*, *Cyanea humboldtiana*, *Cyanea koolauensis*, *Cyanea longiflora*, *Cyanea st.-johnii*, *Cyrtandra dentata*, *Cyrtandra subumbellata*, *Cyrtandra viridiflora*, *Delissea subcordata*, *Gardenia mannii*, *Labordia cyrtandrae*, *Lobelia gaudichaudii* ssp. *koolauensis*, *Lobelia monostachya*, *Melicope saint-johnii*, *Myrsine juddii*, *Phyllostegia hirsuta*, *Trematolobelia singularis*, and *Viola oahuensis*. The vegetation communities of the Koolau Mountains, especially in the upper elevations to which many of the plant taxa in this final rule are restricted, are primarily lowland mesic and wet forests dominated by *Metrosideros polymorpha* ('ohi'a) and/or other tree or fern taxa. However, the vegetation now covering the Koolau Mountain Range is mostly alien. The majority of the remaining native vegetation is restricted to steep valley head walls and inaccessible summit ridges. The windswept ridges are very steep and are characterized by grasses, ferns, and low-growing, stunted shrubs (Gagne and Cuddihy 1990).

The Waianae Mountains were built by eruptions that took place primarily along three rift zones. The two principal rift zones run in a northwestward and south-southeastward direction from the summit and a lesser one runs to the northeast. The range is approximately 64 km (40 mi) long. The caldera lies between the north side of Makaha Valley and the head of Nanakuli Valley (MacDonald *et al.* 1983). The Waianae Mountains are in the rain shadow of the parallel Koolau Mountains and except for Mt. Kaala, the highest point on Oahu (1,225 meters (m)) 4,020 feet (ft)), receive much less rainfall (Wagner *et al.* 1990). The median annual rainfall for the Waianae Mountains varies from 51 to 190 cm (20 to 75 in) with only the small summit area of Mt. Kaala

receiving the highest amount. Relative to the Koolau Mountains, the Waianae Mountains have a greater range of elevations, moisture regimes, and habitat types. As a result, the most biologically diverse region on the island of Oahu is the Waianae Mountains.

Thirteen of the 25 plant taxa occur in the Waianae Mountains—*Chamaesyce herbstii*, *Cyanea longiflora*, *Cyrtandra dentata*, *Delissea subcordata*, *Eragrostis fosbergii*, *Gardenia mannii*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Melicope saint-johnii*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, *Pritchardia kaalae*, and *Schiedea kealiae*. These taxa, with the exception of *Lepidium arbuscula* and *Schiedea kealiae*, are found primarily in mesic forests dominated by 'ohi'a, *Acacia koa* (koa), *Diospyros sandwicensis* (lama), or a diverse mix of trees. *Lepidium arbuscula* is found primarily in mesic shrublands on ridges, steep slopes, and cliffs composed of a variety of native shrubs, herbs, and grasses. *Schiedea kealiae* is found on dry cliff communities with a variety of native trees and shrubs (Joel Lau, The Nature Conservancy of Hawaii (TNCH), pers. comm., 1994).

The known habitat of these 25 plant taxa is owned by the City and County of Honolulu, the State of Hawaii (including land classified as Department of Hawaiian Homelands, Natural Area Reserve (NAR) System, Forest Reserve, and land leased by the Federal Government (Department of Defense (DOD)) for military use), the Federal Government, and private parties. Plants on land owned or leased by the Federal government are located on portions of Dillingham, Kaena Point, Makua, and Schofield Barracks Military Reservations; Kawaihoa and Kahuku training areas; Lualualei Naval Reservation; and the Omega U.S. Coast Guard Station. Private lands include Honouliuli Preserve, leased from a major landowner by TNCH.

Discussion of the 25 Plant Taxa Included in This Final Rule

Chamaesyce herbstii was first described by Warren Wagner (1988) based on a specimen collected by Derral Herbst in 1969 in the Waianae Mountains of Oahu. Other published names which Wagner considers to be synonymous with *Chamaesyce herbstii* include *C. rockii* var. *grandifolia*, *Euphorbia clusiaefolia* var. *grandifolia*, and *E. forbesii* (Hillebrand 1888, Koutnik 1985, Wagner 1988).

Chamaesyce herbstii, a member of the spurge family (Euphorbiaceae), is a small tree ranging from 3 to 8 m (10 to 26 ft) tall. The thin, leathery leaves,

normally 8 to 19.5 cm (3.1 to 7.7 in.) long and 1.8 to 3.8 cm (0.7 to 1.5 in.) wide, are narrowly oblong or sometimes more lance-shaped or elliptic. The leaves are arranged in pairs on the same plane. The small, petalless flower clusters (cyathia or compact flowering stalks with small individual flowers, the whole simulating a single flower) occur in groups of 3 to 15 in branched, open flowering stalks. The individual flower stalks are 8 to 20 millimeters (mm) (0.3 to 0.8 in.) long. The hairy inflorescence bracts (specialized leaves) are broadly bell-shaped and contain five to six yellowish green glands. The green or sometimes reddish purple-tinged, angular capsules (dry fruit that open at maturity) scarcely protrude from the bracts. This species is distinguished from others in the genus by the length of the flowering stalk and the color of the angular fruits (Koutnik 1990).

Historically *Chamaesyce herbstii* was known from scattered populations in the northern and central Waianae Mountains on the island of Oahu (Hawaii Heritage Program (HHP) 1994c1 to 1994c5). Currently this species is known from four populations in the central and northern Waianae Mountains—South Ekahanui Gulch, Pahole (Kukuiula) Gulch, Kapuna Gulch, and West Makaleha-Central Makaleha. These populations are found on private land in TNCH's Honouliuli Preserve and State land, including Pahole NAR (HHP 1994c1 to 1994c5). The total number of plants is estimated to be fewer than 200. *Chamaesyce herbstii* typically grows in mesic koa-'ohi'a lowland forests, *Pisonia* sp. (papala kepau)-*Charpentiera* sp. (papala) lowland forests, or diverse mesic forests at elevations between 530 and 700 m (1,750 to 2,300 ft). Associated plant taxa include the federally endangered *Alectryon macrococcus* var. *macrococcus* (mahoe), as well as *Hibiscus arnottianus* var. *arnottianus* (koki'o ke'oke'o), *Melicope* sp. (alani), *Pouteria* sp. ('ala'a), and *Urera glabra* (opuhe) (HHP 1994c1 to 1994c5).

The primary threats to *Chamaesyce herbstii* are habitat degradation and/or destruction by feral pigs (*Sus scrofa*); competition with alien plant taxa such as *Grevillea robusta* (silk oak), *Passiflora suberosa* (huehue haole), *Psidium cattleianum* (strawberry guava), and *Schinus terebinthifolius* (Christmas berry); potential fire; and risk of extinction from naturally occurring events (such as hurricanes) and/or reduced reproductive vigor due to the small number of remaining populations (HHP 1994c1 to 1994c5; Christa Russell, TNCH, pers. comm. 1994).

Joseph F. Rock collected a plant in 1908 in the Koolau Mountains, Oahu, which was described a year later by Charles Noyes Forbes as *Euphorbia rockii*. Leon Croizat and Otto Degener (Degener and Croizat 1936) later transferred the species to *Chamaesyce*, resulting in the new combination *Chamaesyce rockii*, the name accepted in the current treatment of Hawaiian members of the genus (Koutnik 1990). The specific epithet honors Rock, an intrepid collector and scholar of the Hawaiian flora.

Chamaesyce rockii, a member of the spurge family, is usually a compact shrub or sometimes a small tree typically ranging from 0.5 to 2 m (1.6 to 6.6 ft) tall, but in protected sites it has been known to reach 4 m (13 ft) in height. The leathery leaves, generally 8 to 14 cm (3 to 5.5 in.) long and 2 to 3.5 cm (0.8 to 1.4 in.) wide, are narrowly oblong to oblong-elliptic or sometimes narrowly elliptic in shape. The leaves are arranged in two opposite rows along the stem, and have smooth leaf margins. The cyathia occur in groups of about 3 to 10 in branched, open to sometimes condensed flowering stalks that are usually 2 to 6 cm (0.8 to 2.4 in.) long. The bracts of the flowering stalks are broadly bell-shaped and contain five to six greenish yellow, green, or red glands. The fruit is a brilliant red (sometimes pink-tinged red), round, hairless capsule, 14 to 25 mm (0.6 to 1 in.) long. The fruit protrudes noticeably from the bracts. This species differs from others in the genus in that it has large, red, capsular fruit (Koutnik 1990).

Chamaesyce rockii was known historically from scattered populations along the Koolau Mountains on the island of Oahu (HHP 1994d1 to 1994d13). Eleven of the thirteen known populations of this species are extant and are found on private land and State land leased by DOD for the Kawaihoa Training Area, as well as on Federal land on Schofield Barracks Military Reservation (HHP 1994d1 to 1994d11). Currently the total number of plants is estimated to be between 200 and 400 plants. *Chamaesyce rockii* typically grows in wet 'ohi'a-*Dicranopteris linearis* (uluhe) forest and shrubland between 640 and 915 m (2,100 and 3,000 ft) in elevation. Associated plant taxa include *Dubautia laxa* (na'ena'e pua melemele), *Machaerina* sp. ('uki), *Psychotria fauriei* (kopiko), *Wikstroemia* sp. ('akia), and *Myrsine juddii* (kolea) (HHP 1994d4).

The primary threats to *Chamaesyce rockii* are habitat degradation and/or destruction by feral pigs, potential impacts from military activities, and competition with alien plant taxa, such

as strawberry guava and *Clidemia hirta* (Koster's curse) (HHP 1994d1 to 1994d5, 1994d7, 1994d8).

While a pharmaceutical botanist on the vessel *Uranie*, Charles Gaudichaud-Beaupre collected a new lobelioid on Oahu, which he later described and named *Delissea acuminata* (Hillebrand 1888). Wilhelm Hillebrand (1888) transferred this species to the genus *Cyanea*, resulting in the new combination *Cyanea acuminata*. This is the name accepted in the current treatment of Hawaiian members of the family (Lammers 1990). Other published names considered synonymous with *Cyanea acuminata* include *C.*

acuminata var. *calycina*, *C. acuminata* forma *latifolia*, *C. occultans*, *Delissea acuminata* var. *calycina*, *D. acuminata* forma *latifolia*, *D. acuminata* var. *latifolia*, *D. occultans*, and *Lobelia acuminata* (Degener and Degener 1982, Hosaka and Degener 1938, Lammers 1990, St. John 1981 and 1987b, Wawra 1873).

Cyanea acuminata, a member of the bellflower family (Campanulaceae), is an unbranched shrub 0.3 to 2 m (1 to 6.6 ft) tall. The leaves, 11 to 32 cm (4.3 to 12.6 in.) long and 3 to 9 cm (1.2 to 3.5 in.) wide, are inversely lance-shaped to narrowly egg-shaped or elliptic. The upper leaf surface is green, whereas the lower surface is whitish green. The slightly hardened leaf edges contain small, spreading, pointed teeth. The leaf stalks are 2 to 10 cm (0.8 to 4 in.) long. Six to 20 flowers are arranged on a flowering stalk 15 to 60 mm (0.6 to 2.4 in.) long. The calyx lobes, 2 to 5 mm (0.08 to 0.2 in.) long, are narrowly triangular. The corolla is white and sometimes tinged purplish, 30 to 35 mm (1.2 to 1.4 in.) long and 3 to 4 mm (0.1 to 0.2 in.) wide. The tubular portion of the flower is almost erect to slightly curved, while the lobes are one-fourth to one-third as long as the tube and spreading. The yellow to yellowish orange, round berries are approximately 5 mm (0.2 in.) long. This species is distinguished from others in this endemic Hawaiian genus by the color of the petals and fruit and length of the calyx lobes, flowering stalk, and leaf stalks (Lammers 1990).

Historically, *Cyanea acuminata* was known from 31 scattered populations in the Koolau Mountains of Oahu (HHP 1994e1 to 1994e32). Currently, fewer than 100 plants are known from 15 populations on privately owned land; City and County of Honolulu land; State land, including land leased by the DOD for the Kawaiiloa Training Area; and Federal land on Schofield Barracks Military Reservation and the Omega Coast Guard Station (HHP 1994e1 to

1994e12, 1994e20, 1994e24, 1994e25). This species typically grows on slopes, ridges, or stream banks from 305 to 915 m (1,000 to 3,000 ft) elevation. The plants are found in mesic to wet 'ohi'a-uluhe, koa-'ohi'a, or *Diospyros sandwicensis* (lama)-'ohi'a forest (HHP 1994e1 to 1994e9, 1994e11, 1994e12, 1994e24, 1994e25; Lammers 1990).

The major threats to *Cyanea acuminata* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; potential predation by rats; competition with the noxious alien plant Christmas berry, Koster's curse, and *Ageratina adenophora* (Maui pamakani); and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HHP 1994e1 to 1994e4, 1994e7, 1994e8, 1994e10 to 1994e12, 1994e20; J. Lau, C. Russell, and Joan Yoshioka, TNCH, pers. comms. 1994).

While a botanist on the vessel *La Bonite* on his third trip to Hawaii, Gaudichaud-Beaupre collected a new lobelioid on Oahu which he later described and named as *Rollandia humboldtiana* (Lammers 1990). Other published names considered synonymous with *Rollandia humboldtiana* include *Delissea racemosa*, *Rollandia humboldtiana* forma *albida*, *R. pedunculosa*, and *R. racemosa* (Hillebrand 1888, Lammers 1990, Mann 1867–1868, St. John 1940, Wawra 1873). Recently, Lammers, Thomas Givnish, and Kenneth Sytsma merged the endemic Hawaiian genera *Cyanea* and *Rollandia* under the former name and published the new combination *Cyanea humboldtiana* (Lammers *et al.* 1993). The specific epithet honors the German naturalist and explorer, Baron Alexander von Humboldt.

Cyanea humboldtiana, a member of the bellflower family, is an unbranched shrub with woody stems 1 to 2 m (3.2 to 6.6 ft) tall. The leaves are inversely egg-shaped to broadly elliptic, 18 to 45 cm (7 to 18 in.) long and 7 to 16 cm (2.8 to 6.3 in.) wide. The leaf edges are hardened and have shallow, ascending rounded teeth. Five to twelve flowers are arranged on a hairy, downward bending flowering stalk which is 8 to 25 cm (3 to 10 in.) long. The dark magenta or white petals are 6 to 7.5 cm (2.4 to 3 in.) long and hairy. The pale orangish yellow berries are elliptic to inversely egg-shaped. This species differs from others in this endemic Hawaiian genus by the downward bending flowering stalk and the length of the flowering stalk (Lammers 1990).

Cyanea humboldtiana was known historically from 17 populations from the central portion to the southern end of the Koolau Mountains of Oahu (HHP 1994f1 to 1994f17). Currently, between 100 and 220 plants are known from three populations—Konahuanui summit, Moanalua-Kaneohe summit, and Lulumahu Gulch. These populations occur on private land, State land, and Federal land on the Omega U.S. Coast Guard Station (HHP 1994f1, 1994f2, 1994f16). This species is usually found in wet 'ohi'a-uluhe shrubland from 550 to 960 m (1,800 to 3,150 ft) elevation. Associated native plant taxa include ferns, alani, 'uki, *Ilex anomala* (kawa'u), and *Scaevola mollis* (naupaka kuahiwi) (HHP 1994f1, 1994f16).

Habitat degradation and/or destruction by feral pigs, potential predation by rats, competition with the alien plant Koster's curse, and a risk of extinction from naturally occurring events and/or reduced reproductive vigor, due to the small number of remaining populations, are the major threats to *Cyanea humboldtiana*. The Konahuanui summit population also is threatened by trampling by hikers (HHP 1994f1, 1994f2; J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

Cyanea koolauensis was first described by Hillebrand (1888) as *Rollandia longiflora* var. *angustifolia*, based on a specimen he collected on Oahu. In 1918 Rock elevated the variety to full species status as *Rollandia angustifolia* (Rock 1918b). Lammers *et al.* (1993) published the new name *Cyanea koolauensis* to replace *Rollandia angustifolia* when they merged *Cyanea* and *Rollandia*, as the name *Cyanea angustifolia* had already been used.

Cyanea koolauensis, a member of the bellflower family, is an unbranched shrub with woody stems, 1 to 1.5 m (3.5 to 5 ft) tall. The leaves are linear to narrowly elliptic with a whitish underside, 16 to 36 cm (6.3 to 14.2 in.) long and 1.5 to 4 cm (0.6 to 1.6 in.) wide. The leaf edges are hardened with shallow, ascending rounded teeth. The leaf stalks are 1.5 to 4.5 cm (0.6 to 1.8 in.) long. The flowering stalks are three to six-flowered. The flowering stalk is 15 to 40 mm (0.6 to 1.6 in.) long. The hypanthium (basal portion of the flower) is 6 to 12 mm (0.2 to 0.5 in.) long. The calyx lobes are fused into a sheath 2 to 8 mm (0.08 to 0.3 in.) long. The dark magenta petals are 5 to 9 cm (2.0 to 3.5 in.) long. The fruit is a round berry. *Cyanea koolauensis* is distinguished from others in this endemic Hawaiian genus by the leaf shape and width, the whitish green lower leaf surface and, the lengths of the

leaf stalks, calyx lobes, and hypanthium (Lammers 1990).

Cyanea koolauensis was known historically from 27 scattered populations throughout the Koolau Mountains on Oahu (HHP 1994g1 to 1994g28). Currently, 14 populations totalling fewer than 50 plants are known from the Waimea-Malaekahana Ridge to Hawaii Loa Ridge in the Koolau Mountains. These populations occur on City and County of Honolulu land, private land, and State land, including land leased to the DOD for the Kahuku and Kawailoa Training Areas (HHP 1994g1 to 1994g12, 1994g18, 1994g19, 1994g22). *Cyanea koolauensis* usually is found on slopes and ridge crests in wet 'ohi'a-uluhe forest or shrubland at elevations from 520 to 810 m (1,700 to 2,660 ft). Associated plant taxa include alani, *Antidesma* sp. (hame), *Diplopterygium pinnatum*, *Psychotria* sp. (kopiko), and *Scaevola* sp. (naupaka) (HHP 1994g1 to 1994g12, 1994g18, 1994g19, 1994g22; Lammers 1990).

Cyanea koolauensis is threatened by habitat destruction by feral pigs, potential impacts from military activities, potential predation by rats, competition with the aggressive alien plants Koster's curse and strawberry guava, trampling by hikers, overcollection, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HHP 1994g1 to 1994g5, 1994g7, 1994g22; Loyal Mehrhoff, U.S. Fish and Wildlife Service, J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

Cyanea longiflora was first collected by Hillebrand on Oahu and named in 1873, by Dr. Heinrich Wawra, as *Rollandia longiflora* (Hillebrand 1888). Other names considered synonymous with *Rollandia longiflora* are *R. lanceolata* var. *brevipes* and *R. sessilifolia* (Degener 1932, Lammers 1990, Wimmer 1953). Recently Lammers *et al.* (1993) published the new combination *Cyanea longiflora*. The specific epithet refers to the long flowers.

Cyanea longiflora, a member of the bellflower family, is an unbranched shrub with woody stems 1 to 3 m (3.5 to 10 ft) long. The leaves are elliptic or inversely lance-shaped, 30 to 55 cm (12 to 22 in.) long and 6 to 12 cm (2.4 to 4.7 in.) wide. Mature leaves have smooth or hardened leaf edges with shallow, ascending, rounded teeth. The flowering stalks are 5 to 10-flowered and 30 to 60 mm (1.2 to 2.4 in.) long. The calyx lobes are fused into an irregularly toothed sheath 2 to 4 mm (0.08 to 0.2 in.) long. The petals, 6 to 9 cm (2.4 to 3.5 in.) long, and the hairless

staminal column are dark magenta. The berries are almost pear-shaped. *Cyanea longiflora* differs from others in this endemic Hawaiian genus by the fused calyx lobes (Lammers 1990).

Cyanea longiflora was known historically from five populations in the Waianae Mountains and six populations in the Koolau Mountains of Oahu (HHP 1994h1, 1994h2 to 1994h14). Currently five populations of this species are known: Pahole Gulch, Makaha Valley, and Makaha-Waianae Ridge in the Waianae Mountains; and Kawainui Drainage and Opaepala Gulch in the Koolau Mountains (HHP 1994h1, 1994h3, 1994h11 to 1994h14). These 5 populations total between 220 and 300 plants. The populations are found on City and County of Honolulu land, private land leased by the DOD for the Kawailoa Training Area, and State-owned land, including Pahole NAR. *Cyanea longiflora* usually is found on steep slopes or ridge crests in mesic koa-'ohi'a forest in the Waianae Mountains or wet 'ohi'a-uluhe forest in the Koolau Mountains, usually between 620 and 780 m (2,030 and 2,560 ft) elevation. Associated plant taxa in koa-'ohi'a forest include hame, kopiko, uluhe, *Coprosma* sp. (pilo), and *Syzygium* sp. ('ohi'a ha). In wet 'ohi'a-uluhe forest, associated native taxa include 'akia, alani, *Cibotium* sp. (hapu'u), *Dubautia* sp. (na'ena'e), *Hedyotis* sp., and *Pittosporum* sp. (ho'awa) (HHP 1994h1, 1994h3, 1994h11, 1994h13, 1994h14; Lammers 1990).

The major threats to *Cyanea longiflora* are habitat degradation and/or destruction by feral pigs, potential impacts from military activities, potential predation by rats, competition with the alien plants strawberry guava and *Rubus argutus* (prickly Florida blackberry) in the Waianae Mountains and Koster's curse in the Koolau Mountains, potential fire, and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining, widely dispersed populations (HHP 1994h1, 1994h3, 1994h12 to 1994h14; J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

While hiking in the Koolau Mountains of Oahu, Edward Hosaka collected a new lobelioid, which he later described and named *Rollandia st.-johnii* (St. John and Hosaka 1935). *Rollandia st.-johnii* var. *obtusisepala* (Wimmer 1953) is not recognized in the most recent treatment of Hawaiian members of the family (Lammers 1990). Lammers *et al.* (1993) published the new name *Cyanea st.-johnii* when *Cyanea* and *Rollandia* were merged. The

specific epithet honors the late Harold St. John.

Cyanea st.-johnii, a member of the bellflower family, is an unbranched shrub with a woody stem 30 to 60 cm (12 to 24 in.) long. The leaves are lance-shaped to inversely lance-shaped, 6 to 13 cm (2.4 to 5.1 in.) long and 1.5 to 2 cm (0.6 to 0.8 in.) wide. The leaf edges are thickened, smoothly toothed, and curl under. The flowering stalk is 5 to 15 mm (0.2 to 0.6 in.) long, with 5 to 20 flowers. The hairless, white petals, 3 to 6 cm (1.2 to 2.4 in.) long, are suffused with pale violet in the inner surface. This species is distinguished from others in this endemic Hawaiian genus by the length of the leaves, the distinctly curled leaf margins, and the petal color (Lammers 1990).

Cyanea st.-johnii was known historically from 11 populations in the central and southern Koolau Mountains of Oahu (HHP 1994i1 to 1994i11). Currently, between 40 and 50 plants are known from 5 populations—Waimano Trail summit to Aiea Trail summit, the summit ridge crest between Manana and Kipapa trails, between the summit of Aiea and Halawa trails, Summit Trail south of Poamoho cabin, and Wailupe-Waimanalo summit ridge. These populations are found on City and County of Honolulu, private, and State lands (HHP 1994i1, 1994i7, 1994i9 to 1994i11). This species typically grows on wet, windswept slopes and ridges from 690 to 850 m (2,260 to 2,800 ft) elevation in 'ohi'a mixed shrubland or 'ohi'a-uluhe shrubland. Associated plant taxa include naupaka kuahiwai, 'uki, *Bidens* sp. (ko'oko'olau), and *Freycinetia arborea* ('ie'ie) (HHP 1994i1, 1994i7, 1994i9 to 1994i11).

Cyanea st.-johnii is threatened by habitat degradation and/or destruction by feral pigs, potential predation by rats, competition with the noxious alien plant Koster's curse, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining populations and individuals. The plants between the summit of Aiea and Halawa Trail also are threatened by trampling by hikers (HHP 1994i7, 1994i9, 1994i10; J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

In 1945 St. John collected a plant specimen on Oahu that he and W.B. Storey named *Cyrtandra dentata* (St. John and Storey 1950). In the same paper, St. John and Storey also described *Cyrtandra frederickii*, now considered synonymous with *Cyrtandra dentata* (Wagner *et al.* 1990). The specific epithet refers to the toothed margin of the leaf blades.

Cyrtandra dentata, a member of the African violet family (Gesneriaceae), is a sparingly branched shrub ranging from 1.5 to 5 m (5 to 16 ft) tall. Papery in texture, the leaves are broadly elliptic to almost circular or broadly egg-shaped to egg-shaped, 9 to 33 cm (3.5 to 13 in.) long, and 3 to 17 cm (1.2 to 6.7 in.) wide. Three to nine white flowers are arranged on an inverse umbrella-shaped flower cluster which arises from the leaf axil. The main flower stalk is 25 to 50 mm (1 to 2 in.) long and the individual flower stalks are 15 to 33 mm (0.6 to 1.3 in.) long. The leaf-like bracts are 12 to 30 mm (0.5 to 1.2 in.) long. The tubular portion of the flower is 12 to 25 mm (0.5 to 1 in.) long and 4 to 9 mm (0.2 to 0.4 in.) in diameter. The upper flower lobes are 2 to 6 mm (0.08 to 0.2 in.) long and 3 to 7 mm (0.1 to 0.3 in.) wide, while the lower lobes are 3 to 17 mm (0.1 to 0.7 in.) long and 4 to 9 mm (0.2 to 0.4 in.) wide. The round white berries are 1 to 2.6 cm (0.4 to 1 in.) long. This species is distinguished from others in the genus by the number and arrangement of the flowers, the length of the bracts and flower stalks, and the shape of the leaves (Wagner *et al.* 1990).

Cyrtandra dentata was historically known from six populations in the Waianae Mountains and three populations in the Koolau Mountains of Oahu (HHP 1994j1 to 1994j9). Currently, this species is found only in the Waianae Mountains in Pahole Gulch and Kapuna Valley on State land (within Pahole NAR) and in Ekahanui Gulch on State and private land (within TNCH's Honouliuli Preserve) (HHP 1994j2, 1994j6, 1994j7). The 3 known populations total fewer than 50 individuals. *Cyrtandra dentata* typically grows in gulches, slopes, or ravines in mesic forest with 'ohi'a, 'ohi'a ha, and *Aleurites moluccana* (kukui) at elevations from 580 to 720 m (1,900 to 2,360 ft) (HHP 1994j2, 1994j6, 1994j7; St. John 1966; Wagner *et al.* 1990).

Competition with the alien plants Koster's curse and strawberry guava, potential predation by rats, potential fire, and a risk of extinction from naturally occurring events (such as landslides/hurricanes/flooding) and/or reduced reproductive vigor, due to the small number of extant populations and individuals, are the major threats to *Cyrtandra dentata* (HHP 1994j6; J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

Hillebrand (1888) collected a specimen on Oahu that he named *Cyrtandra gracilis* var. *subumbellata*. St. John and Storey (1950) elevated the variety to full species status. The authors of the current treatment of the family concur with this designation

(Wagner *et al.* 1990). St. John's (1966) variety *intonsa* is not currently recognized (Wagner *et al.* 1990). The specific epithet refers to the umbrella-like flowering stalk.

Cyrtandra subumbellata, a member of the African violet family, is a shrub 2 to 3 m (6.6 to 10 ft) tall. Papery in texture, the leaves are almost circular to egg-shaped, 12 to 39 cm (4.7 to 15.4 in.) long, and 3 to 19 cm (1.2 to 7.5 in.) wide. The upper leaf surface is wrinkled, whereas the lower surface has conspicuously raised net-like veins and is moderately covered with white glands. Five to 15 white flowers are densely arranged on an inverse umbrella-shaped flowering stalk which arises from the leaf axil. The main flower stalk is 2 to 8 mm (0.08 to 0.3 in.) long. The style is approximately 10 mm (0.4 in.) long. The round, white berries are 1 to 1.5 cm (0.4 to 0.6 in.) long. This species is distinguished from others in the genus by the number and arrangement of the flowers, the lengths of the style and main flower stalks, and the texture of the leaves (Wagner *et al.* 1990).

Historically, *Cyrtandra subumbellata* was known from six scattered populations in the central Koolau Mountains on the island of Oahu (HHP 1994k1 to 1994k6). This species is now known from three populations in the central Koolau Mountains—Schofield-Waikane Trail and Puu Ohulehelo on private and State land and Kaukonahua drainage on Federal land within Schofield Barracks Military Reservation (HHP 1994k2, 1994k5, 1994k6). The total number of plants currently is estimated to be fewer than 50. This species typically grows on moist, forested slopes or gulch bottoms dominated by 'ohi'a or a mixture of 'ohi'a and uluhe, between 460 and 670 m (1,500 and 2,200 ft) elevation. Associated plant taxa include 'uki, *Adiantum raddiantum*, *Boehmeria grandis* ('akolea), *Broussaisia arguta* (kanawao), and *Thelypteris* sp. (HHP 1994k2, 1994k5, 1994k6; St. John 1966; Wagner *et al.* 1990).

The primary threats to *Cyrtandra subumbellata* are competition with the noxious alien plant Koster's curse, potential impacts from military activities, potential predation by rats, potential fire, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of extant populations and individuals (HHP 1994k6; J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

In 1950, St. John and Storey first described *Cyrtandra viridiflora* based on a specimen collected by Joseph Rock in

1911. Other published names now considered synonyms of this species are *Cyrtandra crassifolia* and *C. pickeringii* var. *crassifolia* (Hillebrand 1888, Rock 1918a, St. John 1966, Wagner *et al.* 1990). The specific epithet refers to the conspicuous green flowers.

Cyrtandra viridiflora, a member of the African violet family, is a small shrub 0.5 to 2 m (1.6 to 6.6 ft) tall. The thick, fleshy, heart-shaped leaves are 6 to 15 cm (2.4 to 6 in.) long, 3.5 to 7.5 cm (1.4 to 3 in.) wide, and have toothed margins. Both the upper and lower surfaces have long, velvety, pale hairs. One to five green flowers are arranged on an inverse umbrella-shaped flowering stalk. The pale green calyx is 12 to 15 mm (0.5 to 0.6 in.) long. The round, white berries are 1.3 cm (0.5 in.) or longer. This species is distinguished from others in the genus by the leaves, which are thick, fleshy, heart-shaped, and densely hairy on both surfaces (Wagner *et al.* 1990).

Historically, *Cyrtandra viridiflora* was known from seven scattered populations in the Koolau Mountains on the island of Oahu (HHP 1994L1 to 1994L7). This species is now known only from four populations in the northern Koolau Mountains—Kawainui-Laie summit divide, Kawainui-Kaipapau summit divide, Maakua-Kaipapau Ridge, and the Peahinaia Trail. Fewer than 10 plants are known from these 4 populations on State land and private land leased by the DOD for Kawaihoa Training Area (HHP 1994L4 to 1994L7). *Cyrtandra viridiflora* is usually found on wind-blown ridge tops in cloud-covered wet forest or shrubland at elevations of 690 to 850 m (2,260 to 2,800 ft). Associated plant taxa include kanawao, 'ohi'a, 'ohi'a ha, 'uki, and uluhe (HHP 1994L4 to 1994L7, Wagner *et al.* 1990).

The major threats to *Cyrtandra viridiflora* are habitat degradation or destruction by feral pigs, potential impacts from military activities, potential predation by rats, competition with the alien plants Koster's curse and strawberry guava, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining populations and individuals (HHP 1994L4 to 1994L6; J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

Delissea subcordata was first collected on Oahu by Gaudichaud-Beaupre over 150 years ago. He later described and named it for its heart-shaped leaf base (Hillebrand 1888). Lammers considers all subsequently named varieties to be synonymous with *Delissea subcordata*, including *D. subcordata* var. *kauaiensis*, *D. subcordata* var. *obtusifolia*, *D.*

subcordata var. *waiialaensis*, *D. subcordata* var. *waikaneensis*, and *Lobelia subcordata* (Lammers 1990, St. John 1977, Wawra 1873).

Delissea subcordata, a member of the bellflower family, is a branched or unbranched shrub 1 to 3 m (3.5 to 10 ft) tall. The leaves are egg-shaped or oval lance-shaped, with heart-shaped bases and blades 12 to 30 cm (4.7 to 12 in.) long and 6 to 17 cm (2.4 to 6.7 in.) wide. The leaf margins have shallow, rounded to sharply pointed teeth. Occasionally the leaf margin may be irregularly cut into narrow and unequal segments with one to six triangular lobes, 10 to 18 mm (0.4 to 0.7 in.) long, toward the leaf base. Six to 18 white or greenish white flowers are arranged on a flowering stalk 4 to 10 cm (1.6 to 4 in.) long. The calyx lobes are awl-shaped and 0.5 to 1 mm (0.02 to 0.04 in.) long. The curved corolla is 45 to 60 mm (1.8 to 2.4 in.) long and has a knob on the back side. The anthers are hairless. The fruit is an egg-shaped berry. This species is distinguished from others in this endemic Hawaiian genus by the shape and size of the leaves, the length of the calyx lobes and corolla, and the hairless condition of the anthers (Lammers 1990).

Historically, *Delissea subcordata* was known from 21 scattered populations in the Waianae Mountains and 8 populations in the Koolau Mountains of Oahu. A specimen collected by Mann and Brigham in the 1860's and labeled as from the island of Kauai is believed to have been mislabeled (HHP 1994m8). *Delissea subcordata* is now known only from the Waianae Mountains in nine populations distributed from Kawaiu Gulch in the Kealia land section in the northern Waianae Mountains to the north branch of North Palawai Gulch about 20 km (12 mi) to the south. This species is found on private land (TNCH's Honouliuli Preserve), Federal land (Schofield Barracks Military Reservation and Lualualei Naval Reservation), and State land (Pahole and Kaala NARs or leased to the Federal government (Makua Military Reservation)). The total number of plants in the 9 remaining populations is estimated to be between 70 and 80. *Delissea subcordata* typically grows on moderate to steep gulch slopes in mesic native or alien-dominated forests from 430 to 760 m (1,400 to 2,500 ft) elevation. Associated plant taxa include a variety of native trees such as 'ala'a, hame, kukui, 'ohi'a, papala kepau, *Diospyros hillebrandii* (lama), *Nestegis sandwicensis* (olopua), and kopiko (HHP 1994m1 to 1994m26; Takeuchi and Shimabukuro (s.n.) 1987; Takeuchi, Yap, and Paquin (3422) 1987; Takeuchi

and Paquin (2734) 1986; Takeuchi (2410) 1985).

Delissea subcordata is threatened by habitat degradation and/or destruction by pigs and goats; potential impacts from military activities, including road construction and housing development; potential predation by rats; competition with the alien plants Christmas berry, Koster's curse, strawberry guava, and *Lantana camara* (lantana); potential fire; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HHP 1994m1, 1994m7; Takeuchi & Shimabukuro (s.n.) 1987; Takeuchi (2410) 1985; J. Lau, L. Mehrhoff, and J. Yoshioka, pers. comms. 1994).

In 1933, F. Raymond Fosberg collected a plant in the Waianae Mountains that Leo D. Whitney (1937) named *Eragrostis fosbergii*. This species is maintained in the most recent treatment of Hawaiian members of this genus (O'Connor 1990).

Eragrostis fosbergii is a perennial grass (family Poaceae), with stout, tufted culms (stems) 60 to 100 cm (24 to 40 in.) long, which usually arise from an abruptly bent woody base. The leathery leaf blades, 40 to 60 cm (16 to 24 in.) long and 5 to 10 mm (0.2 to 0.4 in.) wide, are flat but curl inward towards the apex. The small flowers occur in complex clusters that are somewhat open, pyramidal, and 20 to 40 cm (8 to 16 in.) long. The pale to dark green spikelets (ultimate flower clusters) generally contain three to five flowers, and are about 5 mm (0.2 in.) long. The slender glumes (small bracts at the base of the spikelet) have margins fringed with long hairs. The lemmas (inner bracts that subtend the flowers) have loosely overlapping margins, which are occasionally fringed with hairs. The fruit is a grain. This species is distinguished from others in the genus by its stiffly ascending flowering stalk and the long hairs on the margins of the glumes and occasionally on the margins of the lemmas (O'Connor 1990).

Historically, *Eragrostis fosbergii* was known only from the Waianae Mountains of Oahu, from the slopes of Mount Kaala and in Waianae Kai and its associated ridges (HHP 1994n1 to 1994n6). This species was thought to be extinct until rediscovered by Joel Lau of TNCH in 1991. Only six individuals are known to remain in Waianae Kai in four populations on land owned by the State and the City and County of Honolulu (HHP 1994n3 to 1994n6). *Eragrostis fosbergii* typically grows on ridge crests or moderate slopes in native or alien forests between 720 and 830 m (2,360 and 2,720 ft) elevation. Associated plant

taxa include Christmas berry, koa, 'ohi'a, *Psydrax odoratum* (alaha'e), *Dodonaea viscosa* ('a'ali'i), and *Eragrostis grandis* (kawelu) (HHP 1994n3 to 1994n6).

Major threats to *Eragrostis fosbergii* include degradation of habitat by feral pigs and goats; competition with alien plants such as Christmas berry, silk oak, and strawberry guava; and trampling by hikers. This species also is threatened by the risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining populations and individuals (HHP 1994n3 to 1994n6; C. Russell, pers. comm. 1994).

Gardenia mannii was first described by St. John and J.R. Kuykendall in 1949, based on a specimen they had collected a few years earlier in the Koolau Mountains, Oahu. In the same paper, St. John and Kuykendall also described *Gardenia mannii* var. *honoluluensis*, which is not currently recognized (Wagner *et al.* 1990). The specific epithet honors Horace Mann, Jr., an early collector of Hawaiian plants.

Gardenia mannii, a member of the coffee family (Rubiaceae), is a tree 5 to 15 m (16 to 50 ft) tall. The leaves are inversely lance-shaped or slightly more elliptic, 6 to 27 cm (2.4 to 10.6 in.) long, and 3.5 to 10 cm (1.4 to 4 in.) wide. The upper leaf surface is sticky. The fragrant flowers bloom in the late afternoon, and usually last for 2 days. They are solitary and occur at the branch tips. The cup-shaped calyx, 3 to 5 mm (0.1 to 0.2 in.) long, extends into four to six leathery, long, thin, terminal spurs (hollow appendages). These spurs are linear spatula-shaped, "S" shaped, or, rarely, sickle-shaped; 23 to 46 mm (0.9 to 1.8 in.) long; and 5 to 11 mm (0.2 to 0.4 in.) wide. The corolla is cream colored on the outside and white on the inside. The tubular portion of the flower is 17 to 27 mm (0.7 to 1.1 in.) long (when dry), and the seven to nine lobes are 16 to 22 mm (0.6 to 0.9 in.) long (when dry). The yellow to orange fruit is broadly elliptic. This species is distinguished from others in the genus by the shape and number of the calyx spurs (Wagner *et al.* 1990).

Historically *Gardenia mannii* was known from 7 widely scattered populations in the Waianae Mountains and 39 populations distributed along almost the entire length of the Koolau Mountains of Oahu (HHP 1994o1 to 1994o46). Currently 22 populations of *Gardenia mannii* are distributed along a 42 km (26 mi) length of the Koolau Mountains, from Kaunala Gulch and Kaunala-Waimea Ridge at the northernmost extent of its range to Palolo at the southernmost extent (HHP

1994o2, 1994o4, 1994o7, 1994o8, 1994o13, 1994o17, 1994o18, 1994o25, 1994o28 to 1994o30, 1994o33, 1994o34, 1994o37, 1994o39 to 1994o46). In the Waianae Mountains, this species is found in five extant populations over a 7 km (4 mi) distance from north Haleauau Valley to Kaluaa Gulch (HHP 1994o1, 1994o14, 1994o21, 1994o35, 1994o38). The 27 extant populations occur on private land, including TNCH's Honouliuli Preserve and land leased by DOD for Kawaihoa and Kahuku Training Areas; City and County of Honolulu land; State land; and Federal land on Schofield Barracks Military Reservation. The existing populations total between 70 and 100 plants, with 23 of the 27 populations each containing 5 or fewer plants. This species is usually found on moderate to moderately steep gulch slopes between 300 and 750 m (980 and 2,460 ft) in elevation. 'Ohi'a co-dominates in mesic or wet forests with a mixture of native plants such as 'ala'a, koa, and uluhe. Other associated plant taxa include alani, hame, kanawao, pilo, *Alyxia oliviformis* (maile), and kopiko (HHP 1994o1, 1994o3 to 1994o11, 1994o14, 1994o15, 1994o17, 1994o18, 1994o20 to 1994o22, 1994o25, 1994o26, 1994o28 to 1994o46).

Gardenia manni is threatened by habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with alien plants such as Koster's curse, prickly Florida blackberry, and strawberry guava; potential fire; and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the widely dispersed, small number of remaining individuals. The Kapakahi Gulch population also is threatened by the black twig borer (*Xylosandrus compactus*) (HHP 1994o1, 1994o13, 1994o14, 1994o35, 1994o37 to 1994o44, 1994o46; L. Mehrhoff, pers. comm. 1994).

Labordia cyrtandrae was first collected by French naturalist and ethnologist Ezechiel Jules Remy on Oahu in 1855. In 1880, H.E. Baillon named Remy's collection *Geniostoma cyrtandrae* in reference to the resemblance of this plant to the pantropical genus *Cyrtandra* (St. John 1936). St. John (1936) transferred the species to the endemic Hawaiian genus *Labordia*. The authors of the current treatment of Hawaiian members of the family concur with this designation (Wagner *et al.* 1990). In 1932, O. Degener described *Labordia hypoleuca*, which Wagner *et al.* (1990) consider to be synonymous with *L. cyrtandrae* (Degener and Degener 1957).

Labordia cyrtandrae, a member of the logania family (Loganiaceae), is a shrub 0.7 to 2 m (2.3 to 6.6 ft) tall. The fleshy, cylindrical to weakly angled stems, which flatten when dry, are covered with short, coarse, stiff hairs. The thick leaves, 12 to 30 cm long (4.7 to 12 in.) and 4 to 14 cm (1.6 to 5.5 in.) wide, are inversely egg-shaped to broadly elliptic or rarely inversely lance-shaped. Eight to 80 or more flowers are arranged on a densely hairy flowering stalk with an erect stalk up to 10 mm (0.4 in.) long. The pale greenish yellow or pale yellow corolla is 20 to 35 mm (0.8 to 1.4 in.) long. The tubular portion of the flower is urn-shaped; the flower lobes are lance-shaped and 8 to 13 mm (0.3 to 0.5 in.) long. The elliptic, lance-shaped fruits are two-valved capsules 32 to 35 mm (1.3 to 1.4 in.) long. This species is distinguished from others in the genus by its fleshy, hairy, cylindrical stem which flattens upon drying, the shape and length of the floral bracts, and the length of the corolla tube and lobes (Wagner *et al.* 1990).

Historically, *Labordia cyrtandrae* was known from both the Waianae and Koolau Mountains of Oahu. In the Koolau Mountains, this species ranged from Kawaihoa Trail to Waialae Iki, extending almost the entire length of the mountain range (HHP 1994p1, 1994p3 to 1994p13). This species currently is known only from 10 individuals in 3 populations in Haleauau Gulch and North Mohiaka Gulch, Waianae Mountains (HHP 1994p2, 1994p14 to 1994p16). These three populations occur on Federal land in Schofield Barracks Military Reservation (HHP 1994p2, 1994p14 to 1994p16). *Labordia cyrtandrae* typically grows in shady gulches in mesic to wet forests dominated by 'ohi'a, *Diplopterygium pinnatum*, and/or koa between the elevations of 730 and 780 m (2,400 and 2,560 ft) (HHP 1994p2, 1994p14 to 1994p16; T. Motley, pers. comm. [1996?]). Associated plant taxa include 'ala'a, *Diplazium sandwichianum*, *Pipturus albidus* (mamaki), *Perrottetia* sp. (olomea), and kopiko (HHP 1994p2, 1994p14 to 1994p16).

Habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with the alien plants Christmas berry, Koster's curse, prickly Florida blackberry, and strawberry guava; potential fire; and risk of extinction from naturally occurring events and/or reduced reproductive vigor, due to the small number of remaining individuals and populations, are the primary threats to *Labordia cyrtandrae* (HHP 1994p14 to 1994p16; 1994p16; C. Russell, pers. comm. 1994).

Over 100 years ago, Hillebrand collected a plant in the Waianae Mountains that he named *Lepidium arbuscula* for its tree-like habit (Hillebrand 1888). This species has been maintained in the most recent treatment of Hawaiian members of the genus (Wagner *et al.* 1990).

Lepidium arbuscula, a member of the mustard family (Brassicaceae), is a gnarled shrub 0.6 to 1.2 m (2 to 3.9 ft) tall. The leathery, hairless leaves, 2.6 to 6 cm (1 to 2.4 in.) long and 0.8 to 1.8 cm (0.3 to 0.7 in.) wide, are spatula-shaped to oblong-elliptic or elliptic, and have toothed margins. The unbranched flowering stalk contains one to three erect flowers. The white, pale yellow, or greenish petals are 2 to 2.5 mm (0.08 to 0.1 in.) long. The fruit is a capsule which is broadly egg-shaped to almost circular. This species is distinguished from others in the genus by its height (Wagner *et al.* 1990).

Historically, *Lepidium arbuscula* was known from 11 populations in the Waianae Mountains (HHP 1994q1 to 1994q11). It now remains at all but one of those populations on Federal (Lualualei Naval Reservation, Makua Military Reservation, and Schofield Barracks Military Reservation), State, and City and County of Honolulu land. Populations range from Kuaokala in the northern Waianae Mountains to Lualualei-Nanakuli Ridge in the southern Waianae Mountains (HHP 1994q2 to 1994q11). Fewer than 900 individuals of this species remain. *Lepidium arbuscula* generally grows on exposed ridge tops and cliff faces in mesic vegetation communities between 230 and 915 m (755 and 3,000 ft) elevation. This species is typically associated with native and non-native plant taxa such as 'a'ali'i, Christmas berry, kawelu, *Ageratina* spp. (pamakani), ko'oko'olau, *Carex meyenii*, and *Melinis minutiflora* (molasses grass) (HHP 1994q2 to 1994q8, 1994q10, 1994q11).

The primary threats to *Lepidium arbuscula* are habitat degradation and/or destruction by feral goats; potential impacts from military activities; competition with alien plants including Christmas berry, lantana, Maui pamakani, molasses grass, silk oak, strawberry guava, *Ageratina riparia* (Hamakua pamakani), and *Myrica faya* (firetree); and potential fire. The population at the head of Kapuhi Gulch also is threatened by its proximity to a road (HHP 1994q4, 1994q5, 1994q7 to 1994q11).

In 1937 Fosberg and Hosaka collected a specimen of *Lobelia gaudichaudii* ssp. *koolauensis* on Oahu, which they described the following year as a variety

of *Lobelia gaudichaudii* and named it for the Koolau Mountains (Fosberg and Hosaka 1938). Lammers (1988, 1990) has elevated the variety to a subspecies.

Lobelia gaudichaudii ssp. *koolauensis*, a member of the bellflower family, is an unbranched, woody shrub 0.3 to 1 m (1 to 3.5 ft) tall. The leaves are inversely lance-shaped to rectangular, 8 to 19 cm (3 to 7.5 in.) long, and 1.3 to 2.8 cm (0.5 to 1.1 in.) wide. The leaf edges are thickened or curled under, fringed with hairs toward the base, and sharp-pointed at the tip. The flowering stalk is two to six-branched and 40 to 70 cm (16 to 28 in.) long. The hairless bracts are lance-shaped to egg-shaped and 18 to 32 mm (0.7 to 1.3 in.) long. The calyx lobes are triangular, lance-shaped or egg-shaped, and 10 to 15 mm (0.4 to 0.6 in.) long. The corolla is greenish or yellowish white and 50 to 75 mm (2 to 3 in.) long. The tubular portion of the flower is curved, with spreading lobes. The fruit is an egg-shaped capsule. The subspecies *koolauensis* is distinguished by the greenish or yellowish white petals and the branched flowering stalks. The species is distinguished from others in the genus by the length of the stem, the length and color of the corolla, the leaf width, the length of the floral bracts, and the length of the calyx lobes (Lammers 1990).

Historically, *Lobelia gaudichaudii* ssp. *koolauensis* was known from only two populations in the central Koolau Mountains on Oahu (HHP 1994s1, 1994s2). Currently this subspecies is known from a single population on the Manana Ridge system in the central Koolau Mountains on privately owned land (HHP 1994s1). The total number of plants is estimated to be less than 250. *Lobelia gaudichaudii* ssp. *koolauensis* typically grows on moderate to steep slopes in 'ohi'a or 'ohi'a-uluhe lowland wet shrublands at elevations between 640 and 730 m (2,100 and 2,400 ft). Associated plant taxa include alani, ko'oko'lau, naupaka, 'uki, and kanawao (HHP 1994s1, 1994s2).

The primary threats to the single remaining population of *Lobelia gaudichaudii* ssp. *koolauensis* are habitat degradation and/or destruction by feral pigs, competition with the noxious alien plant Koster's curse, trampling by hikers, potential overcollection, landslides, and risk of extinction from naturally occurring events and/or reduced reproductive vigor of the one remaining population (HHP 1994s1; L. Mehrhoff and C. Russell, pers. comms. 1994).

In 1919 Rock described a new variety of *Lobelia hillebrandii* based on a specimen collected by Hillebrand in the

1800's. Rock (1919) named this variety *Lobelia hillebrandii* var. *monostachya*. Degener elevated this variety to the species level and transferred it to a new genus as *Neowimmeria monostachya* (Degener 1974). Lammers (1988) transferred the species back to the original genus as *Lobelia monostachya*.

Lobelia monostachya, a member of the bellflower family, is a prostrate woody shrub with stems 15 to 25 cm (6 to 10 in.) long. The leaves are stalkless, linear, hairless, 7 to 15 cm (2.8 to 6 in.) long, and 0.4 to 0.7 cm (0.2 to 0.3 in.) wide. The flowering stalk is unbranched. The corolla is pale magenta, 15 to 18 mm (0.6 to 0.7 in.) long, and approximately 5 mm (0.2 in.) wide. The lobes of the corolla overlap spirally. The species is distinguished from others in the genus by the narrow, linear leaves without stalks and the short pink flowers (Lammers 1990).

Historically, *Lobelia monostachya* was known only from the Koolau Mountains and had not been seen since its original discovery in the 1800's in Niu Valley and in the 1920's in Manoa Valley (HHP 1991a1, 1991a2). In 1994 Joel Lau discovered one individual in a previously unknown location in Wailupe Valley on State-owned land. Since then a total of eight plants has been found. This species occurs on steep, sparsely vegetated cliffs in mesic shrubland at an elevation of about 290 m (950 ft). Associated plant taxa include *Artemisia* sp. (ahinahina), *Carex meyenii*, *Psilotum nudum* (moa), and *Eragrostis* sp. (kawelu) (HHP 1994ff).

The major threats to *Lobelia monostachya* are predation by rats; competition with the alien plants Christmas berry, Hamakua pamakani, *Kalanchoe pinnata* (air plant), and molasses grass; and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the low number of individuals in the only known population (HHP 1994ff).

E.P. Hume first described *Melicope saint-johnii* as *Pelea saint-johnii* based on a specimen he collected with E. Christophersen and G. Wilder at Mauna Kapu on Oahu (St. John 1944). Thomas Hartley and the late Benjamin Stone (1989) transferred Hawaiian *Pelea* species to the Pacific genus *Melicope*. The new combination, *Melicope saint-johnii*, was published in the same paper (Hartley and Stone 1989). Other published names that refer to this taxon are *Evodia elliptica* var. *elongata*, *Pelea elliptica* var. *elongata*, *P. elongata*, and *P. saint-johnii* var. *elongata* (Hillebrand 1888, St. John 1944, Stone 1966, Stone et al. 1990).

Melicope saint-johnii, a member of the rue family (Rutaceae), is a slender tree

3 to 6 m (10 to 20 ft) tall. The leaves are opposite or occasionally occur in threes on young lateral branches. The leaves, 6 to 16 cm (2.4 to 6.3 in.) long and 3 to 8.5 cm (1.2 to 3.3 in.) wide, are narrowly to broadly elliptic, sometimes elliptic egg-shaped or rarely lance-shaped. Three to 11 flowers are arranged on an flowering stalk 9 to 22 mm (0.4 to 0.9 in.) long. The flowers are usually functionally unisexual, with staminate (male) and pistillate (female) flowers. The staminate flowers have broadly egg-shaped sepals which are hairless to sparsely covered with hair. The triangular petals, 6 to 8 mm (0.2 to 0.3 in.) long, are densely covered with hair on the exterior. The pistillate flowers are similar in hairiness to staminate flowers, but are slightly smaller in size. The dry fruit, 7 to 12 mm (0.3 to 0.5 in.) long, splits at maturity. The exocarp (outermost layer of the fruit wall) is hairless, whereas the endocarp (innermost layer) is hairy. This species is distinguished from others in the genus by the combination of the hairless exocarp, the hairy endocarp, the densely hairy petals, and the sparsely hairy to smooth sepals (Stone et al. 1990).

Historically, *Melicope saint-johnii* was known from both the Waianae and Koolau Mountains—Makaha to Mauna Kapu in the Waianae Mountains and Papali Gulch in Hauula, Manoa-Aihualama, Wailupe, and Niu Valley in the Koolau Mountains (HHP 1994t1 to 1994t15, 1994ee; Takeuchi 1992). Today eight populations of this species are found on Federal (Lualualei Naval Reservation), State, and private land from the region between Puu Kua and Puu Kanehoa to Mauna Kapu in the southern Waianae Mountains. Fewer than 150 individuals of this species currently are known (HHP 1994t1 to 1994t4, 1994t7, 1994t14, 1994t15, 1994ee; Takeuchi 1992; Takeuchi and Paquin (s.n.) 1985; J. Lau, pers. comm. 1994). This species typically grows on mesic forested ridges from 500 to 853 m (1,640 to 2,800 ft) elevation. Associated native plant taxa include mamaki, 'ohi'a, *Coprosma longifolia* (pilo), *Hedyotis schlechtendahlana* (kopa), *Labordia kaalae* (kamakahala), and *Psychotria hathewayi* (kopiko) (HHP 1994t1 to 1994t4, 1994t7, 1994t14, 1994t15, 1994ee; Takeuchi 1992; Takeuchi and Paquin (s.n.) 1985).

The primary threats to *Melicope saint-johnii* are habitat degradation and/or destruction by feral goats and pigs; potential predation by the black twig borer; potential fire; and competition with alien plants such as Christmas berry, firetree, Hamakua pamakani, huehue haole, lantana, Maui pamakani, and silk oak (HHP 1994t3, 1994t4,

1994t13, 1994t14, 1994ee; J. Lau, pers. comm. 1994).

Myrsine juddii was first described by Hosaka in 1940, based on a specimen he collected with Fosberg in the Koolau Mountains. In an action not supported by other taxonomists, Otto and Isa Degener (1971, 1975) transferred this species from *Myrsine* to the genus *Rapanea*. Hosaka's concept of *Myrsine* is currently followed (Wagner *et al.* 1990). The specific epithet honors Albert Judd, who had a keen interest in conservation of the native Hawaiian flora.

Myrsine juddii, a member of the myrsine family (Myrsinaceae), is a many branched shrub ranging from 1 to 2 m (3.5 to 6.6 ft) tall. The leathery leaves, 4 to 12 cm (1.6 to 4.7 in.) long and 1.5 to 3.2 cm (0.6 to 1.3 in.) wide, are narrowly inverse lance-shaped or more elliptic. The upper leaf surface is hairless, whereas the lower surface is sparsely to moderately covered with short, coarse, stiff, whitish or brownish hairs toward the base and along the midrib. The leaf base is broadly wedge-shaped to heart-shaped, and the margins are smooth and curl under. The flowers are unisexual and the plants are dioecious (male and female flowers are on separate plants). Flowers occur in groups of four to eight in tight clusters surrounded by small bracts. The yellowish green petals are narrowly inverse lance-shaped, 2.8 to 3.2 mm (0.1 in.) long. The fleshy, round fruit contains a single seed. This species is distinguished from others in the genus by the hairiness of the lower leaf surface and the shape of the leaf base (Wagner *et al.* 1990). In addition, the hairy leaves distinguish this species from all other species of *Myrsine* on Oahu (Environmental Impact Study Corporation 1977).

Myrsine juddii has been reported from only three populations in the central Koolau Mountains—the North Kaukonahua-Kahana Summit divide; Peahinaia Trail; and Puu Kainapuaa to Poamoho Trail. These populations are found on private and State land leased by DOD for Kawaioloa Training Area (HHP 1994u1 to 1994u3). The total number is between 500 and 3,000 individuals, with all but 5 to 10 of these in a single, poorly defined population (HHP 1994u2). *Myrsine juddii* typically grows in wet forests dominated by 'ohi'a or a mixture of 'ohi'a and uluhe at elevations between 580 and 860 m (1,900 and 2,820 ft) (HHP 1994u1 to 1994u3). Associated plant taxa include 'uki, *Cheiodendron trigynum* ('olapa), *Melicope clusiifolia* (kolokolo mokihana), *Psychotria mariniana* (kopiko), *Syzygium sandwicensis* ('ohi'a

ha), and *Chamaesyce rockii* (HHP 1994u2).

The primary threats to *Myrsine juddii* are habitat degradation and/or destruction by feral pigs, potential impacts from military activities, competition with alien plants such as Koster's curse and strawberry guava, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of extant populations (HHP 1994u2, 1994u3; C. Russell, pers. comm. 1994).

In 1825, James Macrae, botanist on H.M.S. *Blonde*, collected a plant on Oahu that George Bentham described and named *Phyllostegia hirsuta* (Wagner *et al.* 1990). This species has been maintained in the current treatment of the Hawaiian members of the genus (Wagner *et al.* 1990).

Phyllostegia hirsuta, a member of the mint family (Lamiaceae), is an erect subshrub or vine with stems densely covered with coarse or stiff hairs. The wrinkled leaves are egg-shaped, generally 17 to 30 cm (6.7 to 12 in.) long, and 7.3 to 18 cm (2.9 to 7 in.) wide. Both leaf surfaces are moderately covered with long, flat hairs. The upper surface is inconspicuously dotted with glands, while the lower surface is more densely glandulose. The egg-shaped floral bracts are 3 to 6 mm (0.1 to 0.2 in.) long. The flowers have two lips—the upper one is approximately 3 mm (0.1 in.) long and the lower one is 5 to 7 mm (0.2 to 0.3 in.) long. The tubular portion of the flower is slightly curved. The corolla is white and usually purple-tinged on the upper lip. The fruit is a nutlet about 3 mm (0.1 in.) long. This species is distinguished from others in the genus by the texture, hairiness, and size of the leaves and the length of the upper bracts (Wagner *et al.* 1990).

Historically, *Phyllostegia hirsuta* was known from widespread populations in the Waianae and Koolau Mountains on Oahu. In the Waianae Mountains, this species ranged from the head of Kukuiaula (Pahole) Gulch to North Palawai Gulch (HHP 1994v1 to 1994v3, 1994v6, 1994v16, 1994v18 to 1994v20, 1994v22, 1994v31, 1994v33 to 1994v36). In the Koolau Mountains, this species ranged from Pupukeya-Kahuku Trail to Palolo, almost the entire length of the Koolau Mountains (HHP 1994v4, 1994v5, 1994v7 to 1994v15, 1994v17, 1994v21, 1994v23 to 1994v30, 1994v32). The distribution of this species in the Waianae Mountains is now restricted to ten populations in the southern part of the historical range—from the ridge between Makaha and Waianae Kai to the south fork of North Palawai Gulch (HHP 1994v2, 1994v3,

1994v6, 1994v19, 1994v20, 1994v31, 1994v33 to 1994v36). The current distribution in the Koolau Mountains is six populations scattered over a 10 km (6 mi) length of the summit—from Kawaiui Gulch in Kawaioloa Training Area to South Kaukonahua drainage (HHP 1994v26 to 1994v30, 1994v32). About 150 to 200 individuals remain in the 16 populations. These populations occur on Federal land in Lualualei Naval Reservation and Schofield Barracks Military Reservation; State land, including Mount Kaala NAR; and private lands, including TNCH's Honouliuli Preserve and land leased by DOD for Kawaioloa Training Area. *Phyllostegia hirsuta* is usually found on steep, shaded slopes in mesic to wet forests dominated by 'ohi'a or a mixture of 'ohi'a and uluhe between 600 and 1,100 m (1,970 and 3,610 ft) elevation. Associated plant taxa include 'ala'a, kanawao, mamaki, pilo, *Hedyotis terminalis* (manono), *Myrsine lessertiana* (kolea lau nui), and native and alien ferns (HHP 1994v2, 1994v3, 1994v6, 1994v19, 1994v20, 1994v26 to 1994v36).

The primary threats to *Phyllostegia hirsuta* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; and competition with Christmas berry, huehue haole, Koster's curse, lantana, prickly Florida blackberry, and strawberry guava (HHP 1994v2, 1994v3, 1994v19, 1994v27, 1994v29 to 1994v31, 1994v34 to 1994v36).

Based upon a specimen collected in 1977 by John Obata, Gerald Carr, and Daniel Palmer on Oahu, St. John (1987a) described *Phyllostegia kaalaensis*, naming it for Mt. Kaala where it was first collected. Publishing deadlines did not allow the authors of the current treatment of the family to review the more than 70 new species of *Phyllostegia* published by St. John in 1987 (Wagner *et al.* 1990). Warren Wagner, however, concurs that *Phyllostegia kaalaensis* is a valid, taxonomically distinct species (Warren Wagner, Smithsonian Institution, pers. comm. 1994).

Phyllostegia kaalaensis, a member of the mint family (Lamiaceae), is an herb. The egg-shaped leaves are 5 to 13 cm (2 to 5 in.) long. Usually six flowers are arranged along a flowering stalk. The calyx is glabrous and 5 mm (0.2 in.) long. The hairless corolla tube is 11 mm (0.4 in.) long and the lower lip is 7 mm (0.3 in.) long (St. John 1987a). The species is distinguished from others of the genus by the spreading, pointed teeth on the leaf edges and by the hairs along the margins of the calyx and bracts (Wagner *et al.* 1990).

Phyllostegia kaalaensis has been known from only five scattered populations in the Waianae Mountains of Oahu (HHP 1994w1 to 1994w6). Fewer than 50 plants are known from 5 populations in Waianae Kai, Pahole Gulch, Ekahanui Gulch, and Palikea Gulch. These populations occur on State land, including Pahole and Mt. Kaala NARs and private land, including TNCH's Honouliuli Preserve (HHP 1994w1 to 1994w6). This species is found in mesic mixed (native/alien) forest or papala kepa'u-*Sapindus oahuensis* (aalu) forest from 490 to 760 m (1,610 to 2,500 ft) in elevation. Associated plant taxa include huehue haole, 'ie'ie, opuhe, *Claoxylon sandwicense* (po'ola), and *Hibiscus* sp. (koki'o) (HHP 1994w2 to 1994w4, 1994w6).

Habitat degradation and/or destruction by feral pigs; potential fire; competition with the alien plants Christmas berry, huehue haole, Koster's curse, and strawberry guava; and risk of extinction from naturally occurring events and/or reduced reproductive vigor, due to the small number of populations and individuals, are the major threats to *Phyllostegia kaalaensis* (HHP 1994w3 to 1994w5; C. Russell, pers. comm. 1994).

More than 75 years ago, Rock collected a specimen from a palm on Mt. Kaala that he later named *Pritchardia kaalae* (Beccari and Rock 1921). Edward Caum (1930) later described *Pritchardia kaalae* var. *minima*, which is not recognized in the current treatment of Hawaiian members of the family (Read and Hodel 1990).

Pritchardia kaalae, a member of the palm family (Arecaceae), is a single-stemmed palm up to 5 m (16 ft) tall. The waxy, hairless leaves are thin and papery or thick and leathery. Sometimes small points, dots, or linear, rusty scales are scattered on the lower leaf surface. The flowering stalks are composed of one or more branches. The round fruits are approximately 2 cm (0.8 in.) in diameter. *Pritchardia kaalae* is distinguished from other members of the genus by the hairless or scaly leaves (Read and Hodel 1990).

Historically, *Pritchardia kaalae* was known from scattered populations in the central and north-central Waianae Mountains of Oahu (Beccari and Rock 1921, HHP 1994aa1 to 1994aa5). Currently 5 populations are known between the Waianae Kai-Haleauau summit divide and the Makua-Keaau Ridge, totalling about 130 individuals. These populations are located on State land, including Mt. Kaala NAR and land leased to DOD for Makua Military Reservation, and on Federal land on

Schofield Barracks Military Reservation (HHP 1994aa1 to 1994aa5). *Pritchardia kaalae* is typically found on steep slopes and gulches in mesic forest or shrubland between elevations of 460 and 945 m (1,500 and 3,100 ft). Associated plant taxa include 'a'ali'i, kolea, ko'oko'olau, mamaki, na'ena'e, 'ohi'a, *Eragrostis* sp. (kawelu), and *Tetraplasandra* sp. ('ohe) (HHP 1994aa1, 1994aa2, 1994aa4, 1994aa5; Read and Hodel 1990).

Habitat degradation by feral pigs and goats; fruit predation by rats; potential impacts from military activities; the alien plants Christmas berry, Maui pamakani, and prickly Florida blackberry; potential fire; and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of populations are major threats to *Pritchardia kaalae* (HHP 1994aa1, 1994aa4, 1994aa5; C. Russell, pers. comm. 1994).

In 1936, Hosaka collected a specimen of *Schiedea kealiae* on Oahu that he named for Kealia where it was collected (Caum and Hosaka 1936). *Schiedea gregoriana* is considered synonymous with *S. kealiae* by the authors of the current treatment of the family (Degener 1936, Sherff 1945, Wagner *et al.* 1990).

Schiedea kealiae, a member of the pink family (Caryophyllaceae), is a subshrub with weakly ascending to sprawling stems 0.2 to 0.5 m (0.7 to 1.6 ft) long that form loose clumps. The lower stems are smooth while the upper stems and flowering stalk bear glands. The opposite leaves, 3 to 10 cm (1.2 to 4 in.) long and 0.3 to 1.5 cm (0.1 to 0.6 in.) wide, are lance-shaped to elliptic lance-shaped and conspicuously three-veined with a prominent midrib. The flowering stalk is 3 to 11 cm (1.2 to 4.3 in.) long, with numerous unisexual flowers in crowded clusters. The green sepals of the male flowers are approximately 2.5 mm (0.1 in.) long. The sepals of the female flowers, 1.5 to 2.2 mm (0.06 to 0.09 in.) are slightly shorter. The nectaries, about 0.5 to 1 mm (0.02 to 0.04 in.) long, are inconspicuous. The capsular fruit is 2 to 2.5 mm (0.08 to 0.1 in.) long. The species is distinguished from others of this endemic Hawaiian genus by the length of the sepals and nectaries and the flowering stalk exclusively with stalkless glands (Wagner *et al.* 1990).

Historically, *Schiedea kealiae* was known from the northern Waianae Mountains and one collection from the Palikea area, near the southern end of the same mountain range (HHP 1994bb1 to 1994bb6). Currently 3 populations totalling between 300 and 500 plants are located on the cliffs above Dillingham Airfield and Camp Erdman and at Kaena

Point at the northern end of the Waianae Mountains. These populations occur on private land; State land, including land leased by DOD (Kaena Military Reservation); and Federal land on Dillingham Military Reservation (HHP 1994bb1, 1994bb2, 1994bb4, 1994bb6; J. Lau, pers. comm. 1994). *Schiedea kealiae* is usually found on steep slopes and cliff faces at elevations from 60 to 305 m (200 to 1,000 ft), in dry remnant *Erythrina sandwicensis* (wiliwili) or aulu forest. Associated plant taxa include alahe'e, ko'oko'olau, *Leucaena leucocephala* (koa haole), *Myoporum sandwicense* (naio), and *Sida fallax* ('ilima) (HHP 1994bb1, 1994bb2, 1994bb4, 1994bb6; Wagner *et al.* 1990).

The major threats to *Schiedea kealiae* are competition with alien plants (Christmas berry and koa haole) and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of existing populations. The Kaena Point population is additionally threatened by naturally occurring rock slides and fire (HHP 1994bb1, 1994bb2, 1994bb4, 1994bb6; C. Russell, pers. comm. 1994).

St. John (1982) described *Trematolobelia singularis* based on a specimen collected by John Obata in 1974. This species has been maintained in the most recent treatment of this endemic Hawaiian genus (Lammers 1990). The specific epithet refers to the solitary flowering stalk.

Trematolobelia singularis, a member of the bellflower family, is an unbranched shrub with stems 0.6 to 1.5 m (2 to 5 ft) long. The long and narrow leaves are 10 to 18 cm (4 to 7 in.) long and 1 to 1.8 cm (0.4 to 0.7 in.) wide. The unbranched, erect flowering stalk is 20 to 42 cm (8 to 16.5 in.) long. The violet petals are about 5 cm (0.2 in.) long and collectively form a three-lobed tube. The largest lobe is curved downward and the other two are bent backward, giving the appearance of two lips. The capsules are almost round and contain numerous small, wind-dispersed seeds. This species differs from others of this endemic Hawaiian genus by the unbranched, erect flowering stalk (Lammers 1990).

Trematolobelia singularis has been reported only from the southern Koolau Mountains (HHP 1994cc1 to 1994cc4). Approximately 165 plants are known from three populations—Moanalua-Tripler Ridge summit to Puu Keahiakahoe, Konahuanui, and Puu Lanipo. These populations are found on private, City and County of Honolulu, State, and Federal land (Omega Coast Guard Station) (HHP 1994cc1 to 1994cc4, Lammers 1990). This species usually grows on steep, windswept cliff

faces or slopes in 'ohi'a-uluhe lowland wet shrubland from 700 to 960 m (2,300 to 3,150 ft) elevation. Associated plant taxa include 'akia, hapu'u, kanawao, and na'ena'e pua melemele (HHP 1994cc1 to 1994cc3, Lammers 1990, Obata 1988, St. John 1982).

Habitat degradation by feral pigs, potential predation by rats, competition with the aggressive alien plant Koster's curse, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of extant populations are serious threats to *Trematolobelia singularis* (HHP 1994cc1, 1994cc2, 1994cc4; J. Lau, C. Russell, and J. Yoshioka, pers. comms. 1994).

Forbes described *Viola oahuensis* in 1909, based on a specimen he collected with Rock in the Koolau Mountains. This species has been maintained in the most recent treatment of Hawaiian members of this genus (Wagner *et al.* 1990).

Viola oahuensis, a member of the violet family (Violaceae), is usually an erect, unbranched subshrub 6 to 40 cm (2.4 to 16 in.) tall. The papery-textured leaves are usually 3 to 12 cm (1.2 to 4.7 in.) long, 2.5 to 5.8 cm (1 to 2.3 in.) wide, and elliptic-egg-shaped to elliptic. The leaf stalks are typically 0.5 to 1 cm (0.2 to 0.4 in.) long. The narrowly triangular stipules are usually 10 to 15 mm (0.4 to 0.6 in.) long, 3.5 to 6 mm (0.1 to 0.2 in.) wide, and have fringed edges. One to two flowers are borne on stalks typically 25 to 60 mm (1 to 2.4 in.) long. The petals are pale yellow, the upper ones 8 to 13 mm (0.3 to 0.5 in.) long, the lateral ones 10 to 13.5 mm (0.4 to 0.5 in.) long, and the lower one 12 to 16 mm (0.5 to 0.6 in.) long. The capsules are 9 to 16 mm (0.4 to 0.6 in.) long. This species is distinguished from other Hawaiian members of the genus by the stipule characters, the length of the leaf stalks, and the length and papery texture of the leaves (Wagner *et al.* 1990).

Historically, *Viola oahuensis* was known from 17 populations in the Koolau Mountains of Oahu scattered over about a 37 km (23 mi) distance from Puu Kainapuaa to Palolo (HHP 1994dd1 to 1994dd16; L. Mehrhoff, pers. comm. 1994). The 8 extant populations, which total fewer than 180 individuals, are now found from the Kawainui-Kooloa summit divide to the Waimalu-Koolaupoko divide over a 20 km (12 mi) distance. These populations are found on DOD land; State land, including land leased by DOD for Kawaihoa Training Area; City and County of Honolulu land; and private land, including land leased by DOD for Kawaihoa Training Area (HHP 1994dd5,

1994dd9 to 1994dd13, 1994dd15, 1994dd16). Farther to the south, at the summit of Moanalua, a single plant, last seen alive in 1991, has since died (L. Mehrhoff, pers. comm. 1994). *Viola oahuensis* is generally found on exposed, windswept ridges of moderate to steep slope in wet 'ohi'a-uluhe shrublands from 700 to 850 m (2,300 to 2,800 ft) elevation. This species typically grows among wind-stunted na'ena'e pua melemele, 'uki, *Sadleria* sp. ('ama'u), 'ohi'a ha, and *Vaccinium* sp. ('ohelo) (HHP 1994dd5, 1994dd9 to 1994dd16).

The primary threats to *Viola oahuensis* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with Koster's curse, strawberry guava, *Paspalum conjugatum* (Hilo grass), and *Sacciolepis indica* (Glenwood grass); and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of populations (HHP 1994dd5, 1994dd9, 1994dd12, 1994dd13).

Previous Federal Action

Federal action on these plants began as a result of section 12 of the Act (16 U.S.C. 1533), which directed the Secretary of the Smithsonian Institution to prepare a report on plants considered to be endangered or threatened in the United States. This report, designated as House Document No. 94-51, was presented to Congress on January 9, 1975. Twelve of the 25 taxa in this rule were considered to be endangered in that document—*Cyanea humboldtiana* (as *Rollandia humboldtiana*), *Cyanea longiflora* (as *Rollandia sessilifolia*), *Cyanea st.-johnii* (as *Rollandia st.-johnii*), *Cyrtandra dentata* (also as *C. frederickii*), *Cyrtandra subumbellata* (as *C. subumbellata* var. *intonsa*), *Delissea subcordata* (as *D. subcordata* var. *subcordata* and var. *obtusifolia*), *Eragrostis fosbergii*, *Lobelia gaudichaudii* ssp. *koolauensis* (as *L. gaudichaudii* var. *koolauensis*), *Melicope saint-johnii* (as *Pelea saint-johnii* var. *elongata*), *Pritchardia kaalae* (as *P. kaalae* var. *kaalae* and var. *minima*), *Schiedea kealiae*, and *Viola oahuensis*. Two of the 25 taxa in this rule were considered to be threatened—*Lobelia monostachya* (as *L. hillebrandii* var. *monostachya*) and *Phyllostegia hirsuta* (as *P. hirsuta* var. *hirsuta* and var. *laxior*). On July 1, 1975, the Service published a notice in the Federal Register (40 FR 27823) accepting the Smithsonian report as a petition within the context of section 4(c)(2) (now section 4(b)(3)) of the Act, and giving notice of its intent to review the status

of the plant taxa named therein. As a result of that review, on June 16, 1976, the Service published a proposed rule in the Federal Register (41 FR 24523) to determine endangered status pursuant to section 4 of the Act for approximately 1,700 vascular plant species. The list of 1,700 plant taxa was assembled on the basis of comments and data received by the Smithsonian Institution and the Service in response to House Document No. 94-51 and the July 1, 1975, Federal Register publication. All 12 taxa cited above as considered to be endangered in House Document No. 94-51 were included in the June 16, 1976 proposed rule.

General comments received in response to the 1976 proposal are summarized in an April 26, 1978, Federal Register publication (43 FR 17909). In 1978, amendments to the Act required that all existing proposals over two years old be withdrawn. A one-year grace period was given to proposals already over two years old. On December 10, 1979, the Service published a notice in the Federal Register (44 FR 70796) withdrawing the portion of the June 16, 1976, proposal that had not been made final, along with four other proposals that had expired. All 12 of the taxa cited previously as included in the June 16, 1976, proposal were also included in the 1979 withdrawal. The Service published an updated notice of review for plants on December 15, 1980 (45 FR 82479), September 27, 1985 (50 FR 39525), February 21, 1990 (55 FR 6183), and September 30, 1993 (58 FR 51144). Sixteen of the taxa in this final rule (including synonymous taxa) have at one time or another been considered Category 1 or Category 2 candidates for Federal listing. Category 1 species were those species for which the Service has on file substantial information on biological vulnerability and threats to support preparation of listing proposals but for which listing proposals have not yet been published because they are precluded by other listing activities. Category 2 species were those species for which listing as endangered or threatened was considered to be possibly appropriate, but for which sufficient data on biological vulnerability and threats were not available to support proposed rules. On February 28, 1996, the Service published a Notice of Review in the Federal Register (61 FR 7596) that discontinued the designation of Category 2 species.

Cyanea humboldtiana (as *Rollandia humboldtiana*), *Cyanea longifolia* (as *Rollandia sessilifolia*), *Cyanea st.-johnii* (as *Rollandia st.-johnii*), *Cyrtandra*

dentata (also as *C. frederickii*), *Cyrtandra subumbellata* (as *C. subumbellata* var. *intonsa*), *Eragrostis fosbergii*, *Lobelia gaudichaudii* ssp. *koolauensis* (as *L. gaudichaudii* var. *koolauensis*), *Melicope saint-johnii* (as *Pelea saint-johnii*), and *Viola oahuensis* were considered Category 1 species in the 1980 and 1985 notices of review. One taxon, *Phyllostegia hirsuta*, was considered a Category 1 species in the 1980 notice and a Category 2 species in the 1985 notice. Three taxa, *Delissea subcordata* (as *D. subcordata* ssp. *subcordata* and ssp. *obtusifolia*), *Pritchardia kaalae* (as *P. kaalae* var. *kaalae* and var. *minima*), and *Schiedea kealiae*, were considered Category 3C taxa in the 1980 and 1985 notices. Category 3C species were those that have proven to be more abundant or widespread than previously believed and/or are not subject to any identifiable threat. *Lobelia monostachya* (as *Lobelia hillebrandii* var. *monostachya*) was considered a Category 1 species and *Lepidium arbuscula* (misspelled as *Lepidium arbusculum*) was considered a Category 1* species in the 1985 notice. Category 1* species are those species that are possibly extinct.

In the 1990 and 1993 notices, *Cyrtandra subumbellata*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Trematolobelia singularis*, and *Viola oahuensis* were considered Category 2 species. *Eragrostis fosbergii* was considered a Category 1* species in the 1990 notice, a category which was redefined as 2* in the 1993 notice. *Lobelia monostachya* was considered a Category 3A species in 1990. Category 3A species were those for which the Service has persuasive evidence of extinction. Five species, *Cyanea humboldtiana* (as *Rollandia humboldtiana*), *Cyanea st.-johnii* (as *Rollandia st.-johnii*), *Cyrtandra dentata*, *Melicope saint-johnii*, and *Phyllostegia hirsuta*, were considered more abundant than previously thought and moved to Category 3C in the 1990 notice. In the 1990 notice, *Rollandia sessilifolia* was considered a Category 3B species because it was merged with *Cyanea longiflora* (as *Rollandia longiflora*), a taxon not considered to warrant listing. Category 3B species were those that do not represent distinct taxa. *Lobelia gaudichaudii* var. *koolauensis* was elevated to *Lobelia gaudichaudii* ssp. *koolauensis* and considered a Category 3B species in the 1990 notice. *Cyrtandra viridiflora* and *Myrsine juddii* were considered Category 2 species in the 1993 notice. Since the 1993 notice, new information suggests that the above Category 2, Category 3A, and Category

3C species, as well as eight additional taxa (*Chamaesyce herbstii*, *Chamaesyce rockii*, *Cyanea acuminata*, *Cyanea koolauensis*, *Cyanea longiflora*, *Gardenia mannii*, *Lobelia gaudichaudii* ssp. *koolauensis*, and *Phyllostegia kaalaensis*), are sufficiently restricted in numbers and distribution and imminently threatened and therefore warrant listing.

Section 4(b)(3)(B) of the Act requires the Secretary to make findings on all petitions that present substantial information indicating the petitioned action may be warranted within 12 months of their receipt. Section 2(b)(1) of the 1982 amendments further requires all petitions pending on October 13, 1982, be treated as having been newly submitted on that date. On October 13, 1983, the Service found that the petitioned listing of these taxa was warranted, but precluded by other pending listing actions, in accordance with section 4(b)(3)(B)(iii) of the Act. Notification of this finding was published on January 20, 1984 (49 FR 2485). Such a finding requires the Service to consider the petition as having been resubmitted, pursuant to section 4(b)(3)(C)(i) of the Act. The finding was reviewed in October of 1984 through 1993. Publication of the proposed rule constituted the final one-year finding for these taxa.

On October 2, 1995, the Service published in the Federal Register (60 FR 51398) a proposal to list 25 plant taxa from the island of Oahu as endangered. This proposal was based primarily on information supplied by the Hawaii Natural Heritage Program, National Tropical Botanical Garden, and observations of botanists and naturalists. Based on comments received in response to the proposal (see Comments and Recommendations, below), the Service now determines 25 taxa from the island of Oahu to be endangered. *Chamaesyce rockii* and *Myrsine juddii* have a Listing Priority of 5 under the current guidance; the other 23 taxa have a Listing Priority of 2.

Summary of Comments and Recommendations

In the October 2, 1995 proposed rule and associated notifications, all interested parties were requested to submit factual reports or information that might contribute to the development of a final rule. The public comment period ended on December 1, 1995. Appropriate State agencies, county governments, Federal agencies, scientific organizations, and other interested parties were contacted and requested to comment. A newspaper notice inviting public comment was

published in the *Honolulu Advertiser* on October 20, 1995, which invited general public comment. Four letters of comment were received. Two letters acknowledged receipt of the proposed ruling and two letters supported the listing of these taxa from the island of Oahu but raised no specific issues. No requests for public hearings were received.

The Service also solicited the expert opinions of three appropriate and independent specialists regarding pertinent scientific or commercial data and assumptions relating to the taxonomy, population models, and biological and ecological information for these 25 species. No responses were received.

Summary of Factors Affecting the Species

After a thorough review and consideration of all information available, the Service has determined that *Chamaesyce herbstii* W.L. Wagner ('akoko), *Chamaesyce rockii* (C. Forbes) Croizat & Degener ('akoko), *Cyanea acuminata* (Gaud.) Hillebr. (haha), *Cyanea humboldtiana* (Gaud.) Lammers, Givnish & Sytsma (haha), *Cyanea koolauensis* Lammers, Givnish & Sytsma (haha), *Cyanea longiflora* (Wawra) Lammers, Givnish & Sytsma (haha), *Cyanea st.-johnii* (Hosaka) Lammers, Givnish & Sytsma (haha), *Cyrtandra dentata* St. John & Storey (ha'iwale), *Cyrtandra subumbellata* (Hillebr.) St. John & Storey (ha'iwale), *Cyrtandra viridiflora* St. John & Storey (ha'iwale), *Delissea subcordata* Gaud. ('oha), *Eragrostis fosbergii* Whitney (No common name (NCN)), *Gardenia mannii* St. John & Kuykendall (nanu), *Labordia cyrtandrae* (Baill.) St. John (kamakahala), *Lepidium arbuscula* Hillebr. ('anaunau), *Lobelia gaudichaudii* ssp. *koolauensis* (Hosaka & Fosb.) Lammers (NCN), *Lobelia monostachya* (Rock) Lammers (NCN), *Melicope saint-johnii* (E. Hume) T. Hartley & B. Stone (alani), *Myrsine juddii* Hosaka (kolea), *Phyllostegia hirsuta* Benth. (NCN), *Phyllostegia kaalaensis* St. John (NCN), *Pritchardia kaalae* Rock (loulou), *Schiedea kealiae* Caum & Hosaka (NCN), *Trematolobelia singularis* St. John (NCN), and *Viola oahuensis* C. Forbes (NCN) should be classified as endangered species. Procedures found at section 4(a)(1) of the Act and regulations implementing the listing provisions of the Act (50 CFR part 424) were followed. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their

application to the 25 plant taxa in this rule are as summarized in Table 1.

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Native vegetation on Oahu has undergone extreme alteration because of past and present land management practices including ranching, deliberate alien animal and plant introductions, agricultural development, military use, and recreational use (Cuddihy and Stone 1990, Wagner *et al.* 1985). The

primary threats facing the 25 plant taxa in this final rule are ongoing and threatened destruction and adverse modification of habitat by feral animals and competition with alien plants (see Factor E).

Twenty-one of the 25 taxa are variously threatened by feral animals (Table 1). Animals such as pigs and goats were introduced by the early Hawaiians (pigs) or more recently by European settlers (goats) for food and/or commercial ranching activities. Over the

200 years following their introduction, their numbers increased and the adverse impacts of feral ungulates on native vegetation have become increasingly apparent. Beyond the direct effect of trampling and grazing native plants, feral ungulates have contributed significantly to the heavy erosion still taking place on most of the main Hawaiian Islands (Cuddihy and Stone 1990).

TABLE 1.—SUMMARY OF THREATS TO TWENTY-FIVE PLANTS FROM THE ISLAND OF OAHU, HAWAII

Species	Alien mammals			Alien plants	Substrate loss	Fire	Human impacts	Insects	Limited numbers
	Goats	Pigs	Rats						
<i>Chamaesyce herbstii</i>		X		X		P			X1
<i>Chamaesyce rockii</i>		X	P	X			P		
<i>Cyanea acuminata</i>		X	P	X			P		X3
<i>Cyanea humboldtiana</i>		X	P	X			X		X1
<i>Cyanea koolauensis</i>		X	P	X			X		X3
<i>Cyanea longiflora</i>		X	P	X		P	P		X1
<i>Cyanea st.-johnii</i>		X	P	X			X		X1,3
<i>Cyrtandra dentata</i>			P	X		P			X1,3
<i>Cyrtandra subumbellata</i>			P	X		P	P		X1,3
<i>Cyrtandra viridiflora</i>		X	P	X			P		X1,2
<i>Delissea subcordata</i>	X	X	P	X		P	X		X3
<i>Eragrostis fosbergii</i>	X	X		X			X		X1,2
<i>Gardenia mannii</i>		X		X		P	P	X	X3
<i>Labordia cyrtandrae</i>		X		X		P	P		X1,2
<i>Lepidium arbuscula</i>	X			X		P	X		
<i>Lobelia gaudichaudii ssp. koolauensis</i>		X	P	X	X		X		X1
<i>Lobelia monostachya</i>			X	X					X1,2
<i>Melicope saint-johnii</i>	X	X		X		P		P	
<i>Myrsine juddii</i>		X		X			P		X1
<i>Phyllostegia hirsuta</i>		X		X		P	P		
<i>Phyllostegia kaalaensis</i>		X		X		P			X1,3
<i>Pritchardia kaalae</i>	X	X	X	X		P	P		X1
<i>Schiedea kealiae</i>				X	X	P			X1
<i>Trematolobelia singularis</i>		X	P	X					X1
<i>Viola oahuensis</i>		X		X			P		

KEY:

- X = Immediate and significant threat.
- P = Potential threat.
- * = No more than 100 individuals and/or no more than 5 populations.
- 1 = No more than 5 populations.
- 2 = No more than 10 individuals.
- 3 = No more than 100 individuals.

Pigs, which were originally native to Europe, northern Africa, Asia Minor, and Asia, were introduced into Hawaii by the Polynesians. European pigs, introduced to Hawaii by Captain James Cook in 1778, escaped domestication and invaded primarily wet and mesic forests and grasslands of the islands of Kauai, Oahu, Molokai, Maui, and Hawaii. The pigs introduced by the Polynesians were apparently smaller and less destructive to native plants than the European pigs. In addition, it appears that Polynesian pigs were maintained in domestication and were not allowed to establish feral populations. While foraging, pigs root and trample the forest floor,

encouraging the establishment of alien plants in the newly disturbed soil. Pigs also disseminate alien plant seeds through their feces and on their bodies, accelerating the spread of alien plants through native forest (Cuddihy and Stone 1990, Stone 1985). Pigs are a major vector in the spread of *Psidium cattleianum* (strawberry guava) and *Schinus terebinthifolius* (Christmas berry), and enhance populations of *Rubus argutus* (prickly Florida blackberry), which threaten several of these taxa (Cuddihy and Stone 1990, Smith 1985, Stone 1985). Feral pigs also feed on the starchy interiors of tree ferns (*Cibotium* sp.) and other succulent-stemmed plants (see Factor C). Feral

pigs pose an immediate threat to one or more populations of 20 of the taxa in this final rule, including the only known population of *Lobelia gaudichaudii ssp. koolauensis* (see Table 1) (HHP 1994c2, 1994c3, 1994d1 to 1994d5, 1994d7, 1994d8, 1994d11, 1994e1 to 1994e4, 1994e7, 1994e10 to 1994e12, 1994f1, 1994f2, 1994g1 to 1994g4, 1994g22, 1994h1, 1994h12 to 1994h14, 1994i7, 1994i10, 1994L5, 1994L6, 1994m20, 1994m22, 1994n3, 1994n5, 1994o1, 1994o13, 1994o35, 1994o37, 1994o38, 1994o43, 1994o44, 1994o46, 1994p14, 1994p16, 1994s1, 1994t3, 1994t4, 1994t13, 1994u2, 1994u3, 1994v27, 1994v29, 1994v30, 1994v34 to 1994v36, 1994w3 to

1994w5, 1994aa4, 1994cc1, 1994dd5, 1994dd12, 1994dd13, 1994ee; J. Lau, pers. comm. 1994).

Goats, originally native to the Middle East and India, were successfully introduced to the Hawaiian Islands in 1792. Feral goats now occupy a wide variety of habitats from lowland dry forests to montane grasslands on Kauai, Oahu, Molokai, Maui, and Hawaii, where they consume native vegetation, which may include the taxa in this final rule (see Factor C), trample roots and seedlings, accelerate erosion, and promote the invasion of alien plants (Stone 1985, van Riper and van Riper 1982). On Oahu, the goat population in the Waianae Mountains area is apparently increasing, becoming an even greater threat to the rare plants that grow there (J. Lau, pers. comm. 1994). One or more populations of five of the taxa in this final rule (including *Delissea subcordata*, *Eragrostis fosbergii*, one of the largest populations of *Lepidium arbuscula*, the largest population of *Melicope saint-johnii*, and more than half of the individuals of *Pritchardia kaalae*) are currently threatened by direct damage from feral goats, such as trampling of plants and seedlings and erosion of substrate (Culliney 1988; HHP 1994m20, 1994n5, 1994n6, 1994q5, 1994q8, 1994q9, 1994q11, 1994t14, 1994aa2, 1994aa4, 1994ee; Scott *et al.* 1986; van Riper and van Riper 1982).

Habitat disturbance caused by human activities may pose a threat to rare plant populations that grow on lands on which military training exercises and ground maneuvers are occasionally conducted. However, as most of the taxa in this final rule grow on moderate to steep slopes, ridges, and gulches, habitat disturbance is probably restricted to foot and helicopter traffic. Trampling by ground troops associated with training activities, and construction, maintenance, and utilization of helicopter landing and drop-off sites could affect populations of 14 of the plant taxa (*Chamaesyce rockii*, *Cyanea acuminata*, *Cyanea koolauensis*, *Cyanea longiflora*, *Cyrtandra subumbellata*, *Cyrtandra viridiflora*, *Delissea subcordata*, *Gardenia manni*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Myrsine juddii*, *Phyllostegia hirsuta*, *Pritchardia kaalae*, and *Viola oahuensis*) that occur on land leased or owned by the U.S. Army (HHP 1994d2, 1994d4, 1994d5, 1994e2 to 1994e5, 1994e7, 1994g1 to 1994g3, 1994g22, 1994h12 to 1994h14, 1994k6, 1994L4, 1994L6, 1994L7, 1994m7, 1994m9 to 1994m11, 1994o1, 1994o2, 1994o4, 1994o13, 1994o18, 1994o37 to 1994o40, 1994o43, 1994o44, 1994p2, 1994p14 to

1994p16, 1994q7 to 1994q9, 1994u1 to 1994u3, 1994v2, 1994v19, 1994v26, 1994v30, 1994v32, 1994v33, 1994aa2, 1994aa5, 1994dd5, 1994dd9, 1994dd10, 1994dd12, 1994dd15, 1994dd16; Wagner *et al.* 1985).

B. *Overutilization for commercial, recreational, scientific, or educational purposes.* Overutilization is not a known factor, but unrestricted collecting for scientific or horticultural purposes and excessive visits by individuals interested in seeing rare plants could seriously impact all of the plant taxa in this final rule, but especially *Cyanea humboldtiana*, *Cyanea koolauensis*, *C. st.-johnii*, *Eragrostis fosbergii*, and *Lobelia gaudichaudii* ssp. *koolauensis*, which have populations close to trails or roads and are thus easily accessible to collectors, and therefore possibly threatened by overcollection, trampling, and/or road maintenance (HHP 1994f1, 1994f2, 1994g22, 1994i9, 1994n3 to 1994n6; L. Mehrhoff, pers. comm. 1994).

C. *Disease and predation.* Disease is not known to be a significant threat to any of the plant taxa in this final rule. However, a tiny beetle, the black twig borer (*Xylosandrus compactus*), is known to infest a wide variety of common plant taxa, including *Melicope* in the Koolau Mountains (Davis 1970). The black twig borer burrows into branches, introduces a pathogenic fungus as food for its larvae, and lays its eggs. Twigs, branches, and even entire plants can be killed from an infestation. In the Hawaiian Islands, the black twig borer has many hosts, disperses easily, and is probably present at most elevations up to 670 m (2,500 ft) (Howarth 1985). In the Koolau Mountains, the black twig borer is known to threaten the Kapakahi Gulch population of *Gardenia manni*. The black twig borer occurs throughout the Waianae Mountains and may pose a threat to all *Melicope saint-johnii* plants that occur there (HHP 1994o41, 1994t1 to 1994t4, 1994t7, 1994t13, 1994t14; J. Lau, pers. comm. 1994).

Of the ungulates introduced to Oahu, pigs are currently the most significant modifiers of native forests (Cuddihy and Stone 1990, Stone 1985). Not only do they destroy native vegetation through their rooting activities and dispersal of alien plant seeds (see Factor A), but pigs also feed on plants, preferring the pithy interior of large tree ferns and fleshy-stemmed plants from the bellflower family (Stone 1985, Stone and Loope 1987). Although there is no conclusive evidence of predation on the eight members of the bellflower family included in this final rule, none of them are known to be unpalatable to pigs.

Pigs have definitely eaten federally endangered *Cyanea crispa* plants immediately adjacent to *Cyanea acuminata* plants. Predation is therefore a probable threat to *Cyanea acuminata*, *C. humboldtiana*, *C. koolauensis*, *C. longiflora*, *C. st.-johnii*, *Delissea subcordata*, *Lobelia gaudichaudii* ssp. *koolauensis*, *Lobelia monostachya*, and *Trematolobelia singularis* in areas where pigs have been reported (J. Lau and J. Yoshioka, pers. comm. 1994).

Predation of Hawaii's native vegetation by goats and the extensive damage caused by them have been well documented (Tomich 1986, van Riper and van Riper 1982). Although there is no evidence of predation on *Delissea subcordata*, *Eragrostis fosbergii*, *Lepidium arbuscula*, *Melicope saint-johnii*, and *Pritchardia kaalae*, all of which occur in areas where goats have been reported, none of those plants are known to be unpalatable. Direct predation by goats is a possible threat to those five taxa (HHP 1994m20, 1994n5, 1994n6, 1994q5, 1994q8, 1994q11, 1994t14, 1994aa2, 1994aa4, 1994ee).

Two rat species, the black rat (*Rattus rattus*) and the Polynesian rat (*Rattus exulans*), and to a lesser extent other introduced rodents, eat large, fleshy fruits and strip the bark of some native plants, particularly fruits of the native palms (*Pritchardia*) and plants in the bellflower and African violet families that have fleshy stems and fruits (Cuddihy and Stone 1990; Tomich 1986; Wagner *et al.* 1985; J. Lau, pers. comm. 1994). Rat predation on fruits threatens the largest population of *Pritchardia kaalae*, as indicated by the lack of reproduction and seedlings (HHP 1994aa2). Rat damage has also been observed in the only known population of *Lobelia monostachya* (HHP 1994ff). It is possible that rats eat the fruits of 11 other plant taxa in this final rule, all of which produce fleshy fruits and stems, and grow in areas where rats occur—*Cyanea acuminata*, *C. humboldtiana*, *C. koolauensis*, *C. longiflora*, *C. st.-johnii*, *Cyrtandra dentata*, *C. subumbellata*, *C. viridiflora*, *Delissea subcordata*, *Lobelia gaudichaudii* ssp. *koolauensis*, and *Trematolobelia singularis* (J. Lau and Joan Yoshioka, pers. comms. 1994).

D. *The inadequacy of existing regulatory mechanisms.* Of the 25 plant taxa in this final rule, 20 have populations located on private land, 22 on State land, 10 on City and County of Honolulu land, and 18 on land under Federal jurisdiction. Of those under Federal jurisdiction, 14 taxa have populations that occur on land owned by the Federal government and 15 have populations on land leased to the Federal government by State, City and

County of Honolulu, and/or private parties. While 22 of the taxa occur in more than one of those 3 ownership categories, the other 3 taxa are restricted to a single category—*Lobelia gaudichaudii* ssp. *koolauensis* is found only on private land, *Lobelia monostachya* is found only on State land, and *Labordia cyrtandrae* is found only on Federal land.

Except for certain provisions applicable only to land designated as a NAR, there are no State laws or existing regulatory mechanisms at the present time to protect or prevent further decline of these plants on private land. However, Federal listing automatically invokes listing under Hawaii State law. Hawaii's Endangered Species Act states, "Any species of aquatic life, wildlife, or land plant that has been determined to be an endangered species pursuant to the (Federal) Endangered Species Act shall be deemed to be an endangered species under the provisions of this chapter * * *" (Hawaii Revised Statutes (HRS), sect. 195D-4(a)). The State law prohibits taking a listed species on private and State lands and encourages conservation by State government agencies. In addition, State regulations specifically prohibit the removal, destruction, or damage of plants found on State lands. However, the regulations are difficult to enforce because of limited personnel.

Seven of the 25 plant taxa in this rule have one or more populations in NARs, which have rules and regulations for the protection of resources (HRS, sect. 195-5). Almost all populations of the taxa in this final rule are located on land classified within conservation districts and owned by the State of Hawaii or private companies or individuals. Regardless of the owner, lands in these districts, among other purposes, are regarded as necessary for the protection of endemic biological resources and the maintenance or enhancement of the conservation of natural resources. Activities permitted in conservation districts must not be detrimental to a multiple use conservation concept and shall conserve threatened or endangered plants (HRS, sect. 205-2). Some uses, such as maintaining animals for hunting, are based on policy decisions, while others, such as preservation of endangered species, are mandated by both Federal and State laws. Requests for amendments to district boundaries or variances within existing classifications can be made by government agencies and private landowners (HRS, sect. 205-4). Before decisions about these requests are made, the impact of the proposed reclassification on "preservation or

maintenance of important natural systems or habitat" (HRS, sects. 205-4, 205-17) as well as the maintenance of natural resources is required to be taken into account (HRS, sects. 205-2, 205-4). Before any proposed land use that will occur on State land, is funded in part or whole by county or State funds, or will occur within land classified as conservation district, an environmental assessment is required to determine whether or not the environment will be significantly affected (HRS, chapt. 343). If it is found that an action will have a significant effect, preparation of a full Environmental Impact Statement is required. Hawaii environmental policy, and thus approval of land use, is required by law to safeguard " * * * the State's unique natural environmental characteristics * * *" (HRS, sect. 344-3(1)) and includes guidelines to "protect endangered species of individual plants and animals * * *" (HRS, sect. 344-4(3)(A)). Federal listing, because it automatically invokes State listing, also implements these State regulations protecting the plants.

State laws relating to the conservation of biological resources allow for the acquisition of land as well as the development and implementation of programs concerning the conservation of biological resources (HRS, sect. 195D-5(a)). The State also may enter into agreements with Federal agencies to administer and manage any area required for the conservation, management, enhancement, or protection of endangered species (HRS, sect. 195D-5(c)). Funds for these activities could be made available under section 6 of the Federal Act (State Cooperative Agreements). The Hawaii Department of Land and Natural Resources is mandated to initiate changes in conservation district boundaries to include "the habitat of rare native species of flora and fauna within the conservation district" (HRS, sect. 195D-5.1).

Twenty-one of the plant taxa in this final rule are threatened by four plants considered by the State of Hawaii to be noxious weeds—*Ageratina adenophora* (Maui pamakani), *Ageratina riparia* (Hamakua pamakani), *Clidemia hirta* (Koster's curse), and *Myrica faya* (firetree). The State has provisions and funding available for eradication and control of noxious weeds on State and private land in conservation districts and other areas (HRS, chapt. 152; Hawaii Department of Agriculture (DOA) 1981).

Listing of these 25 plant taxa therefore would reinforce and supplement the protection available under the State Act and other laws. The Federal Act also

would provide additional protection to these 25 plant taxa because it is a Federal violation of the Act for any person to remove, cut, dig up, damage, or destroy any such plant in an area not under Federal jurisdiction in knowing violation of State law or regulation or in the course of any violation of a State criminal trespass law.

E. *Other natural or manmade factors affecting its continued existence.* All of the 25 taxa in this final rule are threatened by competition with 1 or more alien plant species (see Table 1). The most significant of these appear to be *Clidemia hirta* (Koster's curse), *Psidium cattleianum* (strawberry guava), *Schinus terebinthifolius* (Christmas berry), *Ageratina adenophora* (Maui pamakani), *Ageratina riparia* (Hamakua pamakani), *Passiflora suberosa* (huehue haole), *Rubus argutus* (prickly Florida blackberry), *Lantana camara* (lantana), and *Grevillea robusta* (silk oak).

Koster's curse, a noxious shrub native to tropical America, is found in mesic to wet forests on at least six islands in Hawaii (Almeda 1990, DOA 1981, Smith 1992). Koster's curse was first reported on Oahu in 1941 and had spread through much of the Koolau Mountains by the early 1960's. Koster's curse spread to the Waianae Mountains around 1970 and is now widespread throughout the southern half of that mountain range. This noxious pest forms a dense understory, shading out other plants and hindering plant regeneration, and is considered the major alien plant threat in the Koolau Mountains (Cuddihy and Stone 1990). At present, Koster's curse threatens populations of 18 of the plant taxa—*Chamaesyce rockii*, *Cyanea acuminata*, *Cyanea humboldtiana*, *Cyanea koolauensis*, *Cyanea longiflora*, *Cyanea st.-johnii*, *Cyrtandra dentata*, *Cyrtandra subumbellata*, *Cyrtandra viridiflora*, *Delissea subcordata*, *Gardenia mannii*, *Labordia cyrtandrae*, *Lobelia gaudichaudii* ssp. *koolauensis*, *Myrsine juddii*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, *Trematolobelia singularis*, and *Viola oahuensis* (HHP 1994d1 to 1994d5, 1994d7, 1994d8, 1994d11, 1994e1 to 1994e4, 1994e7, 1994e8, 1994e10 to 1994e12, 1994e20, 1994f1, 1994f2, 1994g1 to 1994g4, 1994g22, 1994h12 to 1994h14, 1994i7, 1994i9, 1994i10, 1994j6, 1994k6, 1994L4 to 1994L6, 1994m1, 1994o1, 1994o13, 1994o14, 1994o35, 1994o38 to 1994o40, 1994o42 to 1994o44, 1994o46, 1994p14, 1994s1, 1994u2, 1994u3, 1994v19, 1994v27, 1994v29, 1994v30, 1994w3, 1994cc2, 1994cc4, 1994dd9, 1994dd12, 1994dd13; Takeuchi & Shimabukuro (s.n.) 1987; Takeuchi (2410) 1985).

Strawberry guava, a tree native to tropical America, has become widely naturalized on all of the main islands, forming dense stands that exclude other plant species in disturbed areas (Cuddihy and Stone 1990). Strawberry guava grows primarily in mesic and wet habitats and is dispersed mainly by feral pigs and fruit-eating birds (Smith 1985, Wagner *et al.* 1990). Strawberry guava is considered to be one of the greatest alien plant threats to Hawaiian rain forests and threatens populations of 15 of the plant taxa in this final rule—*Chamaesyce herbstii*, *Chamaesyce rockii*, *Cyanea koolauensis*, *Cyanea longiflora*, *Cyrtandra dentata*, *Cyrtandra viridiflora*, *Delissea subcordata*, *Eragrostis fosbergii*, *Gardenia manni*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Myrsine juddii*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, and *Viola oahuensis* (HHP 1994c2, 1994c3, 1994d5, 1994g1, 1994g5, 1994h1, 1994h12 to 1994h14, 1994j6, 1994L4 to 1994L6, 1994m7, 1994n4, 1994o1, 1994o13, 1994o37, 1994o38, 1994o44, 1994o46, 1994p15, 1994p16, 1994q7, 1994q11, 1994u2, 1994u3, 1994v27, 1994v36, 1994w3, 1994dd9, 1994dd12; Smith 1985).

Christmas berry, introduced to Hawaii before 1911, is a fast-growing tree or shrub that invade mesic to wet lowland areas of the major Hawaiian Islands (Wagner *et al.* 1990). Christmas berry is distributed mainly by feral pigs and fruit-eating birds and forms dense thickets that shade out and displace other plants (Cuddihy and Stone 1990, Smith 1985, Stone 1985). It is a pervasive threat in the Koolau and Waianae Mountains and threatens one or more populations of *Chamaesyce herbstii*, *Cyanea acuminata*, *Delissea subcordata*, *Eragrostis fosbergii*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Lobelia monostachya*, *Melicope saint-johnii*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, *Pritchardia kaalae*, and *Schiedea kealiae* (HHP 1994c1, 1994c2, 1994c4, 1994e11, 1994m1, 1994m7, 1994n4, 1994p16, 1994q4, 1994q5, 1994q7, 1994q9 to 1994q11, 1994t3, 1994t4, 1994t13, 1994t14, 1994v19, 1994v31, 1994v34, 1994v35, 1994w3, 1994w4, 1994aa2, 1994bb4, 1994bb6, 1994ff).

Maui pamakani and Hamakua pamakani, both native to tropical America, have naturalized in dry areas to wet forest on Oahu and four other islands (Wagner *et al.* 1990). These two noxious weeds form dense mats with other alien plants and prevent regeneration of native plants (Anderson *et al.* 1992). Five of the plant taxa in this final rule in both Oahu mountain ranges are threatened by competition with

Maui pamakani and/or Hamakua pamakani—*Cyanea acuminata*, *Lepidium arbuscula*, *Lobelia monostachya*, *Melicope saint-johnii*, and *Pritchardia kaalae* (HHP 1994e1, 1994q5, 1994q9 to 1994q11, 1994t14, 1994aa2, 1994ff).

Huehue haole, a vine native to tropical America, is found in dryland habitats and mesic forest on Oahu, Maui, and Hawaii, where it thrives in the subcanopy layers and smotherers shrubs, small trees, and the ground layer (Escobar 1990, Smith 1985, Wester 1992). Huehue haole threatens one or more populations of four of the plant taxa, all in the Waianae Mountains—*Chamaesyce herbstii*, *Melicope saint-johnii*, *Phyllostegia hirsuta*, and *Phyllostegia kaalaensis* (HHP 1994c1, 1994t3, 1994t4, 1994t13, 1994t14, 1994v31, 1994v34, 1994v35, 1994w3, 1994w4).

Prickly Florida blackberry was introduced to the Hawaiian Islands in the late 1800's from the continental U.S. (Haselwood and Motter 1983). The fruits are easily spread by birds to open areas such as disturbed mesic or wet forests, where the species forms dense, impenetrable thickets (Smith 1985). In the Waianae Mountains, populations of five of the plant taxa are threatened by this noxious weed—*Cyanea longiflora*, *Gardenia manni*, *Labordia cyrtandrae*, *Phyllostegia hirsuta*, and *Pritchardia kaalae* (HHP 1994h1, 1994o1, 1994p14, 1994p15, 1994v2, 1994v3, 1994aa5).

Lantana, native to the West Indies, is an aggressive, thicket-forming shrub that produces chemicals that inhibit the growth of other plant species. Lantana is now found on all of the main Hawaiian islands in mesic forests, dry shrublands, and other dry, disturbed habitats (Cuddihy and Stone 1990, Smith 1985, Wagner *et al.* 1990). In the Waianae Mountains, lantana negatively affects populations of four of the plant taxa in this final rule—*Delissea subcordata*, *Lepidium arbuscula*, *Melicope saint-johnii*, and *Phyllostegia hirsuta* (HHP 1994q5, 1994q10, 1994t13, 1994v19, 1994v31; Takeuchi and Shimabukuro (s.n.) 1987).

Silk oak, native to Queensland and New South Wales, Australia, was planted extensively in Hawaii for timber and is now naturalized on most of the main islands (Smith 1985, Wagner *et al.* 1990). Silk oak negatively affects populations of four of the plant taxa that grow exclusively in the Waianae Mountains—*Chamaesyce herbstii*, *Eragrostis fosbergii*, *Lepidium arbuscula*, and *Melicope saint-johnii* (HHP 1994c1, 1994n4, 1994q10, 1994q11, 1994t14).

Kalanchoe pinnata (air plant) is an herb that occurs on all the main islands except Niihau and Kahoolawe, especially in dry to mesic areas (Wagner *et al.* 1990). Air plant poses a significant threat to the only population of *Lobelia monostachya* (HHP 1994ff).

Leucaena leucocephala (koa haole), a naturalized shrub which is sometimes the dominant species in low elevation, dry, disturbed areas on all of the main Hawaiian islands, is a major threat to *Schiedea kealiae* (Geesink *et al.* 1990; HHP 1994bb1, 1994bb4, 1994bb6).

Melinis minutiflora (molasses grass), a perennial grass brought to Hawaii for cattle fodder, is now naturalized in dry to mesic, disturbed areas on most of the main Hawaiian Islands. The mats it forms smother other plants and fuel more intense fires than would normally affect an area (Cuddihy and Stone 1990, O'Connor 1990, Smith 1985). Molasses grass threatens *Lepidium arbuscula* and the only known population of *Lobelia monostachya* (HHP 1994q4, 1994q5, 1994q11, 1994ff).

Myrica faya (firetree), native to the Azores, Madeira, and the Canary Islands, was introduced to Hawaii before 1900 for wine-making, firewood, or as an ornamental. Firetree was planted in forest reserves in the 1920's. By the mid-1980's, firetree had infested over 34,000 ha (84,000 ac) throughout the State, with the largest infestations on the island of Hawaii. It is now considered a noxious weed (Cuddihy and Stone 1990, DOA 1981). Firetree can form a dense stand with no ground cover beneath the canopy. This lack of ground cover may be due to dense shading or to chemicals released by firetree that prevent other species from growing. Firetree also fixes nitrogen and increases nitrogen levels in Hawaii's typically nitrogen-poor volcanic soils. This may encourage the invasion of alien plants that would not otherwise be able to grow as well as native species in Hawaii's low-nitrogen soils (Cuddihy and Stone 1990). Firetree threatens *Melicope saint-johnii* and one of the largest populations of *Lepidium arbuscula* (HHP 1994q11, 1994t14).

The perennial grass *Paspalum conjugatum* (Hilo grass) has become naturalized in moist to wet, disturbed areas on most Hawaiian Islands. It produces a dense ground cover, even on poor soil (Cuddihy and Stone 1990). *Sacciolepis indica* (Glenwood grass) is an annual or perennial grass naturalized on five islands in Hawaii in open, wet areas (Wagner *et al.* 1990). Hilo grass and Glenwood grass threaten the largest population of *Viola oahuensis* (HHP 1994dd13).

Fire does not pose an immediate threat to the 25 plant taxa in this final rule, although species that grow in dry and mesic shrubland and forest may be susceptible to fire (see Table 1). Because Hawaii's native plants have evolved with only infrequent naturally occurring episodes of fire (lava flows, infrequent lightning strikes), most species are not adapted to fire and are unable to recover well after recurring fires. Alien plants are often more fire-adapted than native taxa and will quickly exploit suitable habitat after a fire (Cuddihy and Stone 1990). Unintentionally ignited fires have resulted from ordnance training practices in Makua Military Reservation and Schofield Barracks Military Reservation and from other military training practices in Kawaiiloa and Kahuku Training Areas and pose a possible threat to the five species that occur on those military installations—*Cyrtandra subumbellata*, *Delissea subcordata*, *Gardenia mannii*, all known populations of *Labordia cyrtandrae*, and *Pritchardia kaalae* (Environment Impact Study Corp. 1977; HHP 1993, 1994a, 1994b, 1994k2, 1994k5, 1994k6, 1994m7, 1994m9 to 1994m11, 1994o1, 1994o2, 1994o4, 1994o13, 1994o18, 1994o37 to 1994o40, 1994o43, 1994o44, 1994p2, 1994p14 to 1994p16, 1994aa2, 1994aa5; Yoshioka *et al.* 1991). Accidentally or maliciously set fires in areas of habitation near the Lualualei Naval Reservation and the Makua Military Reservation could easily spread and pose a possible threat to more than half of the individuals of *Lepidium arbuscula* that occur on both reservations and one population of *Melicope saint-johnii* (HHP 1994q3, 1994q5, 1994q8, 1994q10, 1994q11, 1994t15; J. Lau, pers. comm. 1994). Fire is also a potential threat to *Chamaesyce herbstii*, *Cyanea longiflora*, *Cyrtandra dentata*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, and *Schiedea kealiae*, which occur in dry or mesic habitats with adequate conditions for the spread of fire, at least seasonally (HHP 1994c1 to 1994c5, 1994h1, 1994h3, 1994h11, 1994j2, 1994j6, 1994j7, 1994v6, 1994v34 to 1994v36, 1994w2 to 1994w4, 1994w6, 1994bb3).

Erosion, landslides, and rockslides due to natural weathering result in habitat destruction as well as the death of individual plants. This especially affects the continued existence of taxa or populations with limited numbers and/or narrow ranges on cliffs, such as the only known population of *Lobelia gaudichaudii* ssp. *koolauensis* and the Kaena Point population of *Schiedea kealiae* (HHP 1994bb3; L. Mehrhoff, pers. comm. 1994).

People are more likely to come into contact with species that have populations near trails or roads or in recreational areas. Alien plants may be introduced into such areas as seeds on footwear, or people may cause erosion, trample plants, or start fires (Cuddihy and Stone 1990). The following taxa have populations in recreational areas or close to roads or trails and are potentially threatened by human disturbance—*Cyanea humboldtiana*, *Cyanea koolauensis*, *Cyanea st.-johnii*, *Delissea subcordata*, *Eragrostis fosbergii*, *Lepidium arbuscula*, and *Lobelia gaudichaudii* (HHP 1994f1, 1994g22, 1994i7, 1994i9, 1994i10, 1994n3 to 1994n6, 1994q4; L. Mehrhoff, pers. comm. 1994).

The small number of populations and individuals of most of these taxa increases the potential for extinction from naturally occurring events. The small gene pool may depress reproductive vigor, or a single human-caused or natural environmental disturbance could destroy a significant percentage of the individuals or the only extant population. Two of the plant taxa, *Lobelia gaudichaudii* ssp. *koolauensis* and *Lobelia monostachya*, are known from a single population. An additional 15 of the taxa in this final rule have 5 or fewer populations. Twelve of the taxa are estimated to number no more than 100 individuals and 4 of those taxa (*Cyrtandra viridiflora*, *Eragrostis fosbergii*, *Labordia cyrtandrae*, and *Lobelia monostachya*) are estimated to number no more than 10 individuals (see Table 1).

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by these taxa in determining to make this rule final. Based on this evaluation, this rulemaking will list these 25 species as endangered—*Chamaesyce herbstii*, *Chamaesyce rockii*, *Cyanea acuminata*, *Cyanea humboldtiana*, *Cyanea koolauensis*, *Cyanea longiflora*, *Cyanea st.-johnii*, *Cyrtandra dentata*, *Cyrtandra subumbellata*, *Cyrtandra viridiflora*, *Delissea subcordata*, *Eragrostis fosbergii*, *Gardenia mannii*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Lobelia gaudichaudii* ssp. *koolauensis*, *Lobelia monostachya*, *Melicope saint-johnii*, *Myrsine juddii*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, *Pritchardia kaalae*, *Schiedea kealiae*, *Trematolobelia singularis*, and *Viola oahuensis*. The 25 taxa are threatened by one or more of the following—habitat degradation and/or predation by pigs, goats, and rats; insect infestations; competition for space, light, water, and nutrients by alien plants; habitat loss

from fires; and human impacts from military training practices and from recreational activities. Twenty of the 25 taxa either number no more than 100 individuals or are known from no more than 5 populations. Small population size and limited distribution make these taxa particularly vulnerable to extinction from reduced reproductive vigor or from naturally occurring events. Because the 25 taxa are in danger of extinction throughout all or a significant portion of their ranges, they fit the definition of endangered as defined in the Act.

Critical habitat is not being designated for the 25 taxa included in this rule for reasons discussed in the "Critical Habitat" section below.

Critical Habitat

Critical habitat is defined in section 3 of the Act as—(I) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management consideration or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. "Conservation" means the use of all methods and procedures needed to bring the species to the point at which listing under the Act is no longer necessary.

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12) require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. Service regulations (50 CFR 424.12(a)(1)) state that designation of critical habitat is not prudent when one or both of the following situations exist—(1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or (2) such designation of critical habitat would not be beneficial to the species. As discussed under Factor B, these taxa could potentially be threatened by overcollection due to their low population size and interest generated by their endangered status. The publication of precise maps and descriptions of critical habitat in the Federal Register and local newspapers as required in designation of critical habitat would increase the degree of threat to these plants from take or vandalism and, therefore, could

contribute to their decline. The listing of these taxa as endangered publicizes the rarity of the plants and, thus, can make these plants attractive to researchers, curiosity seekers, or collectors of rare plants. For this reason, The Service finds that designation of critical habitat for these 25 taxa is not prudent at this time.

Furthermore, such a designation would not only increase The degree of threat from vandalism, collecting, or other human activities, it is unlikely to aid in the conservation of these taxa. Eighteen of the taxa occur on lands under Federal military jurisdiction. The additional protection by the designation of critical habitat to a species is granted through section 7 of the Act. Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Section 7(a)(2) requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of such a species or destroy or adversely modify its critical habitat. All of the 18 species which occur on military lands are confined to small geographic areas, and each population is composed of so few individuals that the determinations for jeopardy to the species and adverse modification of critical habitat would be similar. Therefore, designation of critical habitat for these species provides no benefits beyond those that these species would receive by virtue of their listing as endangered species.

Critical habitat designation, therefore, would increase the degree of threat from vandalism, collecting, or other human activities, and is not likely to aid in the conservation of these taxa. For these reasons, the Service finds that designation of critical habitat for these 25 taxa is not prudent at this time.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recovery actions, requirements for Federal protection, and prohibitions against certain activities. Recognition through listing results in conservation actions by Federal, State, and local agencies, private organizations, and individuals. The Act provides for possible land acquisition and cooperation with the State and requires that recovery plans be developed for listed species. The protection required of Federal agencies and the prohibitions

against certain activities involving listed plants are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(1) requires Federal agencies to use their authorities to further the purposes of the Act by carrying out programs for listed species. Section 7(a)(2) of the Act requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species. If a Federal action is likely to adversely affect a listed species, the responsible Federal agency must enter into formal consultation with the Service.

Eighteen of the taxa occur on land under Federal jurisdiction, including the following agencies—U.S. Army, U.S. Navy, and U.S. Coast Guard. Of those, 15 taxa are found on federally owned land and 14 taxa occur on land leased by the Federal government from the State, City and County of Honolulu, and private parties. Activities carried out by the U.S. Army include ordnance training practices, ground troop training activities, and construction, maintenance, and utilization of helicopter landing and drop-off sites. The Army is coordinating with TNCH to develop management plans for Schofield Barracks Military Reservation, Kawaihoa Training Area, and Kahuku Training Area to limit the impact of these activities on endangered species and their habitats.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered plants. All prohibitions of section 9(a)(2) of the Act, implemented by 50 CFR 17.61, apply. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to import or export, transport in interstate or foreign commerce in the course of a commercial activity, sell or offer for sale in interstate or foreign commerce, or remove and reduce the species to possession from areas under Federal jurisdiction. In addition, for plants listed as endangered, the Act prohibits the malicious damage or destruction on areas under Federal jurisdiction and the removal, cutting, digging up, or damaging or destroying of such plants in knowing violation of any State law or regulation, including State criminal trespass law. Certain exceptions to the

prohibitions apply to agents of the Service and State conservation agencies.

The Act and 50 CFR 17.62 provide for the issuance of permits to carry out otherwise prohibited activities involving endangered plant species under certain circumstances. Such permits are available for scientific purposes and to enhance the propagation or survival of the species. It is anticipated that few permits would ever be sought or issued because these 25 taxa are not common in cultivation or in the wild.

It is the policy of the Service (59 FR 34272) to identify to the maximum extent practicable at the time a species is listed those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of the listing on proposed and ongoing activities within the species' range. Eighteen of the taxa occur on lands under Federal jurisdiction (U.S. Army, U.S. Navy, and U.S. Coast Guard). Of those, 15 taxa are found on federally owned land and 14 taxa occur on land leased by the Federal government from the State, City and County of Honolulu, and private parties. Collection, damage, or destruction of these taxa on Federal lands is prohibited without a Federal endangered species permit. Such activities on non-Federal lands would constitute a violation of section 9 if conducted in knowing violation of Hawaii State law or regulations or in violation of State criminal trespass law. One of the listed taxa (*Pritchardia kaalae*) may be of horticultural interest, though currently it is not in commercial trade. Intrastate commerce (commerce within a State) is not prohibited under the Act. However, interstate and foreign commerce (sale or offering for sale across State or international boundaries), would be prohibited, with limited exceptions. (Endangered species may be advertised for sale provided the advertisement contains a statement that no sale may be consummated until a permit has been obtained from the Service.)

Questions regarding whether specific activities will constitute a violation of section 9 of the Act should be directed to the Pacific Islands Ecoregion Manager (see ADDRESSES section). Requests for copies of the regulations concerning listed plants and inquiries regarding prohibitions and permits may be addressed to the Fish and Wildlife Service, Ecological Services, Endangered Species Permits, 911 N.E. 11th Avenue, Portland, Oregon 97232-4181 (telephone: 503/231-6241; facsimile: 503/231-6243).

Hawaii State Law

Federal listing will automatically invoke listing under the State's endangered species act. Hawaii's Endangered Species Act states, "Any species of aquatic life, wildlife, or land plant that has been determined to be an endangered species pursuant to the [Federal] Endangered Species Act shall be deemed to be an endangered species under the provisions of this chapter * * *" (Hawaii Revised Statutes (HRS), sect. 195D-4(a)). This Federal listing will automatically invoke listing under Hawaii State law. The State law prohibits taking of listed species on private and State lands and encourages conservation by State agencies (HRS, sect. 195D-4).

National Environmental Policy Act

The Fish and Wildlife Service has determined that Environmental Assessments or Environmental Impact Statements, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared in connection with regulations

adopted pursuant to section 4(a) of the Endangered Species Act of 1973, as amended. A notice outlining the Service's reasons for this determination was published in the Federal Register on October 25, 1983 (48 FR 49244).

Required Determinations

The Service has examined this regulation under the Paperwork Reduction Act of 1995 and found it to contain no information collection requirements. This rulemaking was not subject to review by the Office of Management and Budget under Executive Order 12866.

References Cited

A complete list of all references cited herein is available upon request from the Pacific Islands Ecoregion (see ADDRESSES section).

Author

The authors of this rule are Christa Russell and Marie M. Brueggmann, Pacific Islands Ecoregion Office (see ADDRESSES section).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, is amended as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361-1407; 16 U.S.C. 1531-1544; 16 U.S.C. 4201-4245; Pub. L. 99-625, 100 Stat. 3500; unless otherwise noted.

2. Section 17.12(h) is amended by adding the following, in alphabetical order under FLOWERING PLANTS, to the List of Endangered and Threatened Plants to read as follows:

§ 17.12 Endangered and threatened plants.

* * * * *
(h) * * *

Species		Historic range	Family	Status	When listed	Critical habitat	Special rules
Scientific name	Common name						
FLOWERING PLANTS							
<i>Chamaesyce herbstii</i>	'Akoko	U.S.A. (HI)	Euphorbiaceae—Spurge	E	591	NA	NA
<i>Chamaesyce rockii</i>	'Akoko	U.S.A. (HI)	Euphorbiaceae—Spurge	E	591	NA	NA
<i>Cyanea acuminata</i>	Haha	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Cyanea humboldtiana</i>	Haha	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Cyanea koolauensis</i>	Haha	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Cyanea longiflora</i>	Haha	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Cyanea st.-johnii</i>	Haha	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Cyrtandra dentata</i>	Ha'iwale	U.S.A. (HI)	Gesneriaceae—African violet.	E	591	NA	NA
<i>Cyrtandra subumbellata</i>	Ha'iwale	U.S.A. (HI)	Gesneriaceae—African violet.	E	591	NA	NA

Species		Historic range	Family	Status	When listed	Critical habitat	Special rules
Scientific name	Common name						
<i>Cyrtandra viridiflora</i>	Ha'iwale	U.S.A. (HI)	Gesneriaceae—African violet.	E	591	NA	NA
<i>Delissea subcordata</i>	'Oha	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Eragrostis fosbergii</i>	None	U.S.A. (HI)	Poaceae—Grass	E	591	NA	NA
<i>Gardenia mannii</i>	Nanu	U.S.A. (HI)	Rubiaceae—Coffee	E	591	NA	NA
<i>Labordia cyrtandrae</i>	Kamakahala	U.S.A. (HI)	Loganiaceae—Logania	E	591	NA	NA
<i>Lepidium arbuscula</i>	'Anaunau	U.S.A. (HI)	Brassicaceae—Mustard	E	591	NA	NA
<i>Lobelia gaudichaudii</i>	None	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Lobelia monostachya</i>	None	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Melicope saint-johnii</i>	Alani	U.S.A. (HI)	Rutaceae—Rue	E	591	NA	NA
<i>Myrsine juddii</i>	Kolea	U.S.A. (HI)	Myrsinaceae—Myrsine	E	591	NA	NA
<i>Phyllostegia hirsuta</i>	None	U.S.A. (HI)	Lamiaceae—Mint	E	591	NA	NA
<i>Phyllostegia kaalaensis</i>	None	U.S.A. (HI)	Lamiaceae—Mint	E	591	NA	NA
<i>Pritchardia kaalae</i>	Loulu	U.S.A. (HI)	Arecaceae—Palm	E	591	NA	NA
<i>Schiedea kealiae</i>	None	U.S.A. (HI)	Caryophyllaceae—Pink	E	591	NA	NA
<i>Trematolobelia singularis</i>	None	U.S.A. (HI)	Campanulaceae—Bell-flower.	E	591	NA	NA
<i>Viola oahuensis</i>	None	U.S.A. (HI)	Violaceae—Violet	E	591	NA	NA

Dated: September 24, 1996.
 John G. Rogers,
 Acting Director, Fish and Wildlife Service.
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50 CFR Part 17
RIN 1018-AD58
Endangered and Threatened Wildlife and Plants; Determination of Endangered or Threatened Status for Fourteen Plant Taxa From the Hawaiian Islands
AGENCY: Fish and Wildlife Service, Interior.
ACTION: Final rule.

SUMMARY: The U.S. Fish and Wildlife Service (Service) determines endangered status pursuant to the Endangered Species Act of 1973, as amended (Act), for 13 plant taxa—*Achyranthes mutica* (No common name (NCN)), *Cenchrus agrimonioides* (kamanomano), *Cyanea grimesiana* ssp. *grimesiana* (haha), *Cyperus trachysanthos* (pu'uka'a), *Euphorbia haeleleana* (NCN), *Isodendron laurifolium* (aupaka), *Panicum niihauense* (lau 'ehu), *Phyllostegia*