



# Federal Register

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**Tuesday,  
June 17, 2003**

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## **Part II**

# **Department of the Interior**

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**Fish and Wildlife Service**

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**50 CFR Part 17**

**Endangered and Threatened Wildlife and  
Plants; Final Designations or  
Nondesignations of Critical Habitat for  
101 Plant Species From the Island of  
Oahu, HI; Final Rule**

**DEPARTMENT OF THE INTERIOR****Fish and Wildlife Service****50 CFR Part 17**

RIN 1018-AI24

**Endangered and Threatened Wildlife and Plants; Final Designations or Nondesignations of Critical Habitat for 101 Plant Species From the Island of Oahu, HI**

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

**SUMMARY:** We, the U.S. Fish and Wildlife Service (Service), designate critical habitat pursuant to the Endangered Species Act of 1973, as amended (Act), for 99 of the 101 species known historically from the Hawaiian island of Oahu. A total of approximately 22,274 hectares (ha) (55,040 acres (ac)) of land on Oahu fall within the boundaries of the 303 critical habitat units designated for the 99 species. This critical habitat designation requires the Service to consult under section 7 of the Act with regard to actions carried out, funded, or authorized by a Federal agency. Section 4 of the Act requires us to consider economic and other relevant impacts when specifying any particular area as critical habitat. This rule also determines that designating critical habitat would not be prudent for two species (*Cyrtandra crenata* and *Pritchardia kaalae*). We solicited data and comments from the public on all aspects of the proposed rule, including data on economic and other impacts of the designation.

**DATES:** This rule becomes effective on July 17, 2003.

**ADDRESSES:** Comments and materials received, as well as supporting documentation, used in the preparation of this final rule will be available for public inspection, by appointment, during normal business hours at U.S. Fish and Wildlife Service, Pacific Islands Office, 300 Ala Moana Blvd., Room 3-122, PO Box 50088, Honolulu, HI 96850-0001.

**FOR FURTHER INFORMATION CONTACT:** Paul Henson, Field Supervisor, Pacific Islands Office at the above address (telephone 808/541-3441; facsimile 808/541-3470).

**SUPPLEMENTARY INFORMATION:****Disclaimer**

Designation of critical habitat provides little additional protection to species. In 30 years of implementing the ESA, the Service has found that the

designation of statutory critical habitat provides little additional protection to most listed species, while consuming significant amounts of scarce conservation resources. The present system for designating critical habitat has evolved since its original statutory prescription into a process that provides little real conservation benefit, is driven by litigation rather than biology, forces decisions to be made before complete scientific information is available, consumes enormous agency resources that would otherwise be applied to actions of much greater conservation benefit, and imposes huge social and economic costs. The Service believes that rational public policy demands serious attention to this issue in order to allow our limited resources to be applied to those actions that provide the greatest benefit to the species most in need of protection.

**Role of Critical Habitat in Actual Practice of Administering and Implementing the Act**

While attention to and protection of habitat is paramount to successful conservation actions, we have consistently found that, in most circumstances, the designation of critical habitat is of little additional value for most listed species, yet it consumes large amounts of conservation resources. [Sidle (1987. Env. Manage. 11(4):429-437) stated, "Because the ESA can protect species with and without critical habitat designation, critical habitat designation may be redundant to the other consultation requirements of section 7."] Currently, only 306 species or 25% of the 1,211 listed species in the U.S. under the jurisdiction of the Service have designated critical habitat. We address the habitat needs of all 1,211 listed species through conservation mechanisms such as listing, section 7 consultations, the Section 4 recovery planning process, the Section 9 protective prohibitions of unauthorized take, Section 6 funding to the States, and the Section 10 incidental take permit process. The Service believes that it is these measures that may make the difference between extinction and survival for many species.

**Procedural and Resource Difficulties in Designating Critical Habitat**

With a budget consistently inadequate to fund all of the petition review, listing, and critical habitat designation duties required of us by statute, we have in the past prioritized our efforts and focused our limited resources on adding species in need of protection to the lists of threatened or endangered species. We

have been inundated with lawsuits for our failure to designate critical habitat, and we face a growing number of lawsuits challenging critical habitat determinations once they are made. These lawsuits have subjected the Service to an ever-increasing series of court orders and court-approved settlement agreements, compliance with which now consumes nearly the entire listing program budget. This leaves the Service with little ability to prioritize its activities to direct scarce listing resources to the listing program actions with the most biologically urgent species conservation needs.

The consequence of the critical habitat litigation activity is that limited listing funds are used to defend active lawsuits, to respond to Notices of Intent (NOIs) to sue relative to critical habitat, and to comply with the growing number of adverse court orders. As a result, listing petition responses, the Service's own proposals to list critically imperiled species, and final listing determinations on existing proposals are significantly delayed. Litigation over critical habitat issues for species already listed and receiving the Act's full protection has precluded or delayed many listing actions nationwide.

The accelerated schedules of court ordered designations have left the Service with almost no ability to provide for adequate public participation or ensure a defect-free rulemaking process before making decisions on listing and critical habitat proposals due to the risks associated with noncompliance with judicially-imposed deadlines. This in turn fosters a second round of litigation in which those who fear adverse impacts from critical habitat designations challenge those designations. The cycle of litigation appears endless, is very expensive, and in the final analysis provides relatively little additional protection to listed species.

The costs resulting from the designation include legal costs, the cost of preparation and publication of the designation, the analysis of the economic effects and the cost of requesting and responding to public comment, and in some cases the costs of compliance with NEPA, all are part of the cost of critical habitat designation. None of these costs result in any benefit to the species that is not already afforded by the protections of the Act enumerated earlier, and they directly reduce the funds available for direct and tangible conservation actions.

**Background**

In the List of Endangered and Threatened Plants (50 CFR 17.12(h)),

there are 101 plant species that, at the time of listing, were reported from the island of Oahu and are at issue in this final rule. These species and their distribution by island are identified in Table 1 in the **Federal Register** notice proposing this critical habitat designation (67 FR 37107–37272; chart page 37108).

Fifty-seven of these species are endemic to the island of Oahu, while 44 species are reported from one or more other islands, as well as Oahu. Each of these species is described in more detail below in the section "Discussion of Plant Taxa." Although we considered designating critical habitat on Oahu for each of the 101 plant species, for the reasons described below, the final designation includes critical habitat for 99 of 101 plant species. We have designated critical habitat on other islands (Kauai, Niihau, Maui, and Molokai) for species that are also reported from Oahu. Critical habitat may be designated for the species that are also reported from the island of Hawaii in a subsequent rulemaking.

#### *The Island of Oahu*

The island of Oahu was formed from the remnants of two large shield volcanoes, the younger Koolau volcano to the east and the older Waianae volcano to the west (60 FR 51398; Service 1995a, 1996b). 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 and formed a range now approximately 60 kilometers (km) (37 miles (mi)) long (Service 1996b). Median annual rainfall for the Koolau Mountains varies from 100 to 710 centimeters (cm) (40 to 280 inches (in)), most of which is received at higher elevations along the entire length of the windward (northeastern) side (Service 1996b).

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 32 km (20 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 receive much less rainfall, except for Mt. Kaala, the highest point on Oahu at an elevation of 1,225 meters (m) (4,020 feet

(ft)) (Wagner *et al.* 1999). 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 (Service 1995a).

#### *Discussion of the Plant Taxa*

##### **Species Endemic to Oahu**

*Abutilon sandwicense* (No common name (NCN))

*Abutilon sandwicense*, a member of the mallow family (Malvaceae) and a short-lived perennial, is a shrub that grows to 3 m (5 ft) tall and is covered with short glandular hairs. This species is distinguished from others in the genus by the green or reddish-brown tipped petals that extend beyond the sepals (Bates 1999).

*Abutilon sandwicense* has been observed flowering in winter and spring. By summer, most plants have flowered, and the fruits have usually dried up by fall. Fruit capsules develop within six weeks. Although seedlings are often initially abundant, few plants appear to survive to maturity for unknown reasons (56 FR 55770). Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors.

Historically, *Abutilon sandwicense* was known from nearly the entire length of the Waianae Mountains, from Makaleha Valley to Nanakuli Valley. This species is now known from Huliwai Gulch, Kaawa Gulch, Kaimuhole Gulch, Palikea Gulch, Makaha Valley, Makaha-Waianae Kai Ridge, Makaleha Valley, Manuwai Gulch, Halona subdistrict, Mikilua subdistrict, Alaihehe Gulch, and Nanakuli Valley on Federal, State, private, city, and county lands. The 30 known occurrences contain an estimated 253 to 263 individuals (Bates 1999; Hawaii Heritage Program (HINHP) Database 2001).

*Abutilon sandwicense* typically grows on steep slopes or gulches in dry to mesic lowland forest between 149 and 875 m (489 and 2,870 ft) elevation. Associated native species include *Antidesma pulvinatum* (hame), *Diospyros sandwicensis* (lama), *Elaeocarpus bifidus* (kalia), *Eugenia reinwardtiana* (nioi), *Hibiscus arnotianus* (kokio keokeo), *Metrosideros polymorpha* (ohia), *Myrsine lanaiensis* (kolea), *Nestegis sandwicensis* (olopua), *Pipturus albidus* (mamaki), *Pisonia* sp. (papala kepau), *Pittosporum* sp. (hoawa), *Pleomele* sp. (hala pepe), *Psydrax odorata* (alahee), *Rauvolfia sandwicensis* (hao),

*Reynoldsia sandwicensis* (ohe), and *Sapindus oahuensis* (lonomea) (Bates 1999; HINHP Database 2001; Environmental Division of the U.S. Army (EDA), *in litt.* 2001).

The major threats to *Abutilon sandwicense* are competition from the nonnative plant species *Ageratina riparia* (hamakua pamakani), *Aleurites moluccana* (kukui), *Clidemia hirta* (Koster's curse), *Ficus microcarpa* (Chinese banyan), *Grevillea robusta* (silk oak), *Hyptis pectinata* (Comb hyptis), *Ipomoea* sp. (morning glory), *Kalanchoe pinnata* (air plant), *Leucaena leucocephala* (koa haole), *Melia azedarach* (chinaberry), *Melinis minutiflora* (molasses grass), *Montanoa hibiscifolia* (tree daisy), *Oplismenus hirtellus* (basketgrass), *Panicum maximum* (Guinea grass), *Passiflora suberosa* (huehue haole), *Pimenta dioica* (allspice), *Psidium cattleianum* (strawberry guava), *Psidium guajava* (guava), *Rivina humilis* (coral berry), *Schinus terebinthifolius* (Christmasberry), *Syzygium cumini* (Java plum), and/or *Toona ciliata* (Australian red cedar); fire; damage from the black twig borer (*Xylosandrus compactus*) and Chinese rose beetle (*Adoretus sinicus*); habitat degradation and/or destruction by feral pigs (*Sus scrofa*) and goats (*Capra hircus*); and trampling by feral cattle (*Bos taurus*) (Service 1998b; 56 FR 55770).

*Alsinidendron obovatum* (NCN)

*Alsinidendron obovatum*, a member of the pink family (Caryophyllaceae) and a short-lived perennial, is a branching subshrub growing to 3 ft (1 m) tall with thick, somewhat fleshy leaves. This species and *Alsinidendron trinerve* can be distinguished from other members of the genus by their shrubby habit and fleshy purple sepals surrounding the capsule. This species differs from *A. trinerve* in having a more crowded inflorescence (flowering part of plant) with shorter peduncles (flower stalks) and sepals with a rounded tip (Wagner *et al.* 1999).

*Alsinidendron obovatum* generally flowers after about two years of growth. Plants flower and fruit year round, but flowering is usually heavier in winter and spring depending on the level of precipitation. Plants survive three to six years, unless there are drought conditions. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (56 FR 55770).

Historically, *Alsinidendron obovatum* was known from the northern and southern ends of the Waianae Range. This species remains in Keawapilua

Gulch, Kahanakaiki Gulch, Makaleha, Kapuna Gulch, and Pahole Gulch on Federal and State lands. The 6 known occurrences contain about 8 to 10 individuals (EDA Database 2001; HINHP Database 2001; Wagner *et al.* 1999).

*Alsinidendron obovatum* typically grows on ridges and slopes in lowland diverse mesic forest dominated by *Acacia koa* (koa) and *Metrosideros polymorpha* between 476 and 943 m (1,561 and 3,093 ft) elevation. Associated native species include *Alyxia oliviformis* (maile), *Antidesma platyphyllum* (hame), *Bidens torta* (kookoolau), *Cibotium chamissoi* (hapuu), *Coprosma* sp. (pilo), *Hedyotis terminalis* (manono), *Ilex anomala* (kawau), *Machaerina* sp. (uki), *Peperomia* sp. (ala ala wai nui), *Perrottetia sandwicensis* (olomea), *Pipturus* sp. (mamaki), *Psydrax odorata*, or the endangered *Cyanea longiflora* (haha) (HINHP Database 2001; EDA, *in litt.* 2001).

The major threats to *Alsinidendron obovatum* are competition from the aggressive nonnative plant species *Blechnum appendiculatum* (NCN), *Clidemia hirta*, *Grevillea robusta*, *Melinis minutiflora*, *Paspalum conjugatum* (Hilo grass), *Psidium cattleianum*, *Rubus argutus* (prickly Florida blackberry), *Schinus terebinthifolius*, and/or *Stachytarpheta dichotoma* (owi); habitat degradation by feral pigs; trampling by humans; rockslides; and the small number of occurrences and individuals, which make the species highly vulnerable to extinction from random environmental events (Service 1998b; 56 FR 55770).

#### *Alsinidendron trinerve* (NCN)

*Alsinidendron trinerve*, a member of the pink family (Caryophyllaceae) and a short-lived perennial, is very similar in appearance to *A. obovatum* but differs in that it has a more open inflorescence with peduncles more than 2 cm (0.8 in) long and sepals with an acute tip (Wagner *et al.* 1999).

*Alsinidendron trinerve* flowers and fruits throughout the year with the possible exception of fall (56 FR 55770). Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors.

Historically, *Alsinidendron trinerve* was known from the north-central and southern Waianae Mountains. This species is known to be in Makaleha Gulch, on Mt. Kaala and Puu Kalena on Federal and State lands. The 13 known occurrences total between 18 and 34 individuals (EDA Database 2001; HINHP Database 2001).

*Alsinidendron trinerve* typically grows on slopes in wet forest or the wetter portions of diverse mesic forest dominated by *Metrosideros polymorpha* and *Ilex anomala* or *Metrosideros polymorpha* montane wet forest between 833 and 1,233 m (2,732 and 4,044 ft) elevation. Associated native species include *Broussaia arguta* (kanawao), *Coprosma ochracea* (pilo), *Diplazium sandwichianum* (hoio), *Gunnera* sp. (apeape), *Hedyotis* sp. (NCN), *Machaerina* sp., *Nothoperanema rubiginosa*, *Peperomia* sp., *Perrottetia sandwicensis*, *Phyllostegia* sp. (NCN), *Pipturus albidus*, or *Vaccinium* sp. (ohelo) (HINHP Database 2001; Wagner *et al.* 1999; EDA, *in litt.* 2001).

The major threats to *Alsinidendron trinerve* are competition from the aggressive nonnative plant species *Buddleia asiatica* (butterfly bush), *Clidemia hirta*, *Kalanchoe pinnata*, and *Rubus argutus*; habitat degradation by feral pigs; trampling by humans along trails; and the small number of extant individuals, which makes the species highly vulnerable to extinction from random environmental events (Service 1998b; 56 FR 55770).

#### *Chamaesyce celastroides* var. *kaenana* (Akoko)

*Chamaesyce celastroides* var. *kaenana*, a member of the spurge family (Euphorbiaceae) and a short-lived perennial, is a low-growing or upright shrub to 5 ft (1.5 m) tall with milky sap. Its leaves fall off during the dry season, are mostly hairless, and are arranged in two opposite rows along the stem. This species is distinguished from other members of the genus in the area in which it grows in that it is a woody shrub rather than an herb or small subshrub (Koutnik and Huft 1999).

*Chamaesyce celastroides* var. *kaenana* has been observed flowering and fruiting throughout the year, probably in response to precipitation. Fruits mature in three to four weeks and plants live from five to 10 years. No additional information is available on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, or limiting factors (56 FR 55770).

Historically, *Chamaesyce celastroides* var. *kaenana* was known from the northwestern end of the Waianae Mountains as well as from one collection from the southeastern end of the Koolau Mountains. This taxon remains at Kaena Point, Keawaula, Alau Gulch, Waianae Kai, and Kahanahaiki on State land and land under Federal jurisdiction. The 15 known occurrences contain 569 individuals (HINHP Database 2001; Koutnik and Huft 1999).

*Chamaesyce celastroides* var. *kaenana* typically grows in coastal dry shrubland on windward talus slopes, leeward rocky cliffs, open grassy slopes, or on vegetated cliff faces between sea level and 862 m (0 and 2,827 ft) elevation. Associated native species include *Artemisia australis* (ahinahina), *Boerhavia* sp. (alena), *Chamaesyce celastroides* var. *amplectans* (akoko), *Dodonaea viscosa* (aalii), *Gossypium tomentosum* (mao), *Heteropogon contortus* (pili grass), *Jacquemontia ovalifolia* ssp. *sandwicensis* (pauhiiika), *Lipochaeta lobata* (nehe), *Myoporum sandwicense* (naio), *Plumbago zeylanica* (iliee), *Psilotum nudum* (moa), *Psydrax odorata*, *Santalum* sp. (iliahii), *Sida fallax* (ilima), or *Waltheria indica* (uhaloa) (HINHP Database 2001; EDA, *in litt.* 2001).

The major threats to *Chamaesyce celastroides* var. *kaenana* are competition from the nonnative plant species *Acacia confusa* (Formosan koa), *Grevillea robusta*, *Hyptis pectinata*, *Leucaena leucocephala*, *Melinis repens* (natal redtop), *Panicum maximum*, *Pluchea carolinensis* (sourbush), and/or *Schinus terebinthifolius*; fire; and effects of recreational activities (Service 1998b; 56 FR 5577).

#### *Chamaesyce deppeana* (Akoko)

*Chamaesyce deppeana*, a member of the spurge family (Euphorbiaceae) and a short-lived perennial, is an erect subshrub up to 1.2 m (4 ft) tall with fuzzy branches. This species is distinguished from others in the genus by the following combination of characters: Leaves arranged in two rows on opposite sides of the branches, leaves glabrous, leaf apex notched, leaf margin toothed, and cyathia (flower cluster) width (Koutnik and Huft 1999).

*Chamaesyce deppeana* has been observed in flower in May and September. No further information is available on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Chamaesyce deppeana* was known only from southern Oahu. Because the few collections that were made were collected prior to the 20th century, it was thought to be extinct. In 1986, Joel Lau and Sam Gon of The Nature Conservancy of Hawaii (TNCH) rediscovered *C. deppeana* on State land in the southern Koolau Mountains of Oahu in Nuuanu Pali Wayside State Park near the Pali Lookout, a popular tourist attraction. About 50 individuals grow near there (HINHP Database 2001; Koutnik and Huft 1999).

The habitat of the only known occurrence of *Chamaesyce deppeana* is windward-facing ridge crests, cliff faces, and mixed native cliffs with such plant species as *Bidens sandwicensis* (kookoolau) or *Metrosideros polymorpha* between 274 and 661 m (899 and 2,168 ft) elevation (HINHP Database 2001).

The major threats to the single known occurrence of *Chamaesyce deppeana* are competition for water, space, light, and nutrients with the nonnative plant species *Casuarina equisetifolia* (common ironwood), *Paspalum conjugatum*, and *Schinus terebinthifolius*; and extinction due to naturally caused events because of the limited number of individuals and restricted range. Fire and impact by humans threaten the species as well (HINHP Database 2001; Service 1998b; 59 FR 14482).

#### *Chamaesyce herbstii* (Akoko)

*Chamaesyce herbstii*, a member of the spurge family (Euphorbiaceae) and a short-lived perennial, is a small tree ranging from 3 to 8 m (10 to 26 ft) tall with thin, leathery leaves arranged in pairs on the same plane. This species is distinguished from others in the genus by the length of the flowering stalk and the color of the angular fruits (Koutnik and Huft 1999).

*Chamaesyce herbstii* has been observed in flower year-round in January, May, July, September, and October. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Chamaesyce herbstii* was known from scattered occurrences in the northern and central Waianae Mountains on the island of Oahu. Currently, this species is known from 4 occurrences with between 162 and 164 individuals in the central and northern Waianae Mountains, South Ekahanui Gulch, Pahole (Kukuiula) Gulch, Kapuna Gulch, and West Makaleha-Central Makaleha. These occurrences are found on private and State lands (Geographic Decision Systems International (GDSI) 2001; HINHP Database 2001).

*Chamaesyce herbstii* typically grows in shaded gulch bottoms and slopes in mesic *Acacia koa*-*Metrosideros polymorpha* lowland forests or diverse mesic forests at elevations between 435 and 886 m (1,427 and 2,906 ft). Associated plant species include *Antidesma platyphyllum*, *Coprosma* sp., *Diplazium sandwichianum*, *Hedyotis* sp., *Hibiscus arnottianus* var. *arnottianus* (kokio keokeo), *Melicope* sp.

(alani), *Morinda trimera* (noni), *Pipturus albidus*, *Pouteria sandwicensis* (alaa), *Pteralyxia* sp. (kaulu), *Urera glabra* (opuhe), or *Xylosma* sp. (maua) (HINHP Database 2001; EDA, *in litt.* 2001).

The primary threats to *Chamaesyce herbstii* are habitat degradation and/or destruction by feral pigs; competition with nonnative plant species such as *Clidemia hirta*, *Grevillea robusta*, *Passiflora suberosa*, *Psidium cattleianum*, and *Schinus terebinthifolius*; potential fire; a risk of extinction from naturally occurring events (such as hurricanes) and/or reduced reproductive vigor due to the small number of remaining occurrences (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Chamaesyce kuwaleana* (Akoko)

*Chamaesyce kuwaleana*, a member of the spurge family (Euphorbiaceae) and a short-lived perennial, is an erect shrub 20 to 90 cm (8 to 36 in) tall with leaves arranged in two rows along the stem. This species is distinguished from other species of the genus in its habitat by its stalked, oval to rounded leaves with untoothed margins and by the bent stalk supporting the small fruit capsule (Koutnik and Huft 1999).

*Chamaesyce kuwaleana* bears fruit in spring and early summer and has usually finished fruiting by fall. No further information is available on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (56 FR 55770).

Historically, *Chamaesyce kuwaleana* was known from the central Waianae Mountains and Moku Manu Island off the eastern coast of Oahu. This species is currently known only from Kauaopuu Peak, Mauna Kuwale, Waianae Kai-Lualualei Ridge, Puu Kailio, and Kauaopuu in the Waianae Mountains, on Federal and State lands. The 5 occurrences contain around 2,000 individuals (GDSI 2001; HINHP Database 2001; Koutnik and Huft 1999).

*Chamaesyce kuwaleana* typically grows in thin guano soil on basaltic rock, on arid, exposed volcanic cliffs, on dry or mesic rocky ridges, or on sparsely vegetated slopes between sea level and 596 m (0 to 1,955 ft) elevation. Associated native species include *Artemisia* sp. (hinahina), *Bidens* sp. (kookoolau), *Carex* sp. (NCN), *Chamaesyce* sp. (akoko), *Dodonaea viscosa*, *Heteropogon contortus*, *Plectranthus parviflorus* (ala ala wai nui), *Schiedea* sp. (NCN), or *Sida fallax* (HINHP Database 2001; Koutnik and Huft 1999; Service 1998b).

The major threats to *Chamaesyce kuwaleana* are competition from the

nonnative plant species *Genchrus ciliaris* (buffelgrass), *Kalanchoe pinnata*, *Leucaena leucocephala*, *Melinis repens*, *Opuntia* sp. (prickly pear), and *Schinus terebinthifolius*; fire; two-spotted leafhoppers (*Saphonia rufofascia*); and the small number of occurrences, which makes the species highly vulnerable to extinction from random environmental events (HINHP Database 2001; Service 1998b; 56 FR 55770).

#### *Chamaesyce rockii* (Akoko)

*Chamaesyce rockii*, a member of the spurge family (Euphorbiaceae) and a short-lived perennial, 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. This species differs from others in the genus in that it has large, red, capsular fruit (Koutnik and Huft 1999).

*Chamaesyce rockii* has been observed fruiting in February. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Chamaesyce rockii* was known historically from scattered occurrences along the Koolau Mountains on the island of Oahu. Today, 20 occurrences are located in Waikakalaua Gulch, Kaukonahua-Kahana summit area, Punaluu-Kaluanui, Peahinaia Trail Laie-Kaipapau-Kawai Nui junction area, Puu Keahiakahoe, Halawa Trail, summit ridge between Aiea Ridge Trail and Waimano Trail, Ewa Forest Reserve, Halemano Gulch, Kawaiiki-Opaewa Ridge, Puu Kainapuaa, Kawai Iki Stream, Maakua Gulch, and Kaipapau-Loloa Ridge, on State, Federal, and private lands. Currently the total number of plants is estimated to be between 641 and 773 (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Chamaesyce rockii* typically grows on gulch slopes, gulch bottoms, and ridge crests in wet *Metrosideros polymorpha*-*Dicranopteris linearis* (uluhe) forest and shrubland between 208 and 871 m (682 and 2,857 ft) in elevation. Associated plant species include *Bidens* sp., *Antidesma platyphyllum*, *Broussaisia arguta*, *Cibotium* sp. (hapuu), *Coprosma longifolia* (pilo), *Diplopterygium pinnatum* (uluhe lau nui), *Dubautia laxa* (naenae pua melemele), *Hedyotis terminalis*, *Machaerina* sp., *Melicope* spp., *Myrsine juddii* (kolea), *Psychotria* spp. (kopiko), and *Wikstroemia* sp. (akia) (HINHP Database 2001).

The primary threats to *Chamaesyce rockii* are habitat degradation and/or destruction by feral pigs; trail clearing;

potential impacts from military activities; and competition with nonnative plant species such as *Clidemia hirta*, *Leptospermum scoparium* (tea tree), *Paspalum conjugatum*, *Psidium cattleianum*, and *Pterolepis glomerata* (NCN) (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyanea acuminata* (Haha)

*Cyanea acuminata*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is an unbranched shrub 0.3 to 2 m (1 to 6.6 ft) tall with inversely lance-shaped to narrowly egg-shaped or elliptic leaves. This species is distinguished from others in this endemic Hawaiian genus by the color of the petals and fruit and the length of the calyx (the outer of two series of floral leaves) lobes, flowering stalk, and leaf stalks (Lammers 1999).

*Cyanea acuminata* has been observed fruiting in February and November. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Cyanea acuminata* was known from 31 scattered occurrences in the Koolau Mountains of Oahu. Currently, fewer than 200 plants are known from 20 occurrences on private, city, county, State, and Federal lands on Puu o Kona, near South Kaukonahua Stream, in Halemano Gulch, Kawai Iki Gulch, near Poamoho Stream, on Schofield-Waikane Trail, Helemano-Punaluu summit ridge, Konahuanui, in Kamana Nui Valley, Pukele, in Makaua Gulch, on Niu-Waimanalo summit ridge, Waahila Ridge, Kaipapau, Puu Keahia Kahoe, Kaala, Kaluanui, Pia Gulch, Makaleha, and Maakua Gulch (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Cyanea acuminata* typically grows on slopes, ridges, or stream banks between 216 and 1,208 m (708 and 3,962 ft) elevation. The plants are found in *Metrosideros polymorpha*-*Dicranopteris linearis*, *Acacia koa*-*M. polymorpha* wet or mesic forest or shrubland, or *Diospyros sandwicensis*-*M. polymorpha* lowland mesic forest with one or more of the following associated native species: *Antidesma* sp. (hame), *Broussaisia argutas*, *Chamaesyce* sp., *Charpentiera* sp. (papala), *Cyrtandra* spp. (hai wale), *Diplazium sandwichianum*, *Dryopteris sandwicensis* (palapalaia), *Dubautia laxa*, *Freycinetia arborea* (ieie), *Hibiscus* sp. (aloalo), *Hedyotis* sp., *Ilex anomala*, *Labordia* sp. (kamakahala), *Machaerina* sp., *Melicope* spp., *Perrottetia sandwicensis*, *Phyllostegia* sp., *Pipturus*

*albidus*, *Pisonia* sp., *Psychotria* sp., *Sadleria* sp. (amau), *Syzygium sandwicensis*, *Touchardia latifolia* (olona), or *Wikstroemia* sp. (ohia ha) (HINHP Database 2001; Lammers 1999).

The major threats to *Cyanea acuminata* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; potential predation by rats (*Rattus rattus*); competition with the nonnative plant species *Ageratina adenophora* (Maui pamakani), *Aleurites moluccana*, *Clidemia hirta*, *Cordyline fruticosa* (ti), *Dioscorea* sp. (yam), *Erigeron karvinskianus* (daisy fleabane), *Musa* sp. (banana), *Passiflora suberosa*, *Rubus argutus*, and *Schinus terebinthifolius*; a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyanea crispa* (NCN)

*Cyanea crispa*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is an unbranched shrub with leaves clustered at the ends of succulent stems. It is distinguished from other species in this endemic Hawaiian genus by its leaf shape, distinct calyx lobes, and the length of the flowers and stalks of flower clusters (Lammers 1999).

*Cyanea crispa* was observed in flower in April 1930. It was more recently observed fruiting in June and September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b; 59 FR 14482).

Historically, *Cyanea crispa* was known from scattered locations throughout the upper elevations of the Koolau Mountains of Oahu from Kaipapau Valley to Waiialae Iki Ridge. This species is now known from Federal, State, city, county, and private lands in Hidden Valley, Palolo Valley, Kapakahi Gulch, Moanalua Valley, Wailupe, Koolau Summit Trail, Kawaipapa Gulch, Maakua Gulch, Kaipapa Gulch, Maunawili, and Pia Valley. There are a total of 11 occurrences containing a total of 56 individual plants (EDA Database 2001; HINHP Database 2001).

*Cyanea crispa* is found in habitats ranging from steep, open mesic forests to gentle slopes or moist gullies of closed wet forests and stream banks, at elevations between 56 and 959 m (184 and 3,146 ft). Associated native plant species include *Antidesma platyphylla*, *Boehmeria grandis* (akolea), *Broussaisia*

*argutus*, *Christella cyatheoides* (kikawaio), *Cibotium chamissoi*, *Cyrtandra* spp., *Diospyros* sp. (lama), *Dubautia* sp. (naena), *Metrosideros polymorpha*, *Perrottetia sandwicensis*, *Pipturus albidus*, *Pisonia umbellifera* (papala kepau), *Psychotria* sp., or *Touchardia latifolia* (HINHP Database 2001; Service 1998b).

The major threats to *Cyanea crispa* are habitat alteration and predation by feral pigs; competition with the nonnative plant species *Arthrostemma ciliatum* (NCN), *Clidemia hirta*, *Psidium cattleianum*, *Psidium guajava*, *Pterolepis glomerata*, *Rubus rosifolius* (thimbleberry), *Schinus terebinthifolius*, *Setaria palmifolia* (palm grass), and *Zingiber zerumbet* (awapuhi); and extinction due to naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals, their limited gene pool, and restricted distribution (Service 1998b; 59 FR 14482).

#### *Cyanea grimesiana* ssp. *obatae* (Haha)

*Cyanea grimesiana* ssp. *obatae*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is a shrub, usually unbranched, growing from 1 to 3.2 m (3.3 to 10.5 ft) tall with wide, deeply lobed leaves. This subspecies can be distinguished from the other two by its short, narrow calyx lobes that are not fused or overlapping (Lammers 1999).

*Cyanea grimesiana* ssp. *obatae* flowers and fruits year round, depending on rainfall. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (59 FR 32932).

Historically, *Cyanea grimesiana* ssp. *obatae* was known from the southern Waianae Mountains from Puu Hapapa to Kaaikukai. This taxon is known to be extant in Kaluaa Gulch, Ekahanui Gulch, North Palawai Gulch, and Pahole Gulch. The occurrences are on State and private lands. A total of 8 occurrences are known that contain 16 individuals (GDSI 2000; HINHP Database 2001; Lammers 1999).

*Cyanea grimesiana* ssp. *obatae* typically grows on steep, moist, shaded slopes in diverse mesic to wet lowland forests between 404 and 1,075 m (1,325 and 3,528 ft) elevation. Associated native species include *Acacia koa*, *Antidesma platyphyllum*, *Chamaesyce* sp., *Charpentiera obovata* (papala), *Cibotium chamissoi*, *Claoxylon sandwicense* (poola), *Coprosma* sp., *Cyanea membranacea* (haha), *Cyrtandra waianaensis* (hahala), *Diplazium sandwichianum*, *Dryopteris unidentata*

(akole), *Dubautia* sp., *Freycinetia arborea*, *Hedyotis acuminata* (au), *Hedyotis terminalis*, *Metrosideros polymorpha*, *Myrsine lessertiana* (kolea lau nui), *Nothocestrum* sp. (aiea), *Perrottetia sandwicensis*, *Pipturus albidus*, *Pisonia umbellifera*, *Pouteria sandwicensis*, *Psychotria hathewayi* (kopiko), *Rumex* sp. (sorrel), *Selaginella arbuscula* (lepelepe a moa), and *Streblus pendulinus* (aiiai) (HINHP Database 2001; Lammers 1999; EDA, *in litt.* 2001).

The major threats to *Cyanea grimesiana* ssp. *obatae* are habitat degradation by feral pigs; competition from nonnative plant species such as *Ageratina riparia*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Buddleia asiatica*, *Clidemia hirta*, *Christella parasitica* (NCN), *Lantana camara* (lantana), *Morella faya* (firetree), *Paspalum conjugatum*, *Passiflora suberosa*, *Psidium cattleianum*, *Rubus rosifolius*, *Schinus terebinthifolius*, *Setaria palmifolia*, and *Toona ciliata*; predation of seeds or fruits by introduced slugs; and extinction caused by naturally occurring events and/or reduced reproductive vigor due to the small number of extant individuals (HINHP Database 2001; Service 1998b; 59 FR 32932).

#### *Cyanea humboldtiana* (Haha)

*Cyanea humboldtiana*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is an unbranched shrub 1 to 2 m (3.2 to 6.6 ft) tall with woody stems and inversely egg-shaped to broadly elliptic leaves. The leaf edges are hardened and have shallow, ascending, rounded teeth. This species differs from others in this endemic Hawaiian genus by the downward bending flowering stalk and the length of the flowering stalk (Lammers 1999).

*Cyanea humboldtiana* has been observed in flower from September through January. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Cyanea humboldtiana* was known historically from 17 occurrences from the central portion to the southern end of the Koolau Mountains of Oahu. Currently, between 133 and 239 plants are known from 9 occurrences at Konahuanui summit, Moanalua-Kaneohe summit, Wailupe summit, Poamoho Trail, Opaeha Gulch, Maakua Gulch, Kaluanui, and Lulumahu Gulch. These occurrences are on Federal, private, State, city, and county lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Cyanea humboldtiana* is usually found in wet *Metrosideros polymorpha*-*Dicranopteris linearis* lowland shrubland between 261 and 959 m (856 and 3,146 ft) elevation. Associated native plant species include *Acacia koa*, *Bobea elatior* (ahakea), *Broussaisia arguta*, *Cibotium chamissoi*, *Dubautia laxa*, *Hedyotis terminalis*, *Ilex anomala*, *Machaerina angustifolia* (uki), *Melicope* sp., *Phyllostegia* sp., *Psychotria mariniana* (kopiko), *Sadleria* sp., *Scaevola mollis* (naupaka kuahiwi), *Syzygium sandwicensis*, *Wikstroemia* sp., and ferns (HINHP Database 2001).

The major threats to *Cyanea humboldtiana* are habitat degradation and/or destruction by feral pigs; potential predation by rats; competition with the nonnative plant species *Axonopus fissifolius* (narrow-leaved carpet grass), *Clidemia hirta*, *Erigeron karvinskianus*, *Psidium cattleianum*, and *Pterolepis glomerata*, and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining occurrences. The Konahuanui summit occurrence is also threatened by trampling by hikers (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyanea koolauensis* (Haha)

*Cyanea koolauensis*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is an unbranched shrub 1 to 1.5 m (3.5 to 5 ft) tall with woody stems and linear to narrowly elliptic leaves with a whitish underside. The leaf edges are hardened with shallow, ascending, rounded teeth. *Cyanea koolauensis* is distinguished from other species 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 (base of flower) (Lammers 1999).

*Cyanea koolauensis* has been observed in flower and fruit during the months of May through August. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Cyanea koolauensis* was known historically from 27 scattered occurrences throughout the Koolau Mountains on Oahu. Currently, 42 occurrences totaling fewer than 80 plants are known from the Waimea-Malaekahana Ridge to Hawaii Loa Ridge in the Koolau Mountains. These occurrences are on private, city, county, State, and Federal lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Cyanea koolauensis* is usually found on slopes, stream banks, and ridge crests in wet *Metrosideros polymorpha*-*Dicranopteris linearis* forest or shrubland at elevations between 163 and 959 m (535 and 3,146 ft). Associated native plant species include *Acacia koa*, *Antidesma platyphyllum*, *Bidens* sp., *Bobea elatior*, *Broussaisia arguta*, *Cibotium* sp., *Diplopterygium pinnatum*, *Dubautia* sp., *Hedyotis* sp., *Machaerina* sp., *Melicope* sp., *Pittosporum* sp., *Pritchardia martii* (loulu hiwa), *Psychotria mariniana*, *Sadleria* sp., *Scaevola* sp. (naupaka), *Syzygium sandwicensis*, or *Wikstroemia* sp. (HINHP Database 2001; Lammers 1999).

The major threats to *Cyanea koolauensis* are habitat destruction by feral pigs; potential impacts from military activities; trail clearing; potential predation by rats; competition with the aggressive nonnative plant species *Clidemia hirta*, *Heliocarpus popayanensis* (moho), *Psidium cattleianum*, and *Pterolepis glomerata*; trampling by hikers; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyanea longiflora* (Haha)

*Cyanea longiflora*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is an unbranched shrub 1 to 3 m (3.5 to 10 ft) long with woody stems and elliptic or inversely lance-shaped leaves. Mature leaves have smooth or hardened leaf edges with shallow, ascending, rounded teeth. *Cyanea longiflora* differs from others in this endemic Hawaiian genus by the fused calyx lobes (Lammers 1999).

*Cyanea longiflora* has been observed in flower in February, April, and May and in fruit in August. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Cyanea longiflora* was known historically from five occurrences in the Waianae Mountains and six occurrences in the Koolau Mountains of Oahu. Currently, 4 occurrences with less than 217 individuals of this species are known on State, Federal, city, county, and private lands on Makaha-Waianae Kai Ridge, Makaha Valley, Kapuna Gulch, and Pahole Gulch in the Waianae Mountains (GDSI 2001; HINHP Database 2001; Service 1998b).

*Cyanea longiflora* is usually found on steep slopes, bases of cliffs, or ridge



crests in mesic *Acacia koa*-*Metrosideros polymorpha* lowland forest usually between 221 and 1,191 m (725 and 3,906 ft) elevation. Associated native plant species include *Antidesma* sp., *Cibotium* sp., *Coprosma* sp., *Dicranopteris linearis*, *Psychotria* sp., *Schiedea* sp., or *Syzygium sandwicensis* (HINHP Database 2001; Lammers 1999).

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 nonnative plant species *Psidium cattleianum* and *Rubus arguta*; 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 occurrences (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyanea pinnatifida* (Haha)

*Cyanea pinnatifida*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is a shrub, usually unbranched, growing from 0.8 to 3.0 m (2.6 to 10 ft) tall, with deeply lobed leaves. This species differs from other members of the genus on Oahu by its leaves, which are deeply cut into two to six lobes per side. The only other member of the genus on Oahu with lobed leaves has 9 to 12 lobes per side (Lammers 1999).

*Cyanea pinnatifida* has been observed flowering in August. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Cyanea pinnatifida* was known from the central Waianae Mountains. The last known wild individual died in August 2001 (HINHP Database 2001; Lammers 1999; Trae Menard, TNCH, pers. comm., 2001). Currently, this species is known only from individuals under propagation at the University of Hawaii's Lyon Arboretum and the National Tropical Botanical Garden (G. Koob, pers. comm., 2002).

*Cyanea pinnatifida* typically grows on steep, wet, rocky slopes in diverse mesic forest between 450 and 881 m (1,476 and 2,890 ft) elevation. Associated native plant species include *Canavalia* sp. (awikiwiki), *Diplazium sandwichianum*, *Pipturus albidus*, *Pisonia sandwicensis* (aulu), *Pisonia umbellifera*, *Psychotria* sp., *Strongylodon ruber* (nunuiwi), and native ferns (HINHP Database 2001; Lammers 1999).

The major threats to *Cyanea pinnatifida* are competition from the

nonnative plant species *Aleurites moluccana*, *Blechnum appendiculatum*, *Clidemia hirta*, *Passiflora suberosa*, *Psidium cattleianum*, *Psidium guajava*, and *Toona ciliata*; habitat degradation by feral pigs; predation by slugs; and trampling by humans on or near trails (Service 1998b; 56 FR 55770).

#### *Cyanea st-johnii* (Haha)

*Cyanea st-johnii*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is an unbranched shrub with a woody stem 30 to 60 cm (12 to 24 in) long and lance-shaped to inversely lance-shaped leaves. The leaf edges are thickened, are smoothly toothed, and curl under. 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 1999).

*Cyanea st-johnii* has been observed in flower in July through September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Cyanea st-johnii* was known historically from 11 occurrences in the central and southern Koolau Mountains of Oahu. Currently, 57 plants are known from 7 occurrences at 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 occurrences are found on city, county, private, and State lands, as well as lands under Federal jurisdiction (GDSI Database 2000; HINHP Database 2001).

*Cyanea st-johnii* typically grows on wet, windswept slopes and ridges between 415 and 959 m (1,361 and 3,146 ft) elevation in *Metrosideros polymorpha* mixed lowland shrubland or *Metrosideros polymorpha*-*Dicranopteris linearis* lowland shrubland. Associated native plant species include *Alyxia oliviformis*, *Antidesma* sp., *Bidens macrocarpa* (kookoolau), *Broussaisia arguta*, *Chamaesyce clusiifolia* (akoko), *Cibotium* sp., *Dubautia laxa*, *Freycinetia arborea*, *Hedyotis* sp., *Labordia* sp., *Machaerina angustifolia*, *Melicope* sp., *Psychotria* sp., *Sadleria pallida* (amau), *Scaevola mollis*, or *Syzygium sandwicensis* (HINHP Database 2001).

The major threats to *Cyanea st-johnii* are habitat degradation and/or destruction by feral pigs; potential predation by rats; predation by slugs and snails; competition with the nonnative plant species *Andropogon*

*virginicus* (broomsedge), *Axonopus fissifolius*, *Clidemia hirta*, and *Sacciolepis indica* (Glenwood grass); and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining occurrences and individuals. The plants between the summit of Aiea and Halawa Trail are also threatened by trampling by hikers (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyanea superba* (NCN)

*Cyanea superba*, of member the bellflower family (Campanulaceae) and a short-lived perennial, is morphologically very different from its closest relatives. It grows to 6 m (20 ft) tall and has a terminal rosette of large leaves; each rosette is 50 to 100 cm long (20 to 40 in) and 10 to 20 cm (4 to 8 in) wide atop a single, unbranched trunk (Lammers 1999).

The flowering season of *Cyanea superba* varies from year to year depending on precipitation. It ranges from late August to early October. Generally, flowering is at its peak in early to mid-September. Fruits have been known to mature in two to five months, depending on climatic conditions (Service 1998b). Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors.

Historically, *Cyanea superba* was collected from the gulches of Makaleha on Mt. Kaala in the Waianae Mountains of Oahu. Currently, there are no natural occurrences and an outplanted population of 140 individuals on State and Federal lands in the Waianae Mountains (EDA Database 2001; GDSI 2001; HINHP Database 2001; Service 1998b; K. Kawela, pers. comm., 2003; M. Keir, pers. comm., 2001).

*Cyanea superba* grows in the understory on sloping terrain on well drained rocky substrate within mesic forest between 232 and 872 m (761 and 2,860 ft) in elevation with one or more of the following associated native species: *Diospyros* sp., *Hedyotis terminalis*, *Metrosideros polymorpha*, *Nestegis sandwicensis*, *Pisonia brunoniana* (papala kepa), *Psychotria* sp., and *Xylosma* sp. (HINHP Database 2001).

The major threats to *Cyanea superba* are degradation of its habitat due to competition with the nonnative plant species *Aleurites moluccana*, *Melinis minutiflora*, *Psidium cattleianum*, and *Schinus terebinthifolius*; wildfires generated in the nearby military firing range; habitat degradation by feral pigs;



a restricted range that makes it vulnerable to any local environmental disturbance or single incident that could destroy a significant percentage of the known individuals; and the limited gene pool that may depress reproductive vigor (HINHP Database 2001; Service 1998b; 56 FR 46235).

#### *Cyanea truncata* (Haha)

*Cyanea truncata*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is an unbranched or sparsely branched shrub covered with small sharp prickles. Its oval leaves are wider above the middle and lined with hardened teeth along the margins. *Cyanea truncata* is distinguished from other members of this genus by the length of the flower cluster stalk and the size of the flowers and flower lobes (Lammers 1999).

*Cyanea truncata* was observed in flower in December 1919 and November 1980, the last time the species was observed at that population before feral pigs extirpated it. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b; 59 FR 14482).

Historically, *Cyanea truncata* was known from Punaluu, Waikane, and Waiahole in the northern Koolau Mountains of Oahu. Two occurrences are currently known to exist in Hanaimoa Gulch on State and private lands (GDSI 2001; HINHP Database 2001).

*Cyanea truncata* typically grows on windward slopes and stream banks in mesic to wet forests at elevations between 54 and 705 m (177 and 2,312 ft). Associated native plant species include *Cibotium chamissoi*, *Cyrtandra calpidicarpa* (haiwale), *Cyrtandra laxiflora* (haiwale), *Cyrtandra propinqua* (haiwale), *Diospyros sandwicensis*, *Hibiscus arnottianus*, *Metrosideros polymorpha*, *Neraudia melastomifolia* (maaloa), *Pipturus albidus*, or *Pisonia umbellifera* (HINHP Database 2001; Lammers 1999; Service 1998b).

The major threats to *Cyanea truncata* are habitat degradation and predation by feral pigs; competition with the invasive nonnative plant species *Christella parasitica*, *Clidemia hirta*, *Cordyline fruticosa*, *Oplismenus hirtellus*, and *Psidium cattleianum*; predation by rats and slugs; and extinction due to naturally caused events and/or reduced reproductive vigor due to the small number of remaining individuals (Service 1998b; 59 FR 14482).

#### *Cyrtandra crenata* (Haiwale)

*Cyrtandra crenata*, a member of the African violet family (Gesneriaceae) and a short-lived perennial, is a shrub 1 to 2 m (3 to 7 ft) tall with few branches and leaves arranged in whorls of three, which are tufted at the end of branches. *Cyrtandra crenata* is distinguished from other species in the genus by the combination of its three-leaf arrangement, bilaterally symmetrical calyx, and brownish, hemispherical glands (Wagner *et al.* 1999).

*Cyrtandra crenata* has been observed in flower in June. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b; 59 FR 14482).

Historically, *Cyrtandra crenata* was known from Waikane Valley along the Waikane-Schofield Trail in the Koolau Mountains and was last observed in 1947 (HINHP Database 2001).

*Cyrtandra crenata* typically grows on steep slopes, in ravines, or gulches in mesic to wet forests between elevations of 328 and 779 m (1,076 and 2,555 ft) with associated native plant species such as *Dicranopteris linearis*, *Machaerina angustifolia*, and *Metrosideros polymorpha* (HINHP Database 2001; Service 1998b; Wagner *et al.* 1999).

The primary threat to *Cyrtandra crenata* is extinction due to naturally caused events and/or reduced reproductive vigor due to the species' restricted range. No individuals are known to be extant at this time (Service 1998b; 59 FR 14482).

#### *Cyrtandra dentata* (Haiwale)

*Cyrtandra dentata*, a member of the African violet family (Gesneriaceae) and a short-lived perennial, is a sparingly branched shrub ranging from 1.5 to 5 m (5 to 16 ft) tall with papery textured leaves. 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.* 1999).

*Cyrtandra dentata* has been observed in flower and fruit in May and November. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Cyrtandra dentata* was historically known from six occurrences in the Waianae Mountains and three occurrences in the Koolau Mountains of Oahu. Currently, this species is found only in Pahole Gulch, Kapuna Valley,

Ekahanui Gulch, Keawapilau Gulch, Kahanahaiki, Kawai Iki Gulch, Opauea Stream, and Makaleha Valley on Federal, State, city, and county lands (within TNCH's Honouliuli Preserve). The 11 known occurrences total 136 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Cyrtandra dentata* typically grows in gulches, slopes, stream banks, or ravines in mesic or wet forest with associated native plant species such as *Acacia koa*, *Metrosideros polymorpha*, *Pipturus albidus*, *Pisonia sandwicensis*, *Pisonia umbellifera*, *Pouteria sandwicensis*, *Syzygium sandwicensis*, or *Urera glabra*, at elevations between 255 and 953 m (836 and 3,126 ft) (HINHP Database 2001; Wagner *et al.* 1999; EDA, *in litt.* 2001).

The major threats to *Cyrtandra dentata* are competition with the nonnative plant species *Aleurites moluccana*, *Belchnum appendiculatum*, *Christella parasitica*, *Clidemia hirta*, *Psidium cattleianum*, *Psidium guajava*, and *Schinus terebinthifolius*; 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 occurrences and individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyrtandra polyantha* (Haiwale)

*Cyrtandra polyantha*, a member of the African violet family (Gesneriaceae) and a short-lived perennial, is an unbranched or few-branched shrub 1 to 3 m (3 to 10 ft) in height with leathery, elliptic, unequal leaves. *Cyrtandra polyantha* is distinguished from other species in the genus by the texture and hairiness of the leaf surfaces and the length, shape, and degree of cleft of the calyx. This species differs from *C. crenata* by the lack of short-stalked glands and by its leathery leaves, opposite leaf arrangement, and radially symmetrical calyx (Wagner *et al.* 1999).

Nothing is known about the flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors for *Cyrtandra polyantha* (Service 1998b).

Historically, *Cyrtandra polyantha* was known from the Kalihi region and from Kulepeamo Ridge above Niu Valley on the leeward (southwest) side of the southern Koolau Mountains. Currently, one occurrence with three individuals is extant on the summit ridge between Kuliouou and Waimanalo on State and private lands (HINHP Database 2001).

*Cyrtandra polyantha* grows on ridges in *Metrosideros polymorpha* mesic or

wet forests at elevations between 331 and 762 m (1,086 and 2,499 ft). *Cyrtandra polyantha* probably grows in association with *Broussaisia arguta*, *Coprosma foliosa* (pilo), *Dicranopteris linearis*, *Machaerina angustifolia*, and *Psychotria* sp. (HINHP Database 2001; Service 1998b).

The primary threats to *Cyrtandra polyantha* are habitat degradation by feral pigs; competition with the invasive plant species *Ageratina adenophora*, *Clidemia hirta*, *Erigeron karvinskianus*, and *Melinis minutiflora*; extinction due to naturally caused events and/or reduced reproductive vigor due to the small number of remaining individuals and their restricted distribution (HINHP Database 2001; Service 1998b; 59 FR 14482).

#### *Cyrtandra subumbellata* (Haiwale)

*Cyrtandra subumbellata*, a member of the African violet family (Gesneriaceae) and a short-lived perennial, is a shrub 2 to 3 m (6.6 to 10 ft) tall. Papery in texture, the leaves are almost circular to egg-shaped. It is distinguished from other species in the genus by its leaf shape and texture, the number of flowers per cluster, and the length of bracts, flower stem, calyx lobes, floral tube, and styles (Wagner *et al.* 1999).

*Cyrtandra subumbellata* has been observed in fruit in September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Cyrtandra subumbellata* was known from the Koolau Mountains of Oahu. Currently, there are 5 occurrences containing 12 individuals in the central Koolau Mountains at Schofield-Waikane Trail, Puu Ohulehule, and in Kaukonahua drainage on Federal, private, and State lands (EDA Database 2001; HINHP Database 2001).

*Cyrtandra subumbellata* typically grows on moist, forested slopes or gulch bottoms dominated by *Metrosideros polymorpha* or in mixed *Metrosideros polymorpha*-*Dicranopteris linearis*-*Acacia koa* wet forests between 345 and 790 m (1,132 and 2,591 ft) elevation. Associated native plant species include *Boehmeria grandis*, *Broussaisia arguta*, *Dryopteris* sp. (palapalai), and *Machaerina* sp. (HINHP Database 2001; Service 1998b; Wagner *et al.* 1999).

The primary threats to *Cyrtandra subumbellata* are competition with the nonnative plant species *Clidemia hirta*, impacts from military activities, predation by rats, fire, and risk of extinction from naturally occurring

events and/or reduced reproductive vigor due to the small number of extant occurrences and individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Cyrtandra viridiflora* (Haiwale)

*Cyrtandra viridiflora*, a member of the African violet family (Gesneriaceae) and a short-lived perennial, is a small shrub 0.5 to 2 m (1.6 to 6.6 ft) tall. 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.* 1999).

*Cyrtandra viridiflora* has been observed in flower and fruit from May through September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Cyrtandra viridiflora* was known from scattered occurrences in the Koolau Mountains on the island of Oahu. Fifty-two plants are known from 23 occurrences at Puu Kainapuaa, Maakua-Kaipapau Ridge, Kawai Nui Drainage, Opaepala Gulch, and Kawai Nui-Laie Divide (GDSI 2001; HINHP Database 2001).

*Cyrtandra viridiflora* is usually found on wind-blown ridge tops in cloud-covered wet forest or shrubland at elevations between 443 and 867 m (1,453 and 2,844 ft). Associated native plant species include *Broussaisia arguta*, *Cheirodendron platyphyllum* (olapa), *Dicranopteris linearis*, *Diplopterygium pinnatum*, *Dubautia* sp., *Freyinetia arborea*, *Hedyotis* sp., *Ilex anomala*, *Machaerina* sp., *Melicope* sp., *Metrosideros polymorpha*, *Metrosideros rugosa* (lehua papa), *Psychotria* sp., or *Syzygium sandwicensis* (HINHP Database 2001; Wagner *et al.* 1999; EDA, *in litt.* 2001).

The major threats to *Cyrtandra viridiflora* are habitat degradation or destruction by feral pigs, impacts from military activities, predation by rats, competition with the nonnative plant species *Clidemia hirta* and *Psidium cattleianum*, and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining occurrences and individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Delissea subcordata* (Oha)

*Delissea subcordata*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is a branched or unbranched shrub 1 to 3 m (3.5 to 10 ft) tall. 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 1999).

Fertile plants of *Delissea subcordata* have been observed in July. An examination of herbarium specimens shows that this plant flowers throughout the year. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Delissea subcordata* was known from scattered occurrences in the Waianae and Koolau Mountains of Oahu. A specimen collected by Mann and Brigham in the 1860s and labeled from the island of Kauai is believed to have been mislabeled. *Delissea subcordata* is now known from 21 occurrences at South Huliwai Gulch, Palikea Gulch, Kaluaa Gulch, South Mohiaka Gulch, Kahanahaiki Valley, Kapuhi Gulch, South Ekahanui Gulch, Waikoekoe Gulch, Pahole Gulch, Kaawa Gulch, North Palawai Gulch, Kealia land section, Kapuna Gulch, Keawapilau Gulch, North Huliwai Gulch, Kuaokala, and Kolekole. This species is found on private, Federal, and State lands. The total number of plants is estimated to be fewer than 70 (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Delissea subcordata* typically grows on moderate to steep gulch slopes in mixed mesic forests between 162 and 1,025 m (531 and 3,362 ft) elevation. Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma* sp., *Bobea* sp. (ahakea), *Chamaesyce multiformis* (akoko), *Charpentiera obovata*, *Claoxylon sandwicense*, *Diospyros hillebrandii* (lama), *Diospyros sandwicensis*, *Hedyotis acuminata*, *Metrosideros polymorpha*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Pisonia* sp., *Pouteria sandwicensis*, *Psychotria hathewayi*, *Psydrax odorata*, or *Streblus pendulinus* (HINHP Database 2001; Service 1998b).

The major threats to *Delissea subcordata* are habitat degradation and/or destruction by pigs and goats; impacts from military activities, including road construction and housing development; predation by rats and slugs; competition with the nonnative plant species *Blechnum appendiculatum*, *Clidemia hirta*, *Grevillea robusta*, *Lantana camara*, *Melinis minutiflora*, *Oplismenus hirtellus*, *Passiflora suberosa*, *Pimenta dioica*, *Psidium cattleianum*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; fire; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of

remaining individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

*Diellia falcata* (NCN)

*Diellia falcata*, in the polypody family (Polypodiaceae) and a short-lived perennial fern, grows from a rhizome (underground stem) 1 to 5 cm (0.4 to 2 in) long and 0.5 to 2 cm (0.2 to 0.8 in) in diameter. The rhizome is covered with small black or maroon scales. This species is distinguished from others in the genus by the color and texture of its leaf stalk, the venation pattern of its fronds, the color of its scales, its rounded and reduced lower pinnae (leaflets), and its separate sori (spore clusters) arranged on marginal projections (Service 1998b; Wagner 1952).

*Diellia falcata* hybridizes with *Diellia unisora*. It has been observed with fronds bearing sori (spores) year-round. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Diellia falcata* was known from almost the entire length of the Waianae Mountains, from Manini Gulch to Palehua Iki, as well as from the Koolau Mountains of Oahu, from Kaipapau Valley to Aiea Gulch. This species remains in Waieli Gulch, Ekahanui Gulch, Makaleha Valley, Makaha Valley, Palikea Gulch, Makua Valley, Kaimuhole Gulch, Kuaokala-Manini Gulch, Pahole Gulch, Puu Ku Makalii, Kapuna Gulch, Mohiakea Gulch, Waianae Kai, Pualii Gulch, Napepeiauolelo Gulch, Kahanahaiki Valley, Nanakuli-Lualualei Ridge, Makua, Kamaileunu Ridge, Kaluaa Gulch, and Huliwai Gulch on Federal, State, city, county, and private lands. The 30 known occurrences contain fewer than 6,000 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Diellia falcata* is a terrestrial fern that typically grows in deep shade or open understory on moderate to moderately steep slopes and gulch bottoms in diverse mesic forest between 224 and 953 m (735 and 3,126 ft) elevation. Associated native species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma* sp., *Asplenium kaulfussii* (kuau), *Carex meyenii* (NCN), *Charpentiera* sp., *Claoxylon sandwicense*, *Coprosma foliosa*, *Diospyros hillebrandii*, *Diplazium sandwicianum*, *Doodia kunthiana* (okupukupu), *Dryopteris unidentata*, *Elaeocarpus bifidus*, *Freyinetia arborea*, *Hedyotis terminalis*, *Hibiscus* sp., *Melicope* sp., *Metrosideros polymorpha*, *Myrsine lanaiensis*,

*Nephrolepis exaltata* (kupukupu), *Nestegis sandwicensis*, *Nothoecetrum* sp., *Pipturus* sp., *Pisonia sandwicensis*, *Pouteria sandwicensis*, *Psychotria* sp., *Psydrax odorata*, *Sapindus oahuensis*, *Selaginella arbuscula*, *Sophora chrysophylla* (mamane), or *Xylosma* sp. (HINHP Database 2001).

The major threats to *Diellia falcata* are habitat degradation by feral goats and pigs; competition from the nonnative plant species *Aleurites moluccana*, *Ageratina riparia*, *Blechnum appendiculatum*, *Christella parasitica*, *Clidemia hirta*, *Grevillea robusta*, *Heliocarpus popayanensis*, *Kalanchoe pinnata*, *Lantana camara*, *Melinis minutiflora*, *Paspalum conjugatum*, *Passiflora ligularis* (sweet granadilla), *Passiflora suberosa*, *Pimenta dioica*, *Psidium cattleianum*, *Psidium guajava*, *Rubus argutus*, *Schefflera actinophylla* (octopus tree), *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; and fire (HINHP Database 2001; Service 1998b; 56 FR 55770).

*Diellia unisora* (NCN)

*Diellia unisora*, a short-lived perennial in the polypody fern family (Polypodiaceae), grows from a slender, erect rhizome to reach 0.5 to 3 cm (0.2 to 1.2 in) in height and 0.5 to 1 cm (0.2 to 0.4 in) in diameter. The rhizome is covered with the bases of the leaf stalks and a few small black scales. This species is distinguished from others in the genus by a rhizome completely covered by the persisting bases of the leaf stalks and few, very small scales; by sori mostly confined to the upper pinnae margins; and by delicate fronds gradually and symmetrically narrowing toward the apex (Wagner 1952).

*Diellia unisora* hybridizes with *Diellia falcata*. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Diellia unisora* was known from steep, grassy, rocky slopes on the western side of the Waianae Mountains of Oahu. This species is known to be extant in the southern Waianae Mountains at South Ekahanui Gulch, Palawai Gulch, and the Pualii-Napepeiauolelo Ridge. The 4 known occurrences, which are on State and private lands, contain fewer than 800 individuals (GDSI 2001; HINHP Database 2001).

*Diellia unisora* is a terrestrial fern that typically grows on moderate to steep slopes or gulch bottoms in deep shade or open understory, mesic forest between 382 and 953 m (1,253 and 3,126 ft) elevation. Associated native species include *Acacia koa*, *Alyxia*

*oliviformis*, *Antidesma* sp., *Bidens torta*, *Carex meyenii*, *Chamaesyce multififormis*, *Coprosma* sp., *Dodonaea viscosa*, *Doryopteris unidentata*, *Eragrostis grandis* (lovegrass), *Hedyotis schlechtendahlana* (kopa), *Hedyotis terminalis*, *Metrosideros polymorpha*, *Myrsine lessertiana*, *Rumex* sp., *Psychotria* sp., or *Selaginella arbuscula* (HINHP Database 2001; 59 FR 32932).

The major threats to *Diellia unisora* are habitat degradation by feral pigs and competition from the nonnative plant species *Ageratina riparia*, *Blechnum appendiculatum*, *Clidemia hirta*, *Melinis minutiflora*, *Passiflora suberosa*, *Psidium cattleianum*, *Schefflera actinophylla*, and *Schinus terebinthifolius* (HINHP Database 2001; 59 FR 32932).

*Dubautia herbstobatae* (Naenae)

*Dubautia herbstobatae*, a member of the aster family (Asteraceae) and a short-lived perennial, is a small, spreading shrub to 50 cm (20 in) tall. *Dubautia herbstobatae* is distinguished from other species on Oahu in this endemic genus by the outer bracts of the flower heads being fused, forming a cup surrounding the florets, and by one large vein showing in each leaf (Carr 1999).

*Dubautia herbstobatae* is likely outcrossing and possibly self-incompatible (*i.e.*, pollen from the same plant will not produce seed). Flowering usually occurs in May and June. Pollination is almost certainly achieved by insect activity, and fruit dispersal is probably quite localized (Service 1998b). Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors.

*Dubautia herbstobatae* is known to be extant in 12 occurrences in the northern Waianae Mountains, on Ohikilolo and Kamaileunu Ridges, Keaau, and Waianae Kai on State lands and land under Federal jurisdiction. Fewer than 100 individuals are known from these locations (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Dubautia herbstobatae* typically grows on rock outcrops, ridges, moderate slopes, or vertical cliffs in dry or mesic shrubland at elevations between 266 and 978 m (872 and 3,208 ft). Associated native species include *Artemisia australis*, *Bidens torta*, *Carex meyenii*, *Chamaesyce celastroides* (akoko), *Dodonaea viscosa*, *Eragrostis variabilis* (kawelu), *Metrosideros polymorpha*, and *Schiedea mannii* (NCN) (HINHP Database 2001; 56 FR 55770; EDA, *in litt.* 2001).

The major threats to *Dubautia herbstobatae* are habitat degradation by

feral goats and pigs; competition from the nonnative plant species *Ageratina riparia*, *Bromus mollis* (soft chess), *Grevillea robusta*, *Leucaena leucocephala*, *Melinis minutiflora*, *Melinis repens*, and *Schinus terebinthifolius*; fire; visitation and possible trampling by humans; and a risk of extinction from naturally occurring events due to the small number of remaining individuals (56 FR 55770).

*Eragrostis fosbergii* (Fosberg's love grass)

*Eragrostis fosbergii*, a member of the grass family (Poaceae), is a short-lived perennial species with stout, tufted culms (stems), which are 61 to 102 cm (24 to 40 in) long and usually arise from an abruptly bent woody base. 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 (floral bracts) and occasionally on the margins of the lemmas (floral bracts) (O'Connor 1999).

No information is available on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

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. Only four individuals are known to remain in Waianae Kai and on Kumaipo Trail in four occurrences on Federal and State lands (GDSI 2001; HINHP Database 2001).

*Eragrostis fosbergii* typically grows on ridge crests or moderate slopes in dry and mesic forests between 578 and 941 m (1,896 and 3,086 ft) elevation. Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Bidens* sp., *Chamaesyce* sp., *Dodonaea viscosa*, *Doodia* sp. (oku pukupulauui), *Eragrostis grandis*, *Melicope* sp., *Metrosideros polymorpha*, *Nephrolepis exaltata*, *Psydrax odorata*, or *Sphenomeris* sp. (pala) (HINHP Database 2001; 61 FR 53089).

The major threats to *Eragrostis fosbergii* are degradation of habitat by feral pigs and goats; competition with nonnative plant species such as *Grevillea robusta*, *Psidium cattleianum*, and *Schinus terebinthifolius*; trampling by hikers; hybridization with *Eragrostis grandis*; and a threat of extinction from random environmental events and/or reduced reproductive vigor due to the small number of remaining occurrences and individuals (HINHP Database 2001; Service 1998b; G. Koob, pers. comm., 2001).

*Gardenia mannii* (Nanu)

*Gardenia mannii*, a short-lived perennial member of the coffee family (Rubiaceae), is a tree 5 to 15 m (16 to 50 ft) tall. This species is distinguished from others in the genus by the shape and number of the calyx spurs (Wagner *et al.* 1999).

*Gardenia mannii* has been observed in flower and fruit in June and September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Gardenia mannii* was known from 7 widely scattered occurrences in the Waianae Mountains and 39 occurrences distributed along almost the entire length of the Koolau Mountains of Oahu. Currently, there are 49 occurrences of *Gardenia mannii* at Haleauau Gulch, Peahinaia Ridge, Kaunala Gulch and Kaunala-Waimea Ridge, Castle Trail, Halawa Valley and Halawa-Kalauao Ridge, Moanalua Valley, Makaua-Kahana Ridge, Poamoho and Halemano Gulches, Kaluaa and Maunauna Gulches, Waimano Trail, Kawailoa Trail, Puu Hapapa and Waieli Gulch, Wiliwilinui Ridge, Koloa Stream, Waiialae Nui-Kapakahi Ridge, Manaiki Valley, Laie Trail, Malaekahana-Waimea Summit Ridge, Haleauau Gulch, Schofield-Waikane Trail, Kaukonahua Gulch, Kapakahi Gulch, Manana Trail, Peahinaia Trail and Opaepala Stream, Kamana Nui Stream, Pukele, Hanaimoa Gulch, Papali Gulch, Kawai Nui, and Kaipapau Gulch. The 49 extant occurrences are on private, State, and Federal lands. The existing occurrences total between 69 and 80 plants (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Gardenia mannii* is usually found on moderate to moderately steep gulch slopes, ridge crests, in gulch bottoms, and on stream banks in mesic or wet forests between 82 and 1,050 m (269 and 3,444 ft) in elevation. Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma platyphyllum*, *Bohea* sp., *Boehmeria grandis*, *Broussaisia arguta*, *Cheirodendron* sp. (NCN), *Cibotium* sp., *Coprosma foliosa*, *Dicranopteris linearis*, *Elaeocarpus* sp., *Freyinetia arborea*, *Hedyotis acuminata*, *Ilex anomala*, *Melicope* sp., *Metrosideros polymorpha*, *Perottetia sandwicensis*, *Pipturus* sp., *Pisonia* sp., *Pouteria sandwicensis*, *Psychotria mariniana*, *Syzygium sandwicensis*, and *Thelypteris* sp. (HINHP Database 2001).

The major threats to *Gardenia mannii* are habitat degradation and/or destruction by feral pigs; potential

impacts from military activities; competition with nonnative plant species such as *Clidemia hirta*, *Leptospermum scoparium*, *Passiflora suberosa*, *Psidium cattleianum*, *Psidium guajava*, *Rubus argutus*, and *Toona ciliata*; fire; and risk of extinction from random environmental events and/or reduced reproductive vigor due to the widely dispersed, small number of remaining individuals. The Kapakahi Gulch occurrence is also threatened by the black twig borer (HINHP Database 2001; Service 1998b; 61 FR 53089).

*Hedyotis degeneri* (NCN)

*Hedyotis degeneri*, a short-lived perennial member of the coffee family (Rubiaceae), is a prostrate shrub with four-sided stems and peeling, corky bark. This species can be distinguished from others in the genus on Oahu by its low-growing habit, the peeling corky layers on older stems, and the short, crowded, leafy shoots growing in the leaf axils; two varieties within the species are recognized: *Hedyotis degeneri* var. *coprosmifolia* and *Hedyotis degeneri* var. *degeneri* (Wagner *et al.* 1999).

This species has been observed in flower in June, July, and November, and in fruit in July. No further information is available on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, or limiting factors (Service 1998b).

Historically, *Hedyotis degeneri* is known from Mt. Kaala in the northern Waianae Mountains. Variety *coprosmifolia* has not been collected since the 1980s, and no current occurrences are known. Four occurrences, totaling 60 individuals, of variety *degeneri* are known from Makaleha, Pahole Gulch, Kahanahaiki, and Alaihehe Gulch on Federal, State, city, and county lands (GDSI 2001; HINHP Database 2001; Wagner *et al.* 1999).

*Hedyotis degeneri* typically grows on ridge crests in diverse mesic forest between 349 and 1,083 m (1,145 and 3,552 ft) elevation. Associated native species include *Alyxia oliviformis*, *Carex meyenii*, *Chamaesyce multiflora*, *Cocculus* sp. (huehue), *Dicranopteris linearis*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Gahnia* sp. (NCN), *Hedyotis terminalis*, *Leptecophylla tameiameia* (pukiawe), *Lobelia yuccoides* (panaunau), *Lysimachia hillebrandii* (kolokolo kuahiwi), *Metrosideros polymorpha*, *Pleomele* sp., *Psychotria hathewayi*, *Psydrax odorata*, or *Wikstroemia oahuensis* (akia) (HINHP Database 2001).

The major threats to *Hedyotis degeneri* are habitat destruction by feral pigs; competition from the nonnative plant species *Ageratina adenophora*, *Blechnum appendiculatum*, *Clidemia hirta*, *Grevillea robusta*, *Melinis minutiflora*, *Psidium cattleianum*, *Psidium guajava*, *Rubus argutus*, *Schinus terebinthifolius*, and *Toona ciliata*; and a threat of extinction from random environmental events and/or decreased reproductive vigor due to the small number of extant individuals and occurrences (HINHP Database 2001).

*Hedyotis parvula* (NCN)

*Hedyotis parvula*, a short-lived perennial member of the coffee family (Rubiaceae), is a small, many-branched shrub, either upright or sprawling, with stems usually no more than 30 cm (1 ft) in length. Closely spaced, overlapping leaves that are uniform in size along the stem distinguish this species from other members of the genus on Oahu (Wagner *et al.* 1999).

*Hedyotis parvula* has been observed flowering in both winter and summer. The plant is found in dry areas and flowering may be induced by rain. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Hedyotis parvula* was known from the central and southern Waianae Mountains, from Makaleha Valley to Nanakuli Valley. Currently, this species is known from five locations on Federal, State, city, and county lands at Makaleha Ridge, Makua-Keaau Ridge, Lualualei-Nanakuli Ridge, Ohikilolo Ridge, and Halona. Seven occurrences totaling between 116 and 131 individuals are known (EDA Database 2001; GDSI 2001; HINHP Database 2001; Wagner *et al.* 1999).

*Hedyotis parvula* typically grows on and at the base of cliff faces, rock outcrops, and ledges in mesic habitat at elevations between 331 and 1,160 m (1,086 and 3,805 ft). Associated native species include *Bidens* sp., *Carex* sp., *Chamaesyce* sp., *Dodonaea viscosa*, *Eragrostis* sp. (kawelu), *Metrosideros polymorpha*, *Metrosideros tremuloides* (lehua ahihi), *Plectranthus parviflorus*, *Psydrax odorata*, or *Rumex* sp. (HINHP Database 2001; Wagner *et al.* 1999; 56 FR 55770).

The major threats to *Hedyotis parvula* are habitat degradation by feral goats and pigs; competition from the nonnative plant species *Ageratina riparia*, *Melinis minutiflora*, *Morella faya*, and *Schinus terebinthifolius*; and a threat of extinction from random environmental events and/or decreased

reproductive vigor due to the small number of individuals and occurrences (HINHP Database 2001; 56 FR 55770).

*Labordia cyrtandrae* (Kamakahala)

*Labordia cyrtandrae*, a short-lived perennial member of the logania family (Loganiaceae), is a shrub 0.7 to 2 m (2.3 to 6.6 ft) tall. This species is distinguished from others in the genus by its fleshy, hairy, cylindrical stem that flattens upon drying, the shape and length of the floral bracts, and the length of the corolla tube and lobes (Wagner *et al.* 1999).

*Labordia cyrtandrae* has been observed flowering from May through June, fruiting from July through August, and is sporadically fertile year-round. The flowers are functionally unisexual, and male and female flowers are on separate plants. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Labordia cyrtandrae* was known from both the Waianae and Koolau Mountains of Oahu. In the Koolau Mountains, this species extended from Kawailoa Trail to Waialae Iki, almost the entire length of the mountain range. This species currently is known only from 20 individuals in 10 occurrences in Haleaau Gulch, Mohiakea Gulch, Kaala, and Makaleha. These occurrences are on State, city, county, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Labordia cyrtandrae* typically grows in shady gulches, slopes, and glens in mesic to wet forests and shrublands dominated by *Metrosideros polymorpha*, *Diplopterygium pinnatum*, and/or *Acacia koa* between the elevations of 212 and 1,233 m (695 and 4,044 ft). Associated native plant species include *Antidesma* sp., *Artemisia australis*, *Bidens* sp., *Boehmeria grandis*, *Broussaisia arguta*, *Chamaesyce* sp., *Coprosma* sp., *Cyrtandra* sp., *Dicranopteris linearis*, *Diplazium sandwicheanum*, *Dubautia plantaginea* (naenae), *Lysimachia hillebrandii*, *Peperomia membranacea* (ala ala wai nui), *Perrottetia sandwicensis*, *Phyllostegia* sp., *Pipturus albidus*, *Pouteria sandwicensis*, *Psychotria* sp., or *Rumex* sp. (HINHP Database 2001; Service 1998b).

The major threats to *Labordia cyrtandrae* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with the nonnative plant species *Axonopus fissifolius*, *Clidemia hirta*, *Juncus planifolius* (NCN), *Psidium cattleianum*, *Rubus argutus*, *Setaria*

*parviflora* (yellow foxtail), and *Schinus terebinthifolius*; fire; and risk of extinction from random environmental events and/or reduced reproductive vigor due to the small number of remaining individuals and occurrences (HINHP Database 2001; Service 1998b).

*Lepidium arbuscula* (Anaunau)

*Lepidium arbuscula*, a short-lived perennial member of the mustard family (Brassicaceae), is a gnarled shrub 0.6 to 1.2 m (2 to 4 ft) tall. The species is distinguished from others in the genus by its height (Wagner *et al.* 1999).

*Lepidium arbuscula* has been observed in flower in February. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Lepidium arbuscula* was known from 10 occurrences in the Waianae Mountains on Oahu. Currently, there are a total of approximately 1,000 individuals known from 12 occurrences on Federal, State, city, and county lands at Kamaileunu Ridge, Lualualei-Nanakuli Ridge, Kapuhi Gulch, northwest of Puu Kaa, Manini Gulch, Mohiakea Gulch, Ohikilolo Ridge, Makua-Keaau Ridge, the ridge between the Paahoa and Halona subdistricts, northwest of Puu Ku Makalii, and Halona subdistrict (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Lepidium arbuscula* generally grows on exposed ridge tops and cliff faces in mesic and dry vegetation communities between 131 and 978 m (430 and 3,208 ft) elevation. This species is typically associated with native plant species such as *Artemisia australis*, *Bidens* sp., *Carex meyenii*, *Carex wahuensis* (NCN), *Chamaesyce multiformis*, *Dodonaea viscosa*, *Dryopteris unidentata*, *Dubautia* sp., *Eragrostis* sp., *Leptecophylla tameiameiae*, *Lysimachia hillebrandii*, *Metrosideros polymorpha*, *Peperomia* sp., *Psydrax odorata*, *Rumex albescens* (huahuako), *Schiedea ligustrina* (NCN), *Sida fallax*, or *Sophora chrysophylla* (HINHP Database 2001; Service 1998b).

The primary threats to *Lepidium arbuscula* are habitat degradation and/or destruction by feral goats, potential impacts from military activities, competition with nonnative plants, and fire. The occurrence at the head of Kapuhi Gulch is also threatened by its proximity to a road (HINHP Database 2001; 61 FR 53089).

*Lipochaeta lobata* var. *leptophylla* (Nehe)

*Lipochaeta lobata* var. *leptophylla*, a member of the aster family (Asteraceae),

is a low, somewhat woody, short-lived perennial herb with arched or nearly prostrate stems that may be up to 150 cm (59 in) long. Aside from being a coastal species, this species is the only member of its genus on Oahu with four-parted disk florets. This variety has narrower leaves, spaced more closely along the stem, than those of *Lipochaeta lobata* var. *lobata*, the only other variety of the species (Wagner *et al.* 1999).

Flowering of *Lipochaeta lobata* var. *leptophylla* is probably rain-induced. Occurrences may consist of fewer distinct individuals than it appears because many plants are connected underground by the roots and are probably clones. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Lipochaeta lobata* var. *leptophylla* was known from the southern Waianae Mountains of Oahu, from Kolekole Pass to Lualualei. Currently, there are a total of 147 individuals found in 4 occurrences on State, Federal, city, and county lands at Lualualei-Nanakuli Ridge, Kauhiuhi, Puu Hapapa, Mikilua, and Kamaileunu Ridge, (EDA Database 2001; GDSI 2001; HINHP Database 2001; Wagner *et al.* 1999).

*Lipochaeta lobata* var. *leptophylla* typically grows on cliffs, ridges, and slopes in dry or mesic shrubland at elevations between 256 and 978 m (840 and 3,208 ft). Associated native species include *Artemisia australis*, *Bidens* sp., *Carex meyenii*, *Diospyros* sp., *Dodonaea viscosa*, *Eragrostis* sp., *Melanthera tenuis* (nehe), *Peperomia* sp., *Psydrax odorata*, and *Stenogyne* sp. (NCN) (HINHP Database 2001; EDA, *in litt.* 2001).

The major threats to *Lipochaeta lobata* var. *leptophylla* include competition from nonnative plant species such as *Ageratina adenophora*, *Ageratina riparia*, *Erigeron karvinskianus*, *Grevillea robusta*, *Kalanchoe pinnata*, *Lantana camara*, *Leucaena leucocephala*, *Melinis minutiflora*, *Passiflora suberosa*, and *Schinus terebinthifolius*; habitat degradation by feral pigs and goats; fire; and a threat of extinction from random environmental events and/or decreased reproductive vigor due to the small number of individuals and occurrences (HINHP Database 2001).

#### *Lipochaeta tenuifolia* (Nehe)

*Lipochaeta tenuifolia*, a member of the aster family (Asteraceae), is a low growing, somewhat woody, short-lived perennial herb with short, more or less erect branches. Its five-parted disk

florets and its deeply cut, stalkless leaves separate this species from other members of the genus (Wagner *et al.* 1999).

*Lipochaeta tenuifolia* has been observed flowering in April. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Lipochaeta tenuifolia* occurs in the northern half of the Waianae Mountains of Oahu, from Kaluakauila Gulch to Kamaileunu Ridge and east to Mt. Kaala, and northwest, southwest, southeast, and north of Puu Ku Makalii on State, Federal, city, and county lands. The 41 known occurrences contain between 759 and 1,174 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Lipochaeta tenuifolia* typically grows on ridgetops and bluffs in open areas, protected pockets of dry to mesic forests and shrublands, and forests dominated by *Diospyros sandwicensis* at elevations between 67 and 978 m (220 and 3,208 ft). Associated native species include *Artemisia australis*, *Bidens* sp., *Carex meyenii*, *Diospyros* sp., *Dodonaea viscosa*, *Doryopteris* sp. (kumu niu), *Dubautia* sp., *Eragrostis* sp., *Myoporum sandwicense*, *Osteomeles anthyllidifolia* (ulei), *Psydrax odorata*, *Reynoldsia sandwicensis*, *Rumex* sp., *Santalum* sp., *Sapindus oahuensis*, or *Schiedea* sp. (HINHP Database 2001; Wagner *et al.* 1999).

The major threats to *Lipochaeta tenuifolia* are habitat degradation by feral goats and pigs; competition for light and space from nonnative plant species including *Ageratina riparia*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Coffea arabica* (coffee), *Grevillea robusta*, *Hyptis pectinata*, *Lantana camara*, *Leucaena leucocephala*, *Melinis minutiflora*, *Panicum maximum*, *Psidium cattleianum*, *Rivina humilis*, *Schinus terebinthifolius*, or *Toona ciliata*; and fire (HINHP Database 2001; 56 FR 55770).

#### *Lobelia gaudichaudii* ssp. *koolauensis* (NCN)

*Lobelia gaudichaudii* ssp. *koolauensis*, a short-lived perennial member of the bellflower family (Campanulaceae), is an unbranched, woody shrub 0.3 to 1 m (1 to 3.5 ft) tall. 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. The subspecies *koolauensis* is distinguished by the greenish or

yellowish white petals and the branched flowering stalks (Lammers 1990; 61 FR 53089).

*Lobelia gaudichaudii* ssp. *koolauensis* has been observed in flower in September and in fruit in December. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Lobelia gaudichaudii* ssp. *koolauensis* was known from only two occurrences in the central Koolau Mountains on Oahu. Currently, this subspecies is known from five occurrences in the central Koolau Mountains, on Federal, State, and private lands at Waimano-Waiawa Ridge, Waimano, the plateau above Sacred Falls, and Kaukonahua Gulch. The total number of plants is estimated to be fewer than 270 (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Lobelia gaudichaudii* ssp. *koolauensis* typically grows on moderate to steep slopes in *Metrosideros polymorpha* lowland wet shrublands and bogs at elevations between 383 and 867 m (1,256 and 2,844 ft). Associated native plant species include *Bidens* sp., *Broussaisia arguta*, *Cibotium* sp., *Dicanthelium koolauense* (NCN), *Isachne distichophylla* (ohe), *Machaerina angustifolia*, *Melicope* sp., *Sadleria pallida*, *Scaevola* sp., or *Vaccinium dentatum* (ohelo) (HINHP Database 2001; EDA, *in litt.* 2001).

The primary threats to *Lobelia gaudichaudii* ssp. *koolauensis* are habitat degradation and/or destruction by feral pigs; competition with the nonnative plant species *Axonopus fissifolius*, *Clidemia hirta*, *Pterolepis glomerata*, and *Sacciolepis indica*; trampling by hikers; landslides; and risk of extinction from random environmental events and/or reduced reproductive vigor of the few remaining individuals (HINHP Database 2001; 61 FR 53089).

#### *Lobelia monostachya* (NCN)

*Lobelia monostachya*, a short-lived perennial member of the bellflower family (Campanulaceae), is a prostrate woody shrub with stems 15 to 25 cm (6 to 10 in) long. The species is distinguished from others in the genus by its narrow, linear leaves without stalks and its short pink flowers (Lammers 1999).

This species has been observed in flower in May and June. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific



environmental requirements, and limiting factors (Service 1998b).

Historically, *Lobelia monostachya* was known only from the Koolau Mountains and had not been seen since its original discovery in the 1800s in Niu Valley, and in the 1920s in Manoa Valley. In 1994, Joel Lau discovered one individual in a previously unknown location in Wailupe Valley on State and private lands. Currently, one occurrence with a total of three plants is known (GDSI 2001; HINHP Database 2001).

*Lobelia monostachya* occurs on steep, sparsely vegetated cliffs in mesic shrubland between 44 and 614 m (144 and 2,014 ft) elevation. Associated native plant species include *Artemisia australis*, *Carex meyenii*, *Eragrostis* sp., or *Psilotum nudum* (HINHP Database 2001).

The major threats to *Lobelia monostachya* are predation by rats; competition with the nonnative plants *Ageratum riparia*, *Kalanchoe pinnata*, *Melinis minutiflora*, and *Schinus terebinthifolius*; and risk of extinction from random environmental events and/or reduced reproductive vigor due to the low number of individuals in the only known occurrence (HINHP Database 2001; 61 FR 53089).

#### *Lobelia oahuensis* (NCN)

*Lobelia oahuensis*, a short-lived perennial member of the bellflower family (Campanulaceae), is a stout, erect, unbranched shrub 1 to 3 m (3 to 10 ft) tall. *Lobelia oahuensis* differs from other members of the genus in having the following combination of characters: Erect stems 1 to 3 m (3 to 10 ft) long, dense rosettes of leaves at the end of stems, lower leaf surfaces covered with coarse grayish or greenish hairs, and flowers 42 to 45 millimeters (mm) (1.7 to 1.8 in) long (Lammers 1999).

This species has been observed in flower during November. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Lobelia oahuensis* was known from Kahana Ridge, Kipapa Gulch, and the southeastern Koolau Mountains of Oahu. The 12 current occurrences totaling 42 individuals are located on private, State, and Federal lands. These occurrences are on Mt. Olympus, Konahuanui summit, Waikakalaua-Waikane Ridge, Puu o Kona, the summit area between Aiea and Halawa Valley, Puu Keahiakahoe and the summit ridge south of Puu Keahiakahoe, Waialae Nui-Waimanalo and Kapakahi-Waimanalo, Puu Kalena,

and Eleao (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Lobelia oahuensis* grows on steep slopes between elevations of 415 and 959 m (1,361 and 3,146 ft) on summit cliffs in cloudswep wet forests or in lowland wet shrubland that is frequently exposed to heavy wind and rain. Associated native plant species include *Bidens* sp., *Broussaisia arguta*, *Cheirodendron trigynum* (olapa), *Cibotium* sp., *Dicranopteris linearis*, *Dubautia laxa*, *Freycinetia arborea*, *Hedyotis* sp., *Labordia hosakana* (kamakahala), *Lycopodiella cernua* (wawae iole), *Machaerina angustifolia*, *Melicope* sp., *Metrosideros polymorpha*, *Peperomia* sp., *Phyllostegia* sp., *Sadleria squarrosa* (apuu), *Scaevola* sp., *Syzygium sandwicensis*, *Vaccinium* sp., or *Wikstroemia* sp. (HINHP Database 2001; Lammers 1999; Service 1998b).

The primary threats to *Lobelia oahuensis* are competition with the nonnative plant species *Clidemia hirta*, *Erigeron karvinskianus*, *Paspalum conjugatum*, *Rubus argutus*, and *Rubus rosifolius*, and habitat degradation by feral pigs (HINHP Database 2001).

#### *Melicope lydgatei* (Alani)

*Melicope lydgatei*, a long-lived perennial member of the citrus family (Rutaceae), is a small shrub that has leaves arranged oppositely or in threes. The species' leaf arrangement, the amount of fusion of the fruit sections, and the hairless exocarp (outermost layer of the fruit wall) and endocarp (innermost layer) distinguish it from other species in the genus (Wagner *et al.* 1999).

This species has been observed in flower in May and in fruit from June to July. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Melicope lydgatei* was formerly known throughout the Koolau Mountains of Oahu from Hauula to Kahana, Kipapa Gulch to Waimano, and Kalihi Valley to Wailupe Valley. Eighteen occurrences remain within its historical range on State and private lands along Poamoho Trail, Peahinaia Trail, and Manana Trail (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Melicope lydgatei* typically grows in association with *Acacia koa*, *Bobea elatior*, *Dicranopteris linearis*, *Metrosideros polymorpha*, *Psychotria* sp., or *Syzygium sandwicensis* on ridges in mesic and wet forests at elevations between 349 and 671 m (1,145 and 2,201 ft) (HINHP Database 2001; Service 1998b; EDA, *in litt.* 2001).

The primary threat to *Melicope lydgatei* is a threat of extinction due to random environmental events and/or reduced reproductive vigor because of the small number of occurrences remaining (59 FR 14482).

#### *Melicope saint-johnii* (Alani)

*Melicope saint-johnii*, a long-lived perennial member of the rue family (Rutaceae), is a slender tree 3 to 6 m (10 to 20 ft) tall. This species is distinguished from others in the genus by the combination of the hairless exocarp, hairy endocarp, densely hairy petals, and sparsely hairy to smooth sepals (Stone *et al.* 1999).

No information exists on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Melicope saint-johnii* was known from both the Waianae and Koolau Mountains at Makaha to Mauna Kapu in the Waianae Mountains and Papali Gulch in Hauula, Manoa-Aihualama, Wailupe, and Niu Valley in the Koolau Mountains. Today 6 occurrences of this species are found on Federal and private lands from the region between Puu Kaua and Puu Kanehoa to Mauna Kapu in the southern Waianae Mountains, with a total of fewer than 170 individuals (GDSI 2001; HINHP Database 2001).

*Melicope saint-johnii* typically grows on mesic forested ridges and gulch bottoms between the elevation of 240 and 953 m (787 and 3,126 ft). Associated native plant species include *Alyxia oliviformis*, *Artemisia australis*, *Bidens torta*, *Carex wahuensis*, *Coprosma longifolia*, *Eragrostis* sp., *Hedyotis schlechtendahliana*, *Labordia kaalae* (kamakahala), *Lysimachia hillebrandii*, *Metrosideros polymorpha*, *Panicum beechyi* (panic grass), *Pipturus albidus*, *Pittosporum* sp., *Pleomele halapepe* (hala pepe), *Psychotria hathewayi*, or *Rumex albescens* (HINHP Database 2001).

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; competition with nonnative plant species such as *Ageratina adenophora*, *Ageratina riparia*, *Clidemia hirta*, *Grevillea robusta*, *Lantana camara*, *Melinis minutiflora*, *Morella faya*, *Passiflora suberosa*, *Passiflora* sp., *Psidium cattleianum*, and *Schinus terebinthifolius*; and risk of extinction due to naturally occurring events and/or reduced reproductive vigor because of the few individuals remaining and their restricted distribution (HINHP



Database 2001; Service 1998b; 61 FR 53089).

#### *Myrsine juddii* (Kolea)

*Myrsine juddii*, short-lived perennial member of the myrsine family (Myrsinaceae), is a many branched shrub ranging from 1 to 2 m (3.5 to 6.6 ft) tall. This species is distinguished from others in the genus by the hairiness of the lower leaf surface and the shape of the leaf base. In addition, the hairy leaves distinguish this species from all other species of *Myrsine* on Oahu (Wagner *et al.* 1999).

*Myrsine juddii* has been reported from only three occurrences in the central Koolau Mountains: the North Kaukonahua-Kahana Summit divide, Peahinaia Trail, and Puu Kainapuaa to Poamoho Trail. These occurrences are found on State and Federal lands. The total number of individuals is thought to be around 5,000 (GDSI 2001; HINHP Database 2001).

*Myrsine juddii* typically grows on ridge crests and gulch slopes in wet forests and shrublands dominated by *Metrosideros polymorpha* or a mixture of *Metrosideros polymorpha* and *Dicranopteris linearis* at elevations between 384 and 867 m (1,260 and 2,844 ft). Associated native plant species include *Cheiodendron platyphyllum*, *Cheiodendron trigynum*, *Machaerina* sp., *Melicope clusiifolia* (kolokolo mokihana), *Psychotria mariniana*, and *Syzygium sandwicensis* (GDSI 2001; HINHP Database 2001; Service 1998b; 61 FR 53089; EDA, *in litt.* 2001).

The primary threats to *Myrsine juddii* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with nonnative plant species such as *Clidemia hirta* and *Psidium cattleianum*; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of extant occurrences (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Neraudia angulata* (NCN)

*Neraudia angulata*, a short-lived perennial member of the nettle family (Urticaceae), is an erect shrub up to 3 m (10 ft) tall. This species is distinguished from other species in its genus by the conspicuously angled, ridged, fleshy calyx in the female flower. There are two varieties, *N. angulata* var. *angulata* and *N. angulata* var. *dentata*, that differ in the types of leaf hairs on the lower surface of the leaves and the type of leaf margin (Wagner *et al.* 1999).

*Neraudia angulata* flowers and fruits from early spring to summer. Fruits

mature in about one month. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Neraudia angulata* was known from almost the entire length of the Waianae Mountains, from Kaluakauila Gulch nearly to Puu Manawahua. This species is currently known from Kaluakauila Gulch along Makua-Keaau Ridge to Makaha-Waianae Kai Ridge, on Federal, State, city, county, and private lands. The 27 known occurrences are estimated to comprise approximately 51 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Neraudia angulata* var. *angulata* typically grows on slopes, ledges, or gulches in lowland mesic or dry forest between 189 and 978 m (620 and 3,208 ft) elevation. Associated native plant species include *Artemisia australis*, *Bidens* sp., *Carex meyenii*, *Diospyros* sp., *Dodonaea viscosa*, *Hibiscus* sp., *Nestegis sandwicensis*, *Pisonia sandwicensis*, *Psydrax odorata*, or *Sida fallax*. *Neraudia angulata* var. *dentata* typically grows on cliffs, rock embankments, gulches, and slopes in mesic or dry forests between 110 and 978 m (361 and 3,208 ft) elevation. Associated native plant species include *Alyxia oliviformis*, *Antidesma pulvinatum*, *Artemisia australis*, *Bidens torta*, *Canavalia* sp., *Carex* sp., *Charpentiera* sp., *Diospyros hillebrandii*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Eragrostis* sp., *Hibiscus* sp., *Metrosideros polymorpha*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Pisonia* sp., *Psydrax odorata*, *Rauvolfia sandwicensis*, *Sapindus oahuensis*, *Sida fallax*, or *Streblus pendulinus* (HINHP Database 2001; Service 1998b; 56 FR 55770; EDA, *in litt.* 2001).

The major threats to *Neraudia angulata* var. *angulata* are habitat degradation by feral goats and pigs; potential impacts from military activities; competition from the nonnative plant species *Ageratina riparia*, *Melinis minutiflora*, *Passiflora* sp., *Psidium cattleianum*, and *Schinus terebinthifolius*; fire; and a risk of extinction from naturally occurring events due to the small number of extant individuals. The major threats to *Neraudia angulata* var. *dentata* are habitat degradation by feral pigs and goats; fire; competition with the nonnative plant species *Ageratina adenophora*, *Ageratina riparia*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Erigeron karvinskianus*, *Leucaena leucocephala*,

*Melinis* sp., *Montanoa hibiscifolia*, *Oplismenus hirtellus*, *Passiflora suberosa*, *Pimenta dioica*, *Psidium guajava*, *Schefflera actinophylla*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Tecoma castanifolia* (yellow elder); and a risk of extinction from naturally occurring events due to the small number of extant individuals (HINHP Database 2001; Service 1998b; 56 FR 55770).

#### *Phyllostegia hirsuta* (NCN)

*Phyllostegia hirsuta*, a short-lived perennial member of the mint family (Lamiaceae), is an erect subshrub or vine with stems densely covered with coarse or stiff hairs. This species is distinguished from others in the genus by the texture, hairiness, size of the leaves, and the length of the upper bracts (Wagner *et al.* 1999).

*Phyllostegia hirsuta* has been observed in flower in February and in fruit in June. Cultivated material flowered in July. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Phyllostegia hirsuta* was known from widespread locations in the Waianae and Koolau Mountains on Oahu. Currently, this species is found in 26 occurrences with a total of between 214 and 227 individuals from the ridge between Makaha and Waianae Kai to the south fork of North Palawai Gulch in the Waianae Mountains and from Kawainui Gulch in Kawailoa Training Area to south Kaukonahua drainage in the Koolau Mountains. These occurrences are on Federal, State, city, county, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Phyllostegia hirsuta* is usually found on steep, shaded slopes, cliffs, ridges, gullies, and stream banks in mesic or wet forests dominated by *Metrosideros polymorpha* or a mixture of *Metrosideros polymorpha* and *Dicranopteris linearis* between 195 and 1,202 m (640 and 3,943 ft) elevation. Associated native plant species include *Antidesma platyphyllum*, *Astelia* sp. (painiu), *Broussaia arguta*, *Chamaesyce multiformis*, *Cibotium* sp., *Claoxylon sandwicense*, *Clermontia kekeana* (oha wai), *Coprosma longifolia*, *Cyanea membranacea*, *Cyrtandra waianaensis*, *Diplazium sandwichianum*, *Dryopteris unidentata*, *Dubautia laxa*, *Dubautia sherffiana* (naenae), *Elaeocarpus bifidus*, *Freycinetia arborea*, *Hedyotis schlechtendahlana*, *Hedyotis terminalis*, *Hibiscus* sp., *Ilex anomala*, *Labordia kaalae*, *Liparis hawaiiensis* (awapuhiakanaloo), *Lysimachia*

*hillebrandii*, *Machaerina angustifolia*, *Melicope* sp., *Myrsine lessertiana*, *Myrsine sandwicensis* (kolea lau nui), *Neraudia* sp. (NCN), *Nothocestrum* sp., *Perottetia sandwicensis*, *Phyllostegia grandiflora* (kapana), *Pipturus* sp., *Pisonia* sp., *Pleomele* sp., *Pouteria sandwicensis*, *Psychotria* sp., *Rumex albescens*, *Scaevola gaudichaudiana* (naupaka kuahiwi), *Streblus pendulinus*, *Zanthoxylum kauaense* (ae), or native ferns (HINHP Database 2001; Service 1998b; 61 FR 53089).

The primary threats to *Phyllostegia hirsuta* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; rockslides; predation by rats; and competition with *Adiantum raddianum*, *Athyrium* sp. (NCN), *Axonopus fissifolius*, *Blechnum appendiculatum*, *Buddleia asiatica*, *Clidemia hirta*, *Drymaria cordata* (pipili), *Lantana camara*, *Melinis minutiflora*, *Passiflora suberosa*, *Paspalum conjugatum*, *Physalis peruviana* (poha), *Pimenta dioica*, *Psidium cattleianum*, *Rubus argutus*, *Rubus rosifolius*, or *Schinus terebinthifolius* (HINHP Database 2001).

*Phyllostegia kaalaensis* (NCN)

*Phyllostegia kaalaensis*, a member of the mint family (Lamiaceae), is a short-lived perennial herb. The egg-shaped leaves are 5 to 13 cm (2 to 5 in) long. 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.* 1999).

No information is available on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Phyllostegia kaalaensis* was formerly known from only six scattered locations in the Waianae Mountains of Oahu. Currently, this species is known from 7 occurrences containing a total of fewer than 45 plants, in Waianae Kai, Pahole Gulch, central Ekahanui Gulch, Ekahanui Gulch, and Palikea Gulch. These occurrences are on State and private lands (GDSI 2001; HINHP Database 2001).

*Phyllostegia kaalaensis* is found on gulch slopes and bottoms and on almost vertical rock faces in mesic forest or *Sapindus oahuensis* forest between 374 and 796 m (1,227 and 2,611 ft) elevation. Associated native plant species include *Antidesma platyphyllum*, *Claoxylon sandwicense*, *Diplazium sandwichianum*, *Freycinetia arborea*, *Hibiscus* sp., *Myrsine lanaiensis*, *Myrsine lessertiana*, *Neraudia melastomifolia*, *Pipturus albidus*, *Pouteria sandwicensis*,

*Psychotria hathewayi*, *Streblus pendulinus*, or *Urera glabra* (HINHP Database 2001).

The major threats to *Phyllostegia kaalaensis* are habitat degradation and/or destruction by feral pigs and goats; fire; trail clearing; competition with the nonnative plant species *Ageratina adenophora*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Buddleia asiatica*, *Christella parasitica*, *Clidemia hirta*, *Cordyline fruticosa*, *Lantana camara*, *Oplismenus hirtellus*, *Passiflora edulis* (passion fruit), *Passiflora ligularis*, *Passiflora suberosa*, *Psidium cattleianum*, *Psidium guajava*, *Rubus rosifolius*, *Schinus terebinthifolius*, and *Toona ciliata*; and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of occurrences and individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

*Pritchardia kaalae* (Loulu)

*Pritchardia kaalae*, a long-lived perennial 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. *Pritchardia kaalae* is distinguished from other members of the genus by the hairless or scaly leaves (Read and Hodel 1999).

*Pritchardia kaalae* plants have been observed in fruit in April, August, and October and may fruit throughout the year. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Pritchardia kaalae* was known from scattered occurrences in the central and north-central Waianae Mountains of Oahu. Currently, 6 occurrences are known from Manuwai Gulch, East Makaleha, Kaumokunui Gulch, Waianae Kai-Haleauau summit divide, Makua-Keaau Ridge and Makaha Valley, totaling about 200 individuals. These occurrences are located on Federal, State, city, and county lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Pritchardia kaalae* is typically found on steep slopes and gulches in mesic forest or shrubland between elevations of 421 and 1,123 m (1,381 and 3,683 ft). Associated native plant species include *Bidens* sp., *Dodonaea viscosa*, *Dubautia* sp., *Eragrostis* sp., *Metrosideros polymorpha*, *Metrosideros tremuloides*, *Myrsine* sp., *Pipturus* sp., or *Tetraplasandra* sp. (ohe ohe) (HINHP

Database 2001; Service 1998b; 61 FR 53089; EDA, *in litt.* 2001).

Major threats to *Pritchardia kaalae* are habitat degradation by feral pigs and goats; fruit predation by rats; potential impacts from military activities; competition with the nonnative plant species *Ageratina adenophora*, *Rubus argutus*, and *Schinus terebinthifolius*; potential fire; and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of occurrences (HINHP Database 2001; Service 1998b; 61 FR 53089).

*Sanicula mariversa* (NCN)

*Sanicula mariversa*, a short-lived perennial member of the parsley family (Apiaceae), is an upright herb, 40 to 70 cm (16 to 28 in) tall, that produces a caudex (a single branched stem from a sturdy base) growing just beneath the surface of the soil. The larger size of the plant and basal leaves, the color of the flower petals, and the hooked prickles on the fruit separate this species from others of the genus in Hawaii (Constance and Affolter 1999).

*Sanicula mariversa* is known to flower from February through May, and fruits can be found until August. Dry fruits remain on the plant for a long time and may persist beyond August. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Sanicula mariversa* was known from the central Waianae Mountains from Makua-Keaau Ridge to Kaluaa-Lualualei Summit Ridge. This species is now extant on Ohikilolo Ridge, Keaau-Makaha Ridge, Kamaileunu Ridge, and northwest of Puu Kanehoa on Federal, State, city, and county lands. The 4 known occurrences contain approximately 170 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Sanicula mariversa* typically grows on well-drained, dry slopes and rock faces in mesic shrublands and open grassy areas at elevations between 582 and 978 m (1,909 and 3,208 ft). Associated native species include *Bidens torta*, *Carex meyenii*, *Doryopteris* sp., *Eragrostis* sp., *Metrosideros polymorpha*, or *Metrosideros tremuloides* (HINHP Database 2001; EDA, *in litt.* 2001).

The major threats to *Sanicula mariversa* are habitat degradation by feral goats; fire; erosion; competition from the nonnative plant species *Ageratina riparia*, *Erigeron karvinskianus*, *Melinis minutiflora*, *Schinus terebinthifolius*, and

*Stachytarpheta dichotoma*; trampling by humans on or near trails; and the risk of extinction due to the small number of occurrences (HINHP Database 2001; Service 1998b; 56 FR 55770).

#### *Schiedea kaalae* (NCN)

*Schiedea kaalae*, a short-lived perennial member of the pink family (Caryophyllaceae), has a short woody caudex less than 20 cm (8 in) long. This species can be distinguished from other members of its genus by its very short stems and its thick leaves with one conspicuous vein (Wagner *et al.* 1999).

This plant has been observed in flower from March through June. Based on field and greenhouse observations, *Schiedea kaalae* has bisexual flowers. A series of experimental self-pollinations, within-population crosses, and crosses among occurrences has demonstrated that *Schiedea kaalae* experiences moderately strong inbreeding depression. These results indicate that reductions in population size could result in expression of inbreeding depression among progeny, with potentially deleterious consequences for the long-term persistence of this species. Consistent with the evidence for inbreeding depression, *Schiedea kaalae* appears to be an out-crossing species. Under greenhouse conditions, flowers do not set seed unless hand-pollinated. In the field, this species was observed being visited by the introduced syrphid fly, *Simosyrphus grandicornis*. The fly did not appear to be foraging for nectar but may have been feeding on pollen. Individuals of *Schiedea kaalae* appear to be long-lived, but there is no evidence of regeneration from seed under field conditions. Seedlings of *Schiedea kaalae*, like those of other *Schiedea* species in mesic or wet sites, are apparently consumed by introduced slugs and snails, which have been observed feeding on *Schiedea membranacea*, a mesic forest species from Kauai. In contrast, *Schiedea* occurring in dry areas produce abundant seedlings following winter rains, presumably because dry areas have fewer nonnative predators. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b; Weller and Sakai, unpublished data).

Historically, *Schiedea kaalae* was known from the north-central and south-central Waianae Mountains and the northern Koolau Mountains of Oahu. This species remains on State and private lands at Pahole Gulch, Kaluaa Gulch, Puu Kaa, Palawai Gulch, Maakua Gulch, Huliwai Gulch, and

Makaua Stream. The 7 known occurrences contain only 49 individuals (GDSI 2001; HINHP Database 2001).

*Schiedea kaalae* typically grows in deep shade on steep slopes, cliffs, and stream banks in diverse mesic and wet forests at elevations between 64 and 869 m (210 and 2,850 ft). Associated native species include *Alyxia oliviformis*, *Athyrium arnottii* (hoio), *Athyrium sandwichianum*, *Boehmeria grandis*, *Charpentiera* sp., *Claoxylon sandwicense*, *Cyrtandra calpidicarpa*, *Cyrtandra laxiflora*, *Diospyros hillebrandii*, *Dryopteris unidentata*, *Freycinetia arborea*, *Hedyotis acuminata*, *Nothoestrum longifolium* (aiea), *Pipturus albidus*, *Pisonia sandwicensis*, *Pisonia umbellifera*, *Pouteria sandwicensis*, *Psychotria hathewayi*, *Selaginella arbuscula*, or *Xylosma hawaiiense* (maua) (HINHP Database 2001; Service 1998b).

The major threats to *Schiedea kaalae* are habitat degradation by feral pigs and goats; competition from the nonnative plant species *Ageratina adenophora*, *Ageratina riparia*, *Blechnum appendiculatum*, *Christella parasitica*, *Clidemia hirta*, *Cordyline fruticosa*, *Melinis minutiflora*, *Morella faya*, *Oplismenus hirtellus*, *Passiflora suberosa*, *Psidium cattleianum*, *Psidium guajava*, *Rubus rosifolius*, and *Schinus terebinthifolius*; fire; predation by introduced slugs and snails; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HINHP Database 2001; Service 1998b).

#### *Schiedea kealiae* (Ma oli oli)

*Schiedea kealiae*, a short-lived perennial member of the pink family (Caryophyllaceae), is a subshrub with weakly ascending to sprawling stems that form loose clumps. The species is distinguished from others of this endemic Hawaiian genus by the length of the sepals and nectaries and by the stalkless glands found only on the flowering stalk (Wagner *et al.* 1999).

*Schiedea kealiae* has been observed in flower in December. A series of self-pollinations, within-population crosses, and crosses among occurrences has demonstrated that many related *Schiedea* species experience moderately strong inbreeding depression. These results indicate that reductions in population size could result in expression of inbreeding depression among progeny, with potentially deleterious consequences for the long-term persistence of the species. Individuals of *Schiedea kealiae* appear to be long-lived; however, there is no evidence of regeneration from seed

under field conditions. Seedlings of *Schiedea* species occurring in mesic or wet sites are apparently consumed by introduced slugs and snails, which have been observed feeding on *Schiedea membranacea*, a mesic forest species from Kauai. In contrast, *Schiedea* occurring in dry areas produce abundant seedlings following winter rains, presumably because dry areas have fewer nonnative predators. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b; Weller and Sakai, unpublished data).

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. Currently, 4 occurrences totaling between 265 and 315 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 occurrences are on private and State lands, as well as State lands under Federal jurisdiction (Army 2001b; GDSI 2001; HINHP Database 2001).

*Schiedea kealiae* is usually found on steep slopes and cliff faces and bases in dry remnant *Erythrina sandwicensis* forest at elevations between 46 and 341 m (151 and 1,118 ft). Associated native plant species include *Bidens* sp., *Hibiscus arnottianus*, *Lepidium bidentatum* (anaunau), *Lipochaeta remyi* (nehe), *Myoporum sandwicense*, *Plumbago zeylanica*, *Psydrax odorata*, *Sicyos* sp. (anunu), or *Sida fallax* (HINHP Database 2001).

The major threats to *Schiedea kealiae* are competition with the nonnative plant species *Leucaena leucocephala*, *Panicum maximum*, and *Schinus terebinthifolius*; predation by introduced slugs and snails; lack of a pollinator; and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of existing occurrences. The Kaena Point occurrence is additionally threatened by naturally occurring rock slides and fire (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### *Silene perlmanii* (NCN)

*Silene perlmanii*, a member of the pink family (Caryophyllaceae), is a short-lived perennial plant with stems that are woody at the base. It usually is much branched from the base and often forms clumps. It is the only species of the genus on Oahu and can be distinguished from other *Silene* species by its white petals and a calyx that is

more than 19 mm (0.7 in) long and densely covered with short hairs (Wagner *et al.* 1999).

*Silene perlmanii* flowers in the spring, depending on climatic conditions. Flowers last for one day. Fruits develop in a few weeks. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Silene perlmanii* was discovered in the 1980s and was known from a few individuals in two occurrences in the southern Waianae Mountains on Federal and privately owned lands. The occurrences were about 1.6 km (1 mi) apart at Palikea and Palawai Gulch. Since December of 1997, no individuals are known to be extant in the wild. Currently, this species is known only from individuals under propagation at the National Tropical Botanical Garden (G. Koob, pers. comm. 2002; GDSI 2001; HINHP Database 2001; Service 1998b; 56 FR 55770).

*Silene perlmanii* typically grew on steep rocky slopes in *Acacia koa*-*Metrosideros polymorpha* lowland mesic forest at elevations between 493 and 919 m (1,617 and 3,014 ft) (HINHP Database 2001; Service 1998b; 56 FR 55770).

The major threats to *Silene perlmanii* are competition from the nonnative plant species *Ageratina adenophora*, *Erigeron karvinskianus*, *Melinis minutiflora*, *Morella faya*, *Passiflora suberosa*, and *Schinus terebinthifolius*; habitat degradation by feral pigs; and the risk of extinction from naturally occurring events and reduced reproductive vigor due to the small number of individuals believed to be extinct (HINHP Database 2001; Service 1998b; 56 FR 55770).

#### *Stenogyne kanehoana* (NCN)

*Stenogyne kanehoana* is a climbing vine in the mint family (Lamiaceae) with stems weakly four-angled, hairy, and 1 to 2 m (3 to 6 ft) long. *Stenogyne kanehoana* is distinguished from the only other member of the genus occurring on Oahu, *S. kaalae*, primarily by the size and color of its flowers. The flowers of *S. kanehoana* are large, white to yellow, and tipped in pink, while those of *S. kaalae* are small and deep purple (Weller and Sakai 1999).

*Stenogyne kanehoana* generally flowers from February through March, but flowering depends on precipitation, and flowers have been noted from January to as late as April. Fruits mature within six weeks. The lifespan of this species appears to be about seven to 12 years. Little else is known about its flowering cycles, pollination vectors,

seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Stenogyne kanehoana* was known from the east ridge of Puu Kanehoa in the Waianae Mountains, near the summit of the ridge connecting Puu Kanehoa with Puu Hapapa to the north and Puu Kaua to the south, a distance totaling approximately 2.8 km (1.7 mi). This population consisting of two plants near the summit of Puu Kanehoa on privately owned land was found dead recently. An additional occurrence in Kaluaa Gulch was discovered in 2000 by Joan Yoshioka of TNCH. This occurrence consists of one to six individual plants and is located on privately owned land (GDSI 2001; HINHP Database 2001; Service 1998b; 57 FR 20592).

The remnant occurrence of *Stenogyne kanehoana* is found in lowland mesic forest between 559 and 1,168 m (1,834 and 3,831 ft) elevation. Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Bidens* sp., *Chamaesyce* sp., *Cibotium* sp., *Freycinetia arborea*, *Metrosideros polymorpha*, *Psychotria* sp., or *Scaevola* sp. (HINHP Database 2001).

The major threats to *Stenogyne kanehoana* are habitat degradation and competition for space, water, light, and nutrients by the nonnative species *Clidemia hirta*, *Paspalum conjugatum*, *Passiflora suberosa*, *Psidium cattleianum*, and *Schinus terebinthifolius*. The extremely small number of individual plants and their restricted distribution increases the potential for extinction from naturally occurring events. Other potential threats that have been suggested include fire and deforestation, but, at present, these probably are not serious threats to the species. Habitat degradation by feral pigs, predation by the two spotted leafhopper, and trampling by hikers are also thought to be threats to this species (HINHP Database 2001; Service 1998b; 57 FR 20592).

#### *Tetramolopium filiforme* (NCN)

*Tetramolopium filiforme*, a short-lived perennial member of the aster family (Asteraceae), is a dwarf shrub from 5 to 15 cm (2 to 6 in) tall with complexly branched stems. This species is distinguished from the other extant species on Oahu by its separate male and female flowers both on the same plant and its inflorescence of one to four heads (Lowrey 1999).

In cultivation, *Tetramolopium filiforme* germinates in about three weeks. Fifteen weeks after germination, the plants are approximately 9 cm (3.5 in) high and produce their first buds.

The first blossoms are noted about 18 weeks after germination. During growth, an inflorescence forms at the apex of each shoot while new shoots develop laterally. *Tetramolopium filiforme* is relatively short-lived, usually living fewer than five years. In the wild, it usually flowers in the late winter or spring but flowering can also be induced by heavy rainfall. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Tetramolopium filiforme* was known from the northern Waianae Mountains, from Ohikilolo Ridge, Keaau Valley, and Makaha Valley. This species remains in Keaau Valley, Kahanahaiki Valley, Makua-Keaau Ridge, Lualualei, Waianae Kai, and Puu Kawiwi on Federal, State, city, and county lands. The 21 known occurrences are estimated to contain approximately 253 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Tetramolopium filiforme* typically grows on dry cliff faces and ridges in dry and mesic forests at elevations of 247 to 978 m (810 to 3,208 ft). Associated native species include *Artemisia australis*, *Bidens torta*, *Carex meyenii*, *Dodonaea viscosa*, *Peperomia tetraphylla* (ala ala wai nui), *Schiedea* sp., or *Sida fallax* (HINHP Database 2001).

The major threats to *Tetramolopium filiforme* are habitat degradation by feral goats; competition from the nonnative plant species *Acacia confusa*, *Ageratina riparia*, *Erigeron karvinskianus*, *Kalanchoe pinnata*, *Lantana camara*, *Leucaena leucocephala*, *Melinis minutiflora*, *Melinis repens*, and *Schinus terebinthifolius*; fire; potential impacts from military activities; trampling or collection by humans on or near trails; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining occurrences (HINHP Database 2001; Service 1998b).

#### *Tetraplasandra gymnocarpa* (Oheohe)

*Tetraplasandra gymnocarpa*, a long-lived perennial member of the ginseng family (Araliaceae), is a tree 2.5 to 10 m (8 to 33 ft) tall with 7 to 21 leathery, oval to elliptic leaflets per leaf. *Tetraplasandra gymnocarpa* is distinguished from all other species in the genus in that its ovary appears placed fully above the base of the flower (Lowrey 1999).

This species has been observed in flower in November 1991 and in fruit in May, September, and November. Little else is known about its flowering cycles,

pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Tetraplasandra gymnocarpa* was historically known from Punaluu, Waikakalaua Gulch, Mount Olympus, and the region between Niu and Wailupe, all in the Koolau Mountains of Oahu. This species was also sighted in the Waianae Range at Palikea in 1954. Currently, 30 occurrences are scattered along the summit ridges of the Koolau Mountains from the region of Paumalu at the northern extreme to Kuliouou and Waimanalo at the southeasternmost point, on Federal, State, city, and county lands. Fewer than 100 individuals are known (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Tetraplasandra gymnocarpa* is typically found on windswept summit ridges, on slopes, or in gullies in wet or sometimes mesic lowland forests and shrublands between elevations of 93 and 959 m (305 and 3,146 ft). Associated native plant species include *Acacia koa*, *Antidesma platyphyllum*, *Bidens* sp., *Bobea elatior*, *Broussaisia arguta*, *Cheirodendron* sp., *Cibotium chamissoi*, *Cibotium* spp., *Cyanea humboltiana*, *Dicranopteris linearis*, *Diplopterygium pinnatum*, *Dubautia laxa*, *Freycinetia arborea*, *Hedyotis fosbergii* (manono), *Hedyotis terminalis*, *Labordia* sp., *Lobelia hypoleuca* (kuhiaikamoowahie), *Machaerina angustifolia*, *Melicope* spp., *Metrosideros polymorpha*, *Myrsine fosbergii* (kolea), *Pouteria sandwicensis*, *Psychotria* spp., *Sadleria* spp., *Syzygium sandwicensis*, *Tetraplasandra oahuensis* (ohe mauka), or *Wikstroemia* sp. (HINHP Database 2001; Service 1998b; 59 FR 14482).

The major threats to *Tetraplasandra gymnocarpa* are competition with the nonnative plant species *Aleurites moluccana*, *Araucaria columnaris* (Norfolk Island pine), *Ardisia elliptica* (shoebuttan ardisia), *Axonopus fissifolius*, *Clidemia hirta*, *Erigeron karvinskianus*, *Eucalyptus* sp. (gum tree), *Paspalum conjugatum*, *Psidium cattleianum*, *Pterolepis glomerata*, *Sacciolepis indica*, and *Setaria palmifolia*; the two-spotted leafhopper; habitat degradation by feral pigs; and reduced reproductive vigor due to the species' limited gene pool as a consequence of the small number of extant individuals (HINHP Database 2001; Service 1998b; 59 FR 14482).

*Trematolobelia singularis* (NCN)

*Trematolobelia singularis*, a short-lived perennial member of the bellflower family (Campanulaceae), is

an unbranched shrub with stems 0.6 to 1.5 m (2 to 5 ft) long. This species differs from others of this endemic Hawaiian genus by the unbranched, erect flowering stalk (Lammers 1999).

This species has been observed in flower in October and has wind dispersed seeds. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

*Trematolobelia singularis* has been reported only from the southern Koolau Mountains. Approximately 165 plants are known from 3 occurrences at Moanalua-Tripler Ridge summit to Puu Keahiakahoe, Konahuanui, and Puu Lanipo. These occurrences are found on State and private lands (GDSI 2001; HINHP Database 2001).

This species usually grows on steep, windswept cliff faces or slopes in *Metrosideros polymorpha*-*Dicranopteris linearis* lowland wet shrubland from 545 to 953 m (1,788 to 3,126 ft) elevation. Associated native plant species include *Broussaisia arguta*, *Cibotium* sp., *Dubautia laxa*, *Eugenia* sp. (nioi), *Melicope* sp., *Sadleria* sp., or *Wikstroemia* sp. (HINHP Database 2001; Service 1998b; 61 FR 53089).

The major threats to *Trematolobelia singularis* are habitat degradation by feral pigs, potential predation by rats and slugs, competition with the aggressive nonnative plant species *Clidemia hirta*, and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of extant occurrences (HINHP Database 2001; Service 1998b; 61 FR 53089).

*Ureera kaalae* (Opuhe)

*Ureera kaalae*, a long-lived perennial member of the nettle family (Urticaceae), is a small tree or shrub 3 to 7 m (10 to 23 ft) tall. This species can be distinguished from the other Hawaiian species of the genus by its heart-shaped leaves (Wagner *et al.* 1999).

*Ureera kaalae* has been observed flowering in the spring. It is difficult to predict when seeds will be produced and they are often sterile. This may be an indication of pollinator limitation. The plants are fast-growing. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Ureera kaalae* was known from the central to southern windward Waianae Mountains, from Waianae Uka to Kupehau Gulch. This species now occurs only in North and South

Ekahanui, Pualii Gulch, Halona Gulch, Kaluaa Gulch, North and South Palawai, Puu Hapapa, Napepeiaulelo Gulch, and Waianae Kai on Federal, State, and private lands. The 12 known occurrences contain approximately 41 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Ureera kaalae* typically grows on slopes and in gulches in diverse mesic forest at elevations of 439 to 1,074 m (1,440 to 3,523 ft). Associated native species include *Alyxia oliviformis*, *Antidesma platyphyllum*, *Asplenium kaulfusii*, *Athyrium* sp., *Canavalia* sp., *Charpentiera* sp., *Chamaesyce* sp., *Claoxylon sandwicense*, *Diospyros hillebrandii*, *Doryopteris* sp., *Freycinetia arborea*, *Hedyotis acuminata*, *Hibiscus* sp., *Nestegis sandwicensis*, *Pipturus albidus*, *Pleomele* sp., *Pouteria sandwicensis*, *Psychotria* sp., *Senna gaudichaudii* (kolomona), *Streblus pendulinus*, *Ureera glabra*, or *Xylosma hawaiiense* (HINHP Database 2001; Service 1998b; Wagner *et al.* 1999; 61 FR 53089).

The major threats to *Ureera kaalae* are habitat degradation by feral pigs; competition from the nonnative plant species *Buddleia asiatica*, *Christella parasitica*, *Clidemia hirta*, *Heliconia popayaensis*, *Melinis minutiflora*, *Morella faya*, *Passiflora suberosa*, *Pimenta dioica*, *Psidium cattleianum*, *Psidium guajava*, *Rubus rosifolius*, and *Schinus terebinthifolius*; fire; rockslides; and a risk of extinction from naturally-occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HINHP Database 2001; Service 1998b; 61 FR 53089).

*Viola chamissoniana* ssp. *chamissoniana* (Pamakani)

*Viola chamissoniana* ssp. *chamissoniana*, a short-lived perennial member of the violet family (Violaceae), is a branched shrub up to 90 cm (3 ft) tall. This subspecies can be distinguished from the other members of the genus in the Waianae Mountains by the small size of its leaves (Wagner *et al.* 1999).

*Viola chamissoniana* ssp. *chamissoniana* has been observed in fruit and flower in April, August, and October. No further information is available on flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, or limiting factors (Service 1998b).

Historically, *Viola chamissoniana* ssp. *chamissoniana* was known from the central and southern Waianae Mountains and Makaleha Valley. This taxon now occurs on Kamaileunu Ridge,

Palikea Ridge (between Nanakuli and Lualualei), Puu Hapapa, Makuu-Keaau Ridge, Halona, and Puu Kumakalii on Federal, State, city, and county lands. The 15 known occurrences contain 59 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Viola chamissoniana* ssp. *chamissoniana* typically grows on dry cliffs, rocky ledges, and steep slopes in mesic shrubland and cliff vegetation at elevations of 414 to 1,149 m (1,358 to 3,769 ft). Associated native species include *Artemisia australis*, *Bidens torta*, *Carex meyenii*, *Chamaesyce* sp., *Dodonaea viscosa*, *Dubautia* sp., *Eragrostis* sp., *Leptecophylla tameiameia*, *Lipochaeta tenuis*, *Metrosideros polymorpha*, *Peperomia* sp., *Rumex* sp., *Schiedea* sp., or *Sida fallax* (HINHP Database 2001; Service 1998b; 56 FR 55770).

The major threats to *Viola chamissoniana* ssp. *chamissoniana* are habitat degradation by feral goats and pigs; competition from the nonnative plant species *Ageratina adenophora*, *Ageratina riparia*, *Erigeron karvinskianus*, *Melinis minutiflora*, *Morella faya*, and *Schinus terebinthifolius*; fire; landslides; and a risk of extinction from naturally-occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HINHP Database 2001; Service 1998b; 56 FR 55770).

#### *Viola oahuensis* (NCN)

*Viola oahuensis*, a short-lived perennial member of the violet family (Violaceae), is usually an erect, unbranched subshrub 6 to 40 cm (2.4 to 16 in) tall. This species is distinguished from other Hawaiian members of the genus by the shape of the stipules (leaf bracts), the length of the leaf stalks, and the length and papery texture of the leaves (Wagner *et al.* 1999).

*Viola oahuensis* has been observed flowering in August and September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Viola oahuensis* was known from 17 occurrences in the Koolau Mountains of Oahu, scattered over about a 37 km (23 mi) distance from Puu Kainapuaa to Palolo. The 18 extant occurrences, which total fewer than 200 individuals, are now found from the Kawainui-Koloa summit divide to the Waimalu-Koolau-poko divide on Federal, State, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Viola oahuensis* is generally found on exposed, windswept ridges of moderate to steep slope in wet *Metrosideros polymorpha*-*Dicranopteris linearis* shrublands and *Metrosideros polymorpha* mixed montane bogs in the cloud zone from 415 to 959 m (1,361 to 3,146 ft) elevation. This species typically grows among wind-stunted *Antidesma* sp., *Bidens macrocarpa*, *Broussaisia arguta*, *Cibotium* sp., *Dubautia laxa*, *Hedyotis terminalis*, *Labordia* sp., *Machaerina* sp., *Melicope* sp., *Sadleria* sp., *Syzygium sandwicensis*, *Vaccinium* sp., or *Wikstroemia* sp. (HINHP Database 2001; Service 1998b; 61 FR 53089).

The primary threats to *Viola oahuensis* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with the nonnative plants *Axonopus fissifolius*, *Clidemia hirta*, *Paspalum conjugatum*, *Psidium cattleianum*, and *Pterolepis* sp. (NCN); and risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of occurrences (HINHP Database 2001; Service 1998b; 61 FR 53089).

#### Multi-Island Species

##### *Adenophorus periens* (Pendent kihi fern)

*Adenophorus periens*, a member of the grammitis family (Grammitidaceae) and a short-lived perennial, is a small, pendent, epiphytic (not rooted on the ground) fern. This species differs from other species in this endemic Hawaiian genus by having hairs along the pinna margins, by the pinnae being at right angles to the midrib axis, by the placement of the sori on the pinnae, and by the degree of dissection of each pinna (Linney 1989).

Little is known about the life history of *Adenophorus periens*, which seems to grow only in closed canopy dense forest with high humidity. Its breeding system is unknown, but outbreeding is very likely to be the predominant mode of reproduction. Spores are dispersed by wind, possibly by water, and perhaps on the feet of birds or insects. Spores lack a thick resistant coat, which may indicate their longevity is brief, probably measured in days at most. Due to the weak differences between the seasons in the habitats where this species is found, there seems to be no evidence of seasonality in growth or reproduction. Additional information on reproductive cycles, longevity, specific environmental requirements, and limiting factors is not available (Linney 1989).

Historically, *Adenophorus periens* was known from Kauai, the Koolau Mountains of Oahu, Lanai, Maui, and the island of Hawaii. Currently, it is known from several locations on Kauai, Molokai, and Hawaii. This species is no longer extant on the island of Oahu. It was collected in 1909 on the west ridge of Palolo Crater and the west ridge of Palolo Valley (HINHP Database 2001).

*Adenophorus periens* grows epiphytically on trees in *Metrosideros polymorpha* and *Metrosideros rugosa* wet forests between 309 and 867 m (1,014 and 2,844 ft) elevation. Associated native plant species include *Cheirodendron* spp., *Cibotium* sp., *Dicranopteris linearis*, *Hedyotis terminalis*, *Machaerina angustifolia*, or *Syzygium sandwicensis* (HINHP Database 2001).

Nothing is known of the threats to *Adenophorus periens* on Oahu because the species was last collected there in 1909 (Service 1999; 59 FR 56333).

##### *Alectryon macrococcus* (Mahoe)

*Alectryon macrococcus*, a member of the soapberry family (Sapindaceae), consists of two varieties, *macrococcus* and *auwahiensis*, both trees with reddish-brown branches and leaves with one to five pairs of sometimes asymmetrical egg-shaped leaflets. On leaves of young *A. macrococcus* var. *macrococcus* plants, the underside of the leaf has dense brown hairs.

*Alectryon macrococcus* var. *auwahiensis* is only found on the island of Maui. The only member of its genus found in Hawaii, this species is distinguished from other Hawaiian members of its family by being a tree with a hard fruit 2.5 cm (1 in) or more in diameter (Wagner *et al.* 1999).

*Alectryon macrococcus* is a relatively slow-growing, long lived tree that grows in xeric to mesic sites and is adapted to periodic drought. Little else is known about the life history of this species. Flowering cycles, pollination vectors, seed dispersal agents, and specific environmental requirements are unknown (Service 1997).

Currently and historically, *Alectryon macrococcus* var. *macrococcus* occurs on Kauai, Oahu, Molokai, and Maui. On Oahu, there are a total of 82 occurrences containing around 300 individuals. These occurrences are found in Kapuna Gulch, Huliwai Gulch, Kaluaa Gulch, Ekahanui Gulch, Manuwai Gulch, Mohiakea Gulch, Makuu Valley, Puu Ku Makalii, Nanakuli-Lualualei Ridge, Palikea Gulch, Makaha, Pahole Gulch, Makaleha Valley, Waianae Kai, Waieli Gulch, Kaluakauila Gulch, Kaaua Gulch, Puu Hapapa, Mikilua subdistrict, Kaaawa Gulch, and Napepeiauolelo



Gulch on Federal, State, city, county, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001; Wagner *et al.* 1999; EDA, *in litt.* 2001).

*Alectryon macrococcus* var. *macrococcus* grows on slopes or ridges, or in gulches, within mesic lowland forests between elevations of 367 and 941 m (1,204 and 3,086 ft). Associated native plant species include *Alyxia oliviformis*, *Antidesma platyphyllum*, *Canavalia* sp., *Charpentiera* sp., *Claoxylon sandwicense*, *Diospyros hillebrandii*, *Diospyros sandwicensis*, *Diplazium sandwichianum*, *Elaeocarpus bifidus*, *Hibiscus arnottianus*, *Metrosideros polymorpha*, *Myrsine lanaiensis*, *Neraudia* sp., *Nestegis sandwicensis*, *Pipturus albidus*, *Pisonia sandwicensis*, *Pisonia umbellifera*, *Pouteria sandwicensis*, *Psychotria hathewayi*, *Psydrax odorata*, *Streblus pendulinus*, or *Xylosma* sp. (HINHP Database 2001).

The threats to *Alectryon macrococcus* var. *macrococcus* on Oahu are habitat degradation by feral goats and pigs; competition with the nonnative plant species *Aleurites moluccana*, *Blechnum appendiculatum*, *Buddleia asiatica*, *Christella parasitica*, *Clidemia hirta*, *Heliocarpus popayanensis*, *Lanata camara*, *Melinis minutiflora*, *Oplismenus hirtellus*, *Passiflora suberosa*, *Pennisetum clandestinum* (kikuyu grass), *Psidium cattleianum*, *Psidium guajava*, *Rubus rosifolius*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; damage from the black twig borer; seed predation by rats, mice (*Mus domesticus*), and insects; fire; depressed reproductive vigor; loss of pollinators; and, due to the very small remaining number of individuals and their limited distribution, a single natural or human-caused environmental disturbance, which could easily be catastrophic (Service 1997; 57 FR 20772).

#### *Bonamia menziesii* (NCN)

*Bonamia menziesii*, a member of the morning-glory family (Convolvulaceae) and a short-lived perennial, is a vine with twining branches that are fuzzy when young. This species is the only member of the genus that is endemic to the Hawaiian Islands and differs from other genera in the family by its two styles, longer stems and petioles, and rounder leaves (Austin 1999).

Little is known about the life history of *Bonamia menziesii*. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1999).

Historically, *Bonamia menziesii* was known from Kauai, the Waianae Mountains of Oahu, Molokai, Maui, and the island of Hawaii. Currently, this species is extant on Kauai, Oahu, Lanai, Maui, and Hawaii. There are 18 total occurrences on Oahu, containing a total of fewer than 100 plants. These occurrences are found in Niu Valley, Makaleha Valley, Makua-Keaau Ridge, Wailupe, Waialae Nui-Kapakahi Ridge and Kapakahi Gulch, Kaluakauila Gulch, Keawaula, Hawaii Loa Ridge and Kului Gulch, Nanakuli Valley, Kuaokala, Halona, Waialae Iki, Kapuna Gulch, Mikilua, Waianae Kai, and Alaihehe Gulch on Federal, State, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Bonamia menziesii* is found on Oahu on steep slopes or level ground in dry or mesic forest in open or closed canopy at elevations between 31 and 809 m (102 and 2,654 ft). Associated native species include *Acacia koa*, *Alyxia oliviformis*, *Dianella sandwicensis*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Erythrina sandwicensis*, *Hedyotis terminalis*, *Leptecophylla tameiameiae*, *Melicope* sp., *Metrosideros polymorpha*, *Myoporum sandwicense*, *Nestegis sandwicensis*, *Pisonia* sp., *Pittosporum* sp., *Pleomele* sp., *Pouteria sandwicensis*, *Psydrax odorata*, *Rauvolfia sandwicensis*, *Sapindus oahuensis*, *Sicyos* sp., *Sida fallax*, or *Waltheria indica* (HINHP Database 2001; Service 1999).

The primary threats to *Bonamia menziesii* on Oahu are habitat degradation and possible predation by wild and feral pigs, goats, and cattle; competition with the nonnative plant species *Aleurites moluccana*, *Grevillea robusta*, *Hyptis pectinata*, *Kalanchoe pinnata*, *Lantana camara*, *Leucaena leucocephala*, *Melia azedarach*, *Montanoa hibiscifolia*, *Panicum maximum*, *Passiflora suberosa*, *Pennisetum setaceum* (fountain grass), *Pimenta dioica*, *Psidium cattleianum*, *Rivina humilis*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; fire; and nonnative insect (*Physomerus grossipes*); and potential impacts from military activities (HINHP Database 2001; Service 1999; 59 FR 56333).

#### *Cenchrus agrimonioides* (Kamanomano)

*Cenchrus agrimonioides*, a member of the grass family (Poaceae) and a short-lived perennial, has leaf blades that are flat or folded and that have a prominent midrib. There are two varieties, *C. agrimonioides* var. *laysanensis* and *C. agrimonioides* var. *agrimonioides*. They differ from each other in that var. *agrimonioides* has smaller burs, shorter stems, and narrower leaves. This species

is distinguished from others in the genus by the cylindrical to lance-shaped bur and the arrangement and position of the bristles (O'Conner 1999).

Little is known about the life history of *Cenchrus agrimonioides*. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors, except that this species has been observed to produce fruit year-round (Service 1999; 65 FR 53108).

Historically, *Cenchrus agrimonioides* var. *agrimonioides* was known from the Waianae Mountains of Oahu, Lanai, Maui, and an undocumented account from the island of Hawaii. *Cenchrus agrimonioides* var. *laysanensis* was historically and currently only known from the Northwest Hawaiian Islands. Currently, *Cenchrus agrimonioides* var. *agrimonioides* is known from Oahu and Maui; on Oahu from a total of 7 occurrences containing between 113 and 118 individuals. These occurrences are found in Pahole Gulch, on Makaha-Waianae Kai Ridge, in or near Kahanahaiki Gulch, in east Makaleha, Puu Kaua, Huliwai Gulch, and in Pualii drainage, on Federal, State, city, county, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001; Service 1999; 61 FR 53108).

*Cenchrus agrimonioides* var. *agrimonioides* on Oahu is usually found on dry upper slopes or ridges in lowland mixed mesic forest at elevations between 357 and 890 m (1,171 and 2,919 ft). Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Bobea* sp., *Carex wahuensis*, *Chamaesyce multiformis*, *Coprosma foliosa*, *Diospyros sandwicensis*, *Eragrostis variabilis*, *Gahnia beecheyi* (NCN), *Leptecophylla tameiameiae*, *Metrosideros polymorpha*, *Nestegis sandwicensis*, *Psydrax odorata*, or *Psychotria* sp. (HINHP Database 2001; EDA, *in litt.* 2001).

The major threats to *Cenchrus agrimonioides* var. *agrimonioides* on Oahu are habitat degradation and/or destruction by feral pigs; competition with the nonnative plant species *Ageratina riparia*, *Blechnum appendiculatum*, *Casuarina* sp., *Clidemia hirta*, *Grevillea robusta*, *Paspalum conjugatum*, *Passiflora suberosa*, *Psidium cattleianum*, *Rubus argutus*, and *Schinus terebinthifolius*; trampling and fire from military activities; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of existing individuals (HINHP Database 2001; Service 1999; 61 FR 53108).



*Centaurium sebaeoides* (Awiwi)

*Centaurium sebaeoides*, a member of the gentian family (Gentianaceae), is an annual herb with fleshy leaves and stalkless flowers. This species is distinguished from *C. erythraea* (bitter herb), which is naturalized in Hawaii, by its fleshy leaves and the unbranched arrangement of the flower cluster (Wagner *et al.* 1999).

*Centaurium sebaeoides* has been observed flowering in April. Flowering may be induced by heavy rainfall. Occurrences are found in dry areas, and plants are more likely to be found following heavy rains. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (56 FR 55770).

Historically and currently, *Centaurium sebaeoides* is known from Kauai, Oahu, Molokai, Lanai, and Maui. Currently on Oahu, 2 occurrences of this species remain with a total of between 60 and 80 individuals at Kaena Point and Koko Head on State, city, and county lands (HINHP Database 2001; Service 1999; Wagner *et al.* 1999).

*Centaurium sebaeoides* typically grows in volcanic or clay soils or on cliffs in arid coastal areas or on coral plains below 368 m (1,207 ft) elevation. Associated native species include *Artemisia* sp., *Bidens* sp., *Jacquemontia ovalifolia*, *Lipochaeta succulenta* (nehe), or *Lysimachia* sp. (kolokolo kuahiwi) (HINHP Database 2001; Wagner *et al.* 1999; 56 FR 55770).

The major threats to *Centaurium sebaeoides* on Oahu are habitat degradation by feral goats and cattle, competition from the nonnative plant species *Leucaena leucocephala*, trampling by humans on or near trails, fire, and a risk of extinction from naturally occurring events due to the small number of existing occurrences and individuals (56 FR 55770; Service 1999).

*Colubrina oppositifolia* (Kauila)

*Colubrina oppositifolia*, a member of the buckthorn family (Rhamnaceae) and a long-lived perennial, is a tree with extremely hard red wood. This species is readily distinguished from the other species in Hawaii by its opposite leaf position, dull leaf surface, and entire leaf margins (Wagner *et al.* 1999).

*Colubrina oppositifolia* has been observed in flower during January, June, September, and December and in fruit during January, June, and September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific

environmental requirements, and limiting factors (HINHP Database 2001).

Historically and currently, *Colubrina oppositifolia* was known from Oahu, Maui, and the island of Hawaii. Currently, there is a total of 5 occurrences containing 61 individuals on Oahu. These occurrences are found in Kaumokunui Gulch, Makaleha Valley, and Manuwai Gulch on State and private lands (GDSI 2001; HINHP Database 2001).

*Colubrina oppositifolia* is found in lowland dry and mesic forests dominated by *Diospyros sandwicensis* at elevations between 277 and 761 m (909 and 2,496 ft). Associated native species include *Alyxia oliviformis*, *Nestegis sandwicensis*, *Psydrax odorata*, *Reynoldsia sandwicensis*, or *Sapindus oahuensis* (HINHP Database 2001).

The threats to this species on Oahu are habitat destruction by feral pigs and goats; competition with the nonnative plant species *Aleurites moluccana*, *Lantana camara*, *Pennisetum setaceum*, *Psidium cattleianum*, *Schinus terebinthifolius*, and *Syzygium cumini*; damage from the black twig borer and Chinese rose beetle; fire; potential impacts from military activities; and a risk of extinction from naturally occurring events due to the small number of existing occurrences and individuals (HINHP Database 2001; Service 1996c; 59 FR 10305).

*Ctenitis squamigera* (Pauoa)

*Ctenitis squamigera*, a short-lived member of the woodfern family (Aspleniaceae), has a rhizome creeping above the ground that is densely covered with scales similar to those on the lower part of the leaf stalk. It can be readily distinguished from other Hawaiian species of *Ctenitis* by the dense covering of tan-colored scales on its frond (Degener and Degener 1957; Wagner and Wagner 1992).

Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors for *Ctenitis squamigera* (Service 1998a).

Historically, *Ctenitis squamigera* was recorded from Kauai, the Koolau and Waianae Mountains of Oahu, Molokai, Maui, and the island of Hawaii. This species is currently extant on Oahu, Molokai, Lanai, and Maui. Currently on Oahu, 8 occurrences with more than 80 individuals are found in Makaleha Valley, Kaaawa Gulch, Makua Valley, and Waianae Kai Forest Reserve on Federal, State, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Ctenitis squamigera* is found on gentle to steep slopes in *Metrosideros polymorpha-Diospyros sandwicensis* mesic forest and diverse mesic forest at elevations of 387 to 923 m (1,269 to 3,027 ft). Associated native plant taxa include *Alyxia oliviformis*, *Carex meyenii*, *Diospyros hillebrandii*, *Dodonaea viscosa*, *Doodia kunthiana*, *Dryopteris unidentata*, *Freycinetia arborea*, *Hibiscus* sp., *Myrsine* sp., *Nestegis sandwicensis*, *Pisonia* sp., *Pouteria sandwicensis*, *Psychotria* sp., *Psydrax odorata*, or *Xylosma* sp. (HINHP Database 2001).

The primary threats to *Ctenitis squamigera* on Oahu are habitat degradation by feral pigs and goats; competition with the nonnative plant species *Ageratina riparia*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Clidemia hirta*, *Psidium cattleianum*, *Psidium guajava*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; fire; and decreased reproductive vigor and a risk of extinction caused by naturally occurring events due to the small number of existing occurrences (HINHP Database 2001; Service 1998; 59 FR 49025).

*Cyanea grimesiana* ssp. *grimesiana* (Haha)

*Cyanea grimesiana* ssp. *grimesiana*, a member of the bellflower family (Campanulaceae) and a short-lived perennial, is a shrub with pinnately divided leaves. This species is distinguished from others in this endemic Hawaiian genus by the pinnately lobed leaf margins and the width of the leaf blades. This subspecies is distinguished from the other two subspecies by the shape and size of the calyx lobes, which overlap at the base (Lammers 1999).

On Molokai, flowering plants have been reported in July and August. Little else is known about the life history of *Cyanea grimesiana* ssp. *grimesiana*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Currently and historically, *Cyanea grimesiana* ssp. *grimesiana* is known from the Waianae and Koolau Mountains on Oahu, Molokai, Lanai, and Maui. On Oahu, there are seven occurrences known from Palikea Gulch, North Haleauau Gulch, Pahole Natural Area Reserve (NAR), Pia Gulch, Kului Gulch, and in Waialae Iki-Kapakahi on Federal, State, city, county, and private lands containing a total of nine individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Cyanea grimesiana* ssp. *grimesiana* is typically found in mesic forest often dominated by *Metrosideros polymorpha* or *M. polymorpha* and *Acacia koa*, or on rocky or steep slopes of stream banks, at elevations between 114 and 746 m (374 and 2,447 ft). Associated native plant species include *Alyxia oliviformis*, *Antidesma* sp., *Bobea* sp., *Clermontia persicaefolia* (oha wai), *Coprosma* sp., *Cyanea angustifolia* (haha), *Dicranopteris linearis*, *Diplazium sandwichianum*, *Joinvillea* sp. (ohe), *Melicope* sp., *Myrsine* sp., *Nestegis sandwicensis*, *Psychotria* sp., *Syzygium sandwicensis*, or *Xylosma* sp. (Service 1999; 61 FR 53108).

The threats to *Cyanea grimesiana* ssp. *grimesiana* on Oahu are habitat degradation and/or destruction caused by wild and feral goats and pigs; competition with the nonnative plant species *Clidemia hirta*, *Psidium cattleianum*, and *Toona ciliata*; random naturally occurring events creating a risk of extinction due to the small number of existing individuals; fire; trampling by hikers and/or military activities; landslides; and predation by rats and various species of slugs (Service 1999; 61 FR 53108).

#### *Cyperus trachysanthos* (Puukaa)

*Cyperus trachysanthos*, a member of the sedge family (Cyperaceae), is a short-lived, perennial, grass-like plant with a short rhizome. The stems are densely tufted, obtusely triangular in cross-section, tall, sticky, and leafy at the base. This species is distinguished from others in the genus by the short rhizome, the leaf sheath with partitions at the nodes, the shape of the glumes, and the length of the stems (Koyama 1999).

Little is known about the life history of *Cyperus trachysanthos*. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1999).

Historically, *Cyperus trachysanthos* was known from Niihau, Kauai, scattered locations on Oahu, Molokai, and Lanai. This species is now extant on Niihau, Kauai, and Oahu. On Oahu, it is known from Kaena Point NAR, nearby Manini Gulch, Diamond Head, Makapuu, Queens Beach, and the Kawainui Marsh area, on Federal, State, and private lands. There are 6 occurrences with a total of 40 individuals on Oahu (HINHP Database 2001; Service 1999).

*Cyperus trachysanthos* is usually found in seasonally wet sites (mud flats, wet clay soil, seasonal ponds, or wet cliff seeps) on seepy flats, coastal cliffs,

or talus slopes at elevations between 6 and 194 m (609 ft). *Hibiscus tiliaceus* (hau) is often found in association with this species (HINHP Database 2001; Koyama 1999; Service 1999; 61 FR 53108).

The threats to *Cyperus trachysanthos* on Oahu are a risk of extinction from naturally-occurring events due to the small number of occurrences; competition with nonnative plant species; habitat degradation by feral goats; fire; habitat disturbance by off-road vehicles; pumping of wetlands for flood and mosquito control; modifications to the wetland topography; mowing; herbicide application; and run-off from nearby Hawaii Army National Guard (HIARNG) activities such as the cleaning of vehicles, dumping of paints or thinners, or the use of pesticides (Service 1999; 61 FR 53108).

#### *Diellia erecta* (Aspenium-leaved diellia)

*Diellia erecta*, a member of the spleenwort family (Aspleniaceae) and a short-lived perennial, is a fern that grows in tufts of three to nine lance shaped fronds that emerge from a rhizome covered with brown to dark gray scales. This species differs from other members of the genus in having larger brown or dark gray scales, fused or separate sori along both margins of the pinna, shiny black midribs that have a hardened surface, and veins that do not usually encircle the sori (Degener and Greenwell 1950; Wagner 1952).

Little is known about the life history of *Diellia erecta*. Reproductive cycles, dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Diellia erecta* was known from Kauai, the Koolau Mountains on Oahu, Molokai, Lanai, Maui, and the island of Hawaii. Currently, it is known from Kauai, Molokai, Maui, Oahu, and Hawaii. On Oahu, it is known from a single occurrence containing at least 20 plants on Hawaii Loa Ridge on State and private lands (GDSI 2001; HINHP Database 2001).

*Diellia erecta* is found on moderate to steep gulch slopes or sparsely vegetated rock faces in mesic forest at elevations between 118 and 550 m (387 and 1,804 ft). Associated native plant species include *Coprosma* sp., *Dodonaea viscosa*, *Dryopteris unidentata*, *Myrsine* sp., *Psychotria* sp., *Psydrax odorata*, *Sapindus oahuensis*, *Syzygium sandwicensis*, or *Wikstroemia* sp. (HINHP Database 2001; Service 1999).

The major threats to *Diellia erecta* on Oahu are habitat degradation by pigs; competition with nonnative plant

species, including *Blechnum appendiculatum*, *Clidemia hirta*, *Cordyline fruticosa* (ti), *Oplismenus hirtellus*, *Phymatosorus grossus* (lauae), *Psidium cattleianum*, *Schefflera actinophylla*, and *Schinus terebinthifolius*; and random naturally-occurring events causing extinction and/or reduced reproductive vigor due to the small number of occurrences and existing individuals (HINHP Database 2001; Service 1999; 59 FR 56333).

#### *Diplazium molokaiense* (NCN)

*Diplazium molokaiense*, a short-lived perennial member of the woodfern family (Dryopteridaceae), has a short prostrate rhizome and green or straw colored leaf stalks with thin-textured fronds. This species can be distinguished from other species of *Diplazium* in the Hawaiian Islands by a combination of characteristics, including venation pattern, the length and arrangement of the sori, frond shape, and the degree of dissection of the frond (Wagner and Wagner 1992).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors for *Diplazium molokaiense* are unknown (Service 1998a).

Historically, *Diplazium molokaiense* was found at Makaleha and Schofield Barracks on Oahu, Kauai, Molokai, Lanai, and Maui. However, within the last 20 years, only one occurrence of one individual has been recorded from East Maui. This species was last collected on Oahu in 1945 from Kolekole Pass to Kaala (HINHP Database 2001).

*Diplazium molokaiense* on Oahu was found on steep, rocky, wooded gulch walls in wet forests from 618 to 1,202 m (2,027 to 3,943 ft) elevation (HINHP Database 2001).

Nothing is known of the threats to *Diplazium molokaiense* because this species was last collected there in 1945.

#### *Eugenia koolauensis* (Nioi)

*Eugenia koolauensis*, a long-lived perennial member of the myrtle family (Myrtaceae), is a small tree or shrub between 2 and 7 m (7 and 23 ft) tall with branch tips covered with dense brown hairs. *Eugenia koolauensis* is one of two species in the genus that are native to Hawaii. It differs from the other species in having leaves that are densely hairy on the lower surface and leaf margins that curve under the leaves (Wagner et al. 1999).

This species has been observed in flower from February to December. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific

environmental requirements, and limiting factors (Service 1998b).

*Eugenia koolauensis* was historically known from Molokai and from Kaipapau Valley, Hanaimoa and Kahawainui Gulches, and a gully southeast of Kahuku on Oahu. Currently, this species is only found on Oahu in 12 occurrences on Federal, State, and private lands in Hanaimoa, Papali, Kaleleiki, Aimuu, Kaunala, Pahipahialua, Oio, and Palikea Gulches. A total of fewer than 70 individuals occur on Oahu (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Eugenia koolauensis* is found on gentle to steep slopes or ridges in mesic or dry forests dominated by *Metrosideros polymorpha* or *Diospyros* sp. from 57 to 437 m (187 to 1,433 ft) in elevation. Other associated native plant species include *Alyxia oliviformis*, *Bobea elatior*, *Carex meyenii*, *Dicranopteris linearis*, *Leptecophylla tameiameia*, *Myrsine lessertiana*, *Nestegis sandwicensis*, *Pleomele halapepe*, *Pouteria sandwicensis*, *Psydrax odorata*, or *Rauvolfia sandwicensis* (HINHP Database 2001; Service 1998b).

The major threats to *Eugenia koolauensis* on Oahu are habitat degradation by feral pigs; competition with nonnative plant species such as *Acacia confusa*, *Aleurites moluccana*, *Araucaria columnaris*, *Ardisia elliptica*, *Casuarina equisetifolia*, *Clidemia hirta*, *Cordyline fruticosa*, *Eucalyptus* sp., *Grevillea robusta*, *Hyptis pectinata*, *Lantana camara*, *Melia azedarach*, *Oplismenus hirtellus*, *Panicum maximum*, *Passiflora laurifolia* (yellow granadilla), *Passiflora suberosa*, *Psidium cattleianum*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; and the limited numbers of this species, which make it vulnerable to extinction due to naturally caused events and reduced reproductive vigor (HINHP Database 2001; 59 FR 14482).

#### *Euphorbia haeleeleana* (Akoko)

*Euphorbia haeleeleana*, a member of the spurge family (Euphorbiaceae) and a short-lived perennial, is a dioecious (female and male flowers on separate plants) tree 3 to 14 m (10 to 46 ft) tall. This species is distinguished from others in the genus in that it is a tree and by the large leaves with prominent veins (Wagner *et al.* 1999).

Individual trees of *Euphorbia haeleeleana* bear only male or female flowers and must be cross-pollinated from a different tree to produce viable seed. This species sets fruit between August and October. Little else is known about its flowering cycles,

pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1999; Wagner *et al.* 1999).

*Euphorbia haeleeleana* is known historically and currently from northwestern Kauai and the Waianae Mountains of Oahu. On Oahu, 8 occurrences of approximately 134 individuals are known from Keawaula Gulch, Kahanahaiki Valley, Kaumokunui-Kaumokuiki Ridge, and Alaieihe Gulch on Federal, State, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Euphorbia haeleeleana* on Oahu is usually found in dry forest that is often dominated by *Diospyros* sp. at elevations between 156 and 586 m (512 and 1,922 ft). Associated native plant species include *Dodonaea viscosa*, *Erythrina sandwicensis*, *Pleomele* sp., *Psydrax odorata*, *Reynoldsia sandwicensis*, or *Sapindus oahuensis* (HINHP Database 2001).

The main threats to *Euphorbia haeleeleana* on Oahu are habitat degradation and/or destruction by wild and feral goats and pigs; predation by rats; fire; potential impacts from military activities; and competition with the nonnative plant species *Aleurites moluccana*, *Caesalpinia decapetala* (wait-a-bit), *Coffea arabica*, *Digitaria insularis* (sourgrass), *Ficus microcarpa*, *Gavillea robusta*, *Hyptis pectinata*, *Kalanchoe pinnata*, *Lantana camara*, *Leucaena leucocephala*, *Melia azedarach*, *Melinis minutiflora*, *Panicum maximum*, *Passiflora suberosa*, *Psidium cattleianum*, *Rivina humilis*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata* (HINHP Database 2001).

#### *Flueggea neowawraea* (Mehamehame)

*Flueggea neowawraea*, a member of the spurge family (Euphorbiaceae) and a long-lived perennial, is a large dioecious tree up to 30 m (100 ft) tall with white oblong pores covering its scaly, pale brown bark. This species is the only member of the genus found in Hawaii and can be distinguished from similar Hawaiian species in the family by its hairless, whitish lower leaf surfaces and round fruits (Hayden 1999; Service 1999).

Individual trees of *Flueggea neowawraea* bear only male or female flowers and must be cross-pollinated from a different tree to produce viable seed. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Hayden 1999; Service 1999).

Historically, *Flueggea neowawraea* was known from Oahu, Kauai, Maui, Molokai, and the island of Hawaii. Currently, it is known from Kauai, Oahu, Maui, and Hawaii. On Oahu, *Flueggea neowawraea* is known from 23 occurrences with a total of approximately 31 individuals on Federal, State, city, county, and private lands at Makua Valley, Makaha, Alaiheihe Gulch, Kaluaa Gulch, Makaleha Valley, Ekahanui Gulch, Pahole Gulch, Keaau Valley, Kahanahaiki Valley, Kaaawa Gulch, Waianae Kai, Palikea Gulch, Manuwai Gulch, Mohiaka Gulch, Kauhiuhi, Mikilua, and Lualualei (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Flueggea neowawraea* occurs on gulch slopes or ridge crests, or near streams, in dry or mesic forest at elevations of 323 to 1,006 m (1,059 to 3,300 ft). Associated native plant species include *Alyxia oliviformis*, *Antidesma platyphyllum*, *Antidesma pulvinatum*, *Bobea* sp., *Chamaesyce herbstii*, *Chamaesyce multifloris*, *Charpentiera* sp., *Claoxylon sandwicensis*, *Diospyros hillebrandii*, *Diospyros sandwicense*, *Erythrina sandwicensis*, *Hedyotis terminalis*, *Hibiscus arnottianus*, *Metrosideros polymorpha*, *Morinda trimera* (noni), *Myoporum sandwicense*, *Myrsine* sp., *Nestegis sandwicensis*, *Pipturus albidus*, *Pisonia sandwicensis*, *Pisonia umbellifera*, *Pittosporum* sp., *Pleomele* sp., *Psydrax odorata*, *Pteralyxia* sp., *Rauvolfia sandwicensis*, *Sapindus oahuensis*, and *Streblus pendulina* (Hayden 1999; HINHP Database 2001).

The primary threat to the continued existence of *Flueggea neowawraea* on Oahu is the black twig borer, which has affected all known *Flueggea neowawraea* plants. Other major threats include habitat degradation by feral pigs and goats; competition with the nonnative plant species *Ageratina riparia*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Clidemia hirta*, *Ficus macrophylla*, *Ficus microcarpa*, *Grevillea robusta*, *Kalanchoe pinnata*, *Lantana camara*, *Melinis minutiflora*, *Paspalum conjugatum*, *Passiflora suberosa*, *Psidium* spp., *Rivina* sp., *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; fire; predation by the Chinese rose beetle; the small occurrence size with its limited gene pool and depressed reproductive vigor, compounded by a requirement for cross-pollination because the species is dioecious; potential impacts from military activities; and predation of the fruit by rats (HINHP Database 2001; Service 1999).

*Gouania meyenii* (NCN)

*Gouania meyenii*, a member of the buckthorn family (Rhamnaceae) and a short-lived perennial, is an erect to spreading shrub. It is distinguished from the two other Hawaiian members of its genus by its lack of tendrils on flowering branches, the lack of teeth on the leaves, and the hairiness of the fruits (Wagner *et al.* 1999).

*Gouania meyenii* flowers from March to May. Seed capsules develop in about six to eight weeks. Plants appear to live about 10 to 18 years in the wild. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Gouania meyenii* was known from central and southern areas of Oahu's Waianae Mountains, from Kamaileunu Ridge to Honouliuli and from Diamond Head. Currently, this species is found on Oahu and Kauai. On Oahu, it is found on Makaha-Waianae Kai Ridge on State, private, city, and county lands. The 4 known occurrences on Oahu contain an estimated 63 individuals (GDSI 2001; HINHP Database 2001; Wagner *et al.* 1999).

*Gouania meyenii* typically grows on moderate to steep slopes in dry shrubland or mesic lowland forest at elevations of 17 to 930 m (56 to 3,050 ft). Associated native plant species include *Alyxia oliviformis*, *Bidens* sp., *Canavalia* sp., *Carex meyenii*, *Chamaesyce* sp., *Charpentiera* sp., *Diospyros sandwicensis*, *Diospyros* sp., *Dodonaea viscosa*, *Dryopteris unidentata*, *Dubautia sherffiana*, *Eragrostis* sp., *Hedyotis* sp., *Hibiscus* sp., *Lysimachia* sp., *Melicope* sp., *Myrsine* sp. (kolea), *Nestegis sandwicensis*, *Pisonia* sp., *Psychotria* sp., *Psydrax odorata*, *Sapindus oahuensis*, *Schiedea* sp., *Senna gaudichaudii*, *Sida fallax*, or *Sophora chrysophylla* (HINHP Database 2001).

The major threats to *Gouania meyenii* on Oahu are competition from the nonnative plant species *Grevillea robusta*, *Kalanchoe pinnata*, *Lantana camara*, *Leucaena leucocephala*, *Melinis minutiflora*, *Oplismenus hirtellus*, *Pimenta dioica*, *Psidium cattleianum*, *Psidium guajava*, and *Schinus terebinthifolius*; fire; habitat degradation by feral pigs and goats; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining occurrences and individuals (HINHP Database 2001).

*Gouania vitifolia* (NCN)

*Gouania vitifolia*, a short-lived member of the buckthorn family

(Rhamnaceae), is a climbing shrub or woody vine with tendrils. The species is the only Hawaiian member of the genus with tendrils and toothed leaf margins (Wagner *et al.* 1999).

*Gouania vitifolia* flowers from March to May. Seed capsules develop in about six to eight weeks. Plants appear to live about 10 to 18 years in the wild. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Gouania vitifolia* was known from Maui, the island of Hawaii, and the northwestern portion of the Waianae Mountains in Makaleha, Keaau, and Waianae Kai Valleys on Oahu. Currently, this species is extant on Oahu and Hawaii. It is known from 2 occurrences on Oahu on State and private lands, located at Waianae Kai and Keaau Valley, totaling 44 individuals (GDSI 2001; HINHP Database 2001; Wagner *et al.* 1999).

*Gouania vitifolia* typically grows on the sides of ridges and gulches in dry to mesic forests at elevations of 39 to 978 m (128 to 3,208 ft). Associated native plant species include *Bidens* sp., *Carex meyenii*, *Chamaesyce* sp., *Diospyros sandwicensis*, *Dodonaea viscosa*, *Erythrina sandwicensis*, *Hedyotis* sp., *Hibiscus arnottianus*, *Melicope* sp., *Nestegis sandwicensis*, *Pipturus albidus*, *Psychotria* sp., or *Urera glabra* (Service 1998b).

The major threats to *Gouania vitifolia* are competition from the nonnative plant species *Aleurites moluccana*, *Buddleia asiatica*, *Cordyline fruticosa*, *Hyptis pectinata*, *Lantana camara*, *Leucaena leucocephala*, *Melinis minutiflora*, *Oplismenus hirtellus*, *Panicum* sp. (panic grass), *Passiflora edulis*, *Passiflora ligularis*, *Passiflora suberosa*, *Psidium cattleianum*, *Rubus argutus*, *Schinus terebinthifolius* and *Toona ciliata*; habitat destruction by feral pigs; and a threat of random extinction and reduced reproductive vigor due to the small number of extant individuals (HINHP Database 2001; 59 FR 32932).

*Hedyotis coriacea* (Kioele)

*Hedyotis coriacea*, a short-lived member of the coffee family (Rubiaceae), is a small shrub with leathery leaves that are generally elliptic to oblong in shape. This species is distinguished from others of the genus by its small, triangular calyx lobes that do not enlarge in fruit, by capsules that are longer than wide, and by flower buds that are square in cross-section (Wagner *et al.* 1999).

Little is known about the life history of *Hedyotis coriacea*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1997).

Historically, *Hedyotis coriacea* was known from the Waianae and Koolau Mountains on Oahu and the island of Hawaii. Currently, this species is extant on Maui and Hawaii. This species was last collected on Oahu in the 1800s (HINHP Database 2001).

*Hedyotis coriacea* is found on steep, rocky slopes in dry to mesic *Dodonaea viscosa* dominated shrublands or forests at elevations of 57 to 836 m (187 to 2,742 ft). Associated native species include *Alyxia oliviformis*, *Leptecophylla tameiameia*, or *Metrosideros polymorpha* (HINHP Database 2001; 57 FR 20772).

Nothing is known of the threats to *Hedyotis coriacea* on Oahu because the species was last collected there in the 1800s (Service 1997; 57 FR 20772).

*Hesperomannia arborescens* (NCN)

*Hesperomannia arborescens*, a long-lived member of the aster family (Asteraceae), is a small shrubby tree that usually stands 1.5 to 5 m (5 to 16 ft) tall. This member of an endemic Hawaiian genus differs from other *Hesperomannia* species in having the following combination of characteristics: Erect to ascending flower heads, thick flower head stalks, and usually hairless and relatively narrow leaves (Wagner *et al.* 1999).

This species has been observed in flower from April through June and fruit during March and June. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b; 59 FR 14482).

*Hesperomannia arborescens* was formerly known from Molokai, Lanai, and scattered occurrences throughout the Koolau Mountains, Oahu, from Koolauloa and Pupukeya at its northern extreme to Konahuanui at the southern end. This species is now known from Oahu, Molokai, and Maui. On Oahu, there are 36 occurrences containing between 86 and 93 individuals on private, city, county, State, and Federal lands at a few disjunct locations upslope of Kahuku, Laie, and Malaekahana; along Poamoho Trail above Poamoho Stream; along Waikane-Schofield Trail near the ridge summit; and at Kipapa Gulch, on Halawa Ridge, Waimanalo-Niu divide, Kainawaanui, Kaukonahua Gulch, Maakua-Kaipapau

Ridge, Kapakahi Gulch, Halemano-Opaeula Ridge, Kawaihoa Trail, Kaimananui Gulch, and upper Palolo Valley to Niu Valley (EDA Database 2001; GDSI 2001; HINHP Database 2001; Service 1998b).

*Hesperomannia arborescens* on Oahu is found in association with *Acacia koa*, *Antidesma platyphyllum*, *Bobea elatior*, *Broussaisia arguta*, *Cheirodendron* sp., *Cibotium* sp., *Coprosma* sp., *Dicranopteris linearis*, *Dubautia* sp., *Hedyotis terminalis*, *Hibiscus arnottianus*, *Labordia sessilis* (kamakahala), *Machaerina angustifolia*, *Melicope* sp., *Metrosideros polymorpha*, *Myrsine* sp., *Nestegis sandwicensis*, *Perottetia sandwicensis*, *Pipturus* sp., *Psychotria mariniana*, *Scaevola gaudichaudiana*, *Scaevola glabra* (ohe naupaka), *Syzygium sandwicensis*, *Tetraplasandra oahuensis*, and *Wikstroemia* sp. It typically grows on steep slopes, ridge tops, and gulches in lowland wet forests and occasionally in shrublands between 110 and 1,147 m (361 and 3,762 ft) in elevation (HINHP Database 2001; Service 1998b; Wagner *et al.* 1999).

The major threats to *Hesperomannia arborescens* are habitat degradation by feral pigs and goats; competition with the nonnative plant species *Axonopus fissifolius*, *Clidemia hirta*, *Leptospermum scoparium*, and *Psidium cattleianum*; fire; impact by humans; and a risk of extinction due to random environmental events or reduced reproductive vigor due to this species' limited numbers (HINHP Database 2001; 59 FR 14482).

#### *Hesperomannia arbuscula* (NCN)

*Hesperomannia arbuscula*, a long-lived perennial member of the aster family (Asteraceae), is a small shrubby tree, 2 to 3.3 m (7 to 11 ft) tall. This species can be distinguished from other members of the genus by the erect flower heads and the leaves, usually hairy beneath, which are one to two times as long as wide (Wagner *et al.* 1999).

*Hesperomannia arbuscula* usually flowers in the spring depending on precipitation. Seeds mature in about six weeks and trees live for about 10 to 15 years. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Hesperomannia arbuscula* was known from the central and southern Waianae Mountains, from Makaleha to Puu Kanehoa on Oahu, and from West Maui. This species is currently known to be extant on the Makaha-Waianae Kai Ridge and in

Kaluaa and Kapuna Gulches on Oahu and on West Maui. The 6 known occurrences on Oahu contain between 90 and 92 individuals on State, private, city, and county lands (GDSI 2001; HINHP Database 2001).

*Hesperomannia arbuscula* on Oahu typically grows on slopes and ridges in dry to wet forest dominated by *Acacia koa* and *Metrosideros polymorpha* at elevations of 370 to 1,053 m (1,214 to 3,454 ft). Associated native species include *Alyxia oliviformis*, *Antidesma* sp., *Bidens* sp., *Bobea elatior*, the endangered *Cyanea longiflora*, *Diospyros hillebrandii*, *Freycinetia arborea*, *Hedyotis terminalis*, *Hibiscus* sp., *Psychotria* sp., and *Syzygium sandwicensis* (HINHP Database 2001; Service 1998b; Wagner *et al.* 1999).

The major threats to *Hesperomannia arbuscula* on Oahu are habitat degradation by feral pigs; competition from the nonnative plant species *Clidemia hirta*, *Lantana camara*, *Psidium cattleianum*, *Rubus argutus*, and *Schinus terebinthifolius*; trampling by humans; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining occurrences and individuals (HINHP Database 2001; 56 FR 55770).

#### *Hibiscus brackenridgei* (Mao hau hele)

*Hibiscus brackenridgei*, a short-lived perennial member of the mallow family (Malvaceae), is a sprawling to erect shrub or small tree. This species differs from other members of the genus in having the following combination of characteristics: Yellow petals, a calyx consisting of triangular lobes with raised veins and a single midrib, bracts attached below the calyx, and thin stipules that fall off, leaving an elliptical scar.

Three subspecies of *Hibiscus brackenridgei* are now recognized: *brackenridgei*, *molokaiana*, and *mokuleianus*. When we listed this species in 1994, only two subspecies, *brackenridgei* and *mokuleianus*, were recognized. Subsequently we became aware of Wilson's (1993) taxonomic treatment of this group, in which *H. brackenridgei* ssp. *molokaiana* was recognized as distinct from *H. brackenridgei* ssp. *brackenridgei*. Wilson's (1993) treatment is cited in the supplement in the revised edition of the *Manual of the Flowering Plants of Hawaii* as the basis for recognizing *H. brackenridgei* ssp. *molokaiana*. We will address this name change in a future **Federal Register** notice (Bates 1999; HINHP Database 2000; Wagner *et al.* 1999; Wilson 1993).

*Hibiscus brackenridgei* is known to flower continuously from early February through late May, and intermittently at other times of year. Intermittent flowering may possibly be related to day length. Little else is known about the life history of this plant. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1999).

This species was historically known from Kauai, Oahu, Molokai, Lanai, Maui, and the island of Hawaii. *Hibiscus brackenridgei* ssp. *mokuleianus* is currently known from Oahu, Lanai, Maui, and Hawaii; it may possibly occur on Kauai. On Oahu, there are a total of fewer than 206 individual plants in 5 occurrences at Kaumokunui, Kawaiu, Palikea, Kihakapu, and Kaimuhole Gulches on State and private lands. *Hibiscus brackenridgei* ssp. *molokaiana* is currently known from Oahu. There are a total of five individual plants in one occurrence in Makua Valley on land under Federal jurisdiction (GDSI 2001; HINHP Database 2001; Joel Lau, pers. comm., 2001).

*Hibiscus brackenridgei* ssp. *mokuleianus* on Oahu occurs on slopes, cliffs, and arid ledges in lowland dry forest and shrubland from 24 to 490 m (79 to 1,607 ft) in elevation. Associated native plant species include *Bidens amplexans* (kookoolau), *Chamaesyce* sp., *Diospyros hillebrandii*, *Dodonaea viscosa*, *Doryopteris* sp., *Erythrina sandwicensis*, *Heteropogon contortus*, *Hibiscus brackenridgei* ssp. *molokaiana*, *Lepidium bidentatum*, *Melanthera remyi*, *Pleomele halapepe*, *Psydrax odorata*, *Reynoldsia sandwicensis*, *Sida fallax*, or *Waltheria indica*. *Hibiscus brackenridgei* ssp. *molokaiana* occurs in dry shrublands between 23 and 580 m (75 to 1,902 ft) elevation. Associated native plant species include *Dodonaea viscosa*, *Doryopteris* sp., *Heteropogon contortus*, *Sida fallax*, and *Waltheria indica* (GDSI Database 2001; HINHP Database 2001; EDA, *in litt.* 2001).

The primary threats to *Hibiscus brackenridgei* ssp. *mokuleianus* on Oahu are habitat degradation and possible predation by pigs, goats, cattle, and rats; competition with the nonnative plant species *Ageratum conyzoides* (maile honohono), *Aleurites moluccana*, *Caesalpinia decapetala*, *Coffea arabica*, *Grevillea robusta*, *Hyptis pectinata*, *Leucaena leucocephala*, *Melia azedarach*, *Neonotonia wightii* (NCN), *Panicum maximum*, *Passiflora edulis*, *Passiflora suberosa*, *Schinus terebinthifolius*, *Spathodea campanulata* (African tulip tree),

*Syzygium cumini*, and *Toona ciliata*; road construction; fire; and susceptibility to extinction caused by random environmental events or reduced reproductive vigor due to a limited number of occurrences and individuals. The primary threats to *Hibiscus brackenridgei* ssp. *molokaiana* are habitat degradation and possible predation by pigs and goats; competition with the nonnative plant species *Ageratum conyzoides*, *Leucaena leucocephala*, and *Panicum maximum*; fire; predation by the Chinese rose beetle; and susceptibility to extinction caused by random environmental events or reduced reproductive vigor due to the single occurrence and limited number of individuals (HINHP Database 2001; 59 FR 56333).

#### *Isodendron laurifolium* (Aupaka)

*Isodendron laurifolium*, a short-lived perennial member of the violet family (Violaceae), is a slender, erect shrub with few branches. The species is distinguished from others in the genus by its leathery, oblong-elliptic, narrowly elliptic, lance-shaped leaves (Wagner *et al.* 1999).

Little is known about the flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors of this species (Service 1999).

Historically, *Isodendron laurifolium* was known from Kauai and the Waianae and Koolau mountains of Oahu. Currently, this species is found on Kauai and Oahu. On Oahu, there are a total of between 22 and 23 individuals found in 5 occurrences on State, private, city, and county lands in Makaha in the Waianae Mountains, East Makaleha Valley, Waianae Kai, Kaawa Gulch, and Kaumokunui Gulch (GDSI 2001; HINHP Database 2001).

*Isodendron laurifolium* on Oahu is usually found between 90 and 959 m (295 and 3,146 ft) elevation on gulch slopes, in ravines, and on ridges in diverse mesic or dry forest dominated by *Metrosideros polymorpha*, *Eugenia reinwardtiana*, or *Diospyros sandwicensis* with one or more of the following associated native plant species: *Acacia koa*, *Alyxia oliviformis*, *Antidesma platyphyllum*, *Antidesma pulvinatum*, *Carex wahuensis*, *Charpentiera tomentosa* (papala), *Doodia* sp., *Dryopteris unidentata*, *Hedyotis terminalis*, *Hibiscus arnotianus*, *Nestegis sandwicensis*, *Pisonia* sp., *Pouteria sandwicensis*, *Psydrax odorata*, *Rauvolfia sandwicensis*, *Sapindus* sp. (soapberry), *Smilax melastomifolia* (hoi kuahiwi), or

*Xylosma hawaiiense* (HINHP Database 2001; Service 1999).

The primary threats to *Isodendron laurifolium* on Oahu are habitat degradation by feral goats and pigs; competition with the nonnative plant species *Aleurites moluccana*, *Cordyline fruticosa*, *Grevillea robusta*, *Psidium cattleianum*, *Schinus terebinthifolius*, and *Toona ciliata*; and a potential threat from military activities (HINHP Database 2001; 61 FR 53108).

#### *Isodendron longifolium* (Aupaka)

*Isodendron longifolium*, a member of the violet family (Violaceae), is a slender, erect shrub. The hairless, leathery, lance-shaped leaves distinguish this species from others in the genus (Wagner *et al.* 1999).

Little is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors of this species (Service 1999).

Historically and currently, *Isodendron longifolium* is known from scattered locations on Kauai and the Waianae Mountains on Oahu. There is a total of 30 individual plants on Oahu in 7 occurrences on Federal, State, and private lands in Palikea Gulch, Kaawa Gulch, Makaua Gulch, and Kaukonahua Stream (EDA Database 2001; HINHP Database 2001).

*Isodendron longifolium* on Oahu is found on steep slopes and stream banks in mixed mesic or lowland wet *Metrosideros polymorpha*-*Dicranopteris linearis* forest, usually between 363 and 964 m (1,191 and 3,162 ft) elevation. Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma* sp., *Bobea brevipes* (ahakea lau lii), *Carex* sp., *Cyanea* sp. (haha), *Cyrtandra* sp., *Hedyotis terminalis*, *Isachne pallens* (NCN), *Melicope* sp., *Peperomia* sp., *Perrottetia sandwicensis*, *Pittosporum* sp., *Pouteria sandwicensis*, *Psychotria* sp., *Psydrax odorata*, *Selaginella arbuscula*, or *Syzygium sandwicensis* (HINHP Database 2001; Service 1999).

The major threats to *Isodendron longifolium* on Oahu are habitat degradation or destruction by feral goats and pigs; competition with the nonnative plants *Ageratina riparia*, *Clidemia hirta*, *Oplismenus hirtellus*, *Paspalum conjugatum*, *Psidium cattleianum*, and *Thelypteris parasitica*; and a risk of extinction from naturally occurring events due to the small number of occurrences and individuals. The Palikea Gulch occurrence is also potentially threatened by fire (HINHP Database 2001; 61 FR 53108).

*Isodendron pyriformium* (wahine noho kula)

*Isodendron pyriformium*, a short-lived perennial member of the violet family (Violaceae), is a small, branched shrub. The species is distinguished from others in the genus by its smaller, green-yellow flowers and by its hairy stipules and leaf veins (Wagner *et al.* 1999).

During periods of drought, this species will drop all but the newest leaves. After sufficient rains, the plants produce flowers with seeds ripening one to two months later. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1996c).

*Isodendron pyriformium* was known historically from Oahu's central Waianae mountains, Maui, Hawaii, Niihau, Molokai, and Lanai. Currently, this species is found only on the island of Hawaii. This species was last collected on Oahu in the late 1800s (HINHP Database 2001).

*Isodendron pyriformium* was found on Oahu on bare rocky hills and in wooded ravines in dry shrublands at low elevations from 363 to 964 m (1,191 to 3,162 ft) (HINHP Database 2001; Wagner *et al.* 1999).

Nothing is known of the threats to *Isodendron pyriformium* on Oahu because it was last collected there in the 1800s.

#### *Lobelia niihauensis* (NCN)

*Lobelia niihauensis*, a short-lived perennial member of the bellflower family (Campanulaceae), is a small, branched shrub. This species is distinguished from others in the genus by its leaves lacking or nearly lacking leaf stalks, the width of the leaf, and length of the magenta-colored flowers (56 FR 55770).

*Lobelia niihauensis* flowers in late summer and early fall. Fruits mature four to six weeks later. Plants are known to live as long as 20 years. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Lobelia niihauensis* was known from the Waianae Mountains of Oahu (Uluhulu Gulch to Nanakuli Valley), Kauai, and Niihau. It is now known to be extant only on Kauai and Oahu. On Oahu, this species remains on Ohikilolo Ridge, Kaimokuiki-Manuwai Ridge, Kamaileunu Ridge, Mt. Kaala, Makaha-Waianae Kai, Makua Military Reservation, Nanakuli, South Mohiaka Gulch, east of Puu Kalena, Kahanahai



Valley, between Puu Hapapa and Puu Kanehoa, Puu Kailio, between Kolekole Pass and Puu Hapapa, North of Palikea, Puu Kaua-Kauhiuhi-Pahoa-Halona subdistricts, and Lualualei Naval Magazine in 40 occurrences containing between 362 and 397 individual plants on Federal, State, city, and county lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Lobelia niihauensis* on Oahu typically grows on exposed mesic or dry cliffs and ledges, at elevations from 339 to 926 m (1,112 to 3,037 ft). Associated native plant species include *Artemisia* sp., *Bidens* sp., *Carex meyenii*, *Dodonaea viscosa*, *Doryopteris* sp., *Eragrostis* sp., *Leptecophylla tameiameia*, *Lipochaeta tenuis*, *Osteomeles anthyllidifolia*, *Plectranthus parviflorus*, *Schiedea mannii*, or *Sida fallax* (HINHP Database 2001; 56 FR 55770).

On Oahu, the major threats to *Lobelia niihauensis* are habitat degradation and predation by feral goats, rats, and slugs; fire; potential impacts from military activities; and competition from the nonnative plant species *Acacia confusa*, *Ageratina riparia*, *Erigeron karvinskianus*, *Ficus microcarpa*, *Grevillea robusta*, *Kalanchoe pinnata*, *Lantana camara*, *Leucaena leucocephala*, *Melinis minutiflora*, *Melinis repens*, and *Schinus terebinthifolius* (HINHP Database 2001; 56 FR 55770).

#### *Lysimachia filifolia* (NCN)

*Lysimachia filifolia*, a short-lived perennial member of the primrose family (Primulaceae), is a small shrub 15 to 50 cm (0.5 to 1.6 ft) tall. This species is distinguished from other members of the genus by its leaf shape and width, calyx lobe shape, and corolla length (Service 1995; Wagner *et al.* 1999).

Little is known about the life history of *Lysimachia filifolia*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995b).

Historically, *Lysimachia filifolia* was known only from Kauai. This species is now known from Oahu and Kauai. On Oahu, there is one occurrence containing a total of 50 individuals, on the slopes of Waiahole Valley in the Koolau Mountains on State land (GDSI 2001; HINHP Database 2001).

On Oahu, *Lysimachia filifolia* typically grows on mossy banks at the base of cliff faces within the spray zone of waterfalls or along streams in lowland wet forests at elevations of 65 to 798 m (213 to 2,617 ft). Associated

plants include mosses, ferns, liverworts, and *Pilea peploides* (NCN) (HINHP Database 2001; Service 1995b; Wagner *et al.* 1999).

The major threat to *Lysimachia filifolia* on Oahu is competition with the nonnative plant species *Ageratina riparia*, *Blechnum appendiculatum*, *Cordyline fruticosa*, *Pluchea* sp. (sourbush), and *Schefflera actinophylla*. Additionally, individuals of the species are vulnerable to rock slides. Because only one occurrence of *Lysimachia filifolia* exists on each of only two islands, the species is threatened by extinction due to naturally caused events (HINHP Database 2001; 59 FR 09304).

#### *Mariscus pennatiformis* (NCN)

*Mariscus pennatiformis*, a member of the sedge family (Cyperaceae), is a short-lived perennial plant with a woody root system covered with brown scales. This species differs from other members of the genus by its three-sided, slightly concave, smooth stems; the length and number of spikelets; the leaf width; and the length and diameter of stems. The two subspecies (*Mariscus pennatiformis* ssp. *pennatiformis* and *Mariscus pennatiformis* ssp. *bryanii*) are distinguished by the length and width of spikelets, shape and length of fruits, and color, length, and width of glumes.

Subsequent to the final rule listing this species in 1994, we became aware of Tucker's (1994) treatment of this genus reclassifying it to *Cyperus*. Tucker's (1994) treatment is cited in the supplement in the revised edition of the *Manual of the Flowering Plants of Hawaii* as the basis for recognizing *Mariscus* as *Cyperus*. We will address this name change in a future **Federal Register** notice (Service 1999; Wagner *et al.* 1999).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown for *Mariscus pennatiformis* ssp. *pennatiformis* (Service 1999).

Historically, *Mariscus pennatiformis* was known from Kauai, Oahu (Waianae Mountains on a ridge above Makaha Valley), East Maui, the island of Hawaii, and Laysan Island in the Northwestern Hawaiian Islands. *Mariscus pennatiformis* ssp. *bryanii* is known from Laysan. Only one occurrence of *Mariscus pennatiformis* ssp. *pennatiformis* has been seen in the last 70 years on the main Hawaiian islands, in Keanae Valley on Maui in the 1970s (HINHP Database 2001).

*Mariscus pennatiformis* typically grows in mesic and wet *Metrosideros polymorpha* forest and *Metrosideros*

*polymorpha-Acacia koa* forest at elevations between 424 and 1,032 m (1,391 and 3,385 ft). The associated native plant species on Oahu are unknown (J. Lau, *in litt.* 2001).

No threat information is available for *Mariscus pennatiformis* on Oahu.

#### *Marsilea villosa* (Ihiihi)

*Marsilea villosa*, a short-lived perennial member of the marsilea family (Marsileaceae), is an aquatic to semiaquatic fern similar in appearance to a four-leaved clover that requires periodic flooding to complete its life cycle. The species is the only member of the genus native to Hawaii and is closely related to *Marsilea vestita* of the western coast of the United States (Service 1996a).

Sexual reproduction of *Marsilea villosa* is initiated through the production of a hard sporocarp (a structure in or on which spores are produced) borne on the rhizome of a leaf pair node. The young sporocarp is covered with rust-colored hairs that are lost as the sporocarp matures. The sporocarp will mature only if the soil dries below threshold levels for leaf growth. The sporocarp remains in the soil for an extended period of time and must be scarified before it will open. It is not known how the sporocarp is scarified in *Marsilea villosa*, but bacterial action is thought to erode the wall of the sporocarp to the point that water can be absorbed and force the sporocarp to open, as in other *Marsilea* species (Service 1996a).

*Marsilea villosa* was historically known from Oahu, Molokai, and Niihau. Currently, it is found on Oahu and Molokai. There are five occurrences on Oahu with an unknown number of individuals at Koko Head, on Lualualei Naval Reservation, and at Kealakipapa on Federal, city, county, and private lands (GDSI 2001; HINHP Database 2001; Service 1996a).

*Marsilea villosa* typically grows in cinder craters, vernal pools surrounded by lowland dry forest vegetation, mud flats, or lowland grasslands at elevations between 424 and 1,032 m (1,391 and 3,385 ft). Associated native plant species include *Sida fallax* (HINHP Database 2001).

The main reason for the decline of *Marsilea villosa* on Oahu is habitat destruction and the destruction of natural hydrology; many of the areas where it formerly occurred are now sugar cane fields, industrial parks, housing developments, and pastures. The greatest immediate threats to the survival of this species are encroachment and competition from naturalized, nonnative plants such as



*Bidens pilosa*, *Cynodon dactylon* (Bermuda grass), *Panicum maximum*, and *Prosopis pallida* (kiawe); habitat disturbance by off-road vehicles or by grazing cattle; continued development and habitat degradation; fire; small occurrence size; and fragmentation, trampling, and other impacts from humans and introduced mammals (HINHP Database 2001; 57 FR 27863).

*Melicope pallida* (Alani)

*Melicope pallida*, a long-lived perennial member of the citrus family (Rutaceae), is a tree with grayish white hairs and black, resinous new growth. The species differs from other members of the genus by the resinous new growth, leaves folded and in clusters of three, and fruits with separate carpels (Stone *et al.* 1999).

Little is known about the life history of *Melicope pallida*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995b).

*Melicope pallida* is currently and historically known from Kauai and Oahu. On Oahu, it is currently known from the Waianae Mountains within TNCH's privately owned Honouliuli Preserve on State and private lands. There is a single occurrence with a single individual (GDSI 2001; HINHP Database 2001).

*Melicope pallida* usually grows on steep rock faces in lowland dry or mesic forests at elevations of 234 to 841 m (768 to 2,758 ft). Associated native plant species include the endangered *Abutilon sandwicense*, *Acacia koa*, *Alyxia oliviformis*, *Bobea elatior*, *Cibotium* sp., *Dryopteris* sp. (NCN), *Metrosideros polymorpha*, *Pipturus albidus*, *Psychotria mariniana*, *Sapindus oahuensis*, *Syzygium sandwicense*, *Tetraplasandra* sp., *Wikstroemia oahuensis*, or *Xylosma hawaiiense* (HINHP Database 2001; 59 FR 09304).

The major threat to *Melicope pallida* on Oahu is competition from nonnative plants, especially *Andropogon virginicus*, *Clidemia hirta*, *Psidium cattleianum*, *Pterolepis glomerata*, and *Toona ciliata*. A potential threat to *M. pallida* is the black twig borer, which is known to occur in areas where this species grows and to feed on members of the genus *Melicope*. Additional threats to *M. pallida* are fire, habitat degradation by feral pigs, and a high risk of extinction due to naturally caused events and/or reduced reproductive vigor due to the solitary existing individual on Oahu (HINHP Database 2001; 59 FR 09304).

*Nototrichium humile* (Kului)

*Nototrichium humile*, a short-lived perennial member of the amaranth family (Amaranthaceae), is an upright to trailing shrub with branched stems to 1.5 m (5 ft) long. This species is distinguished from the only other species in the genus by the size and hairiness of its inflorescence (Wagner *et al.* 1999).

*Nototrichium humile* is found on and at the base of rock cliffs and talus slopes in areas in partial shade. Plants have been observed flowering after heavy rain, but flowering is generally heaviest in the spring and summer. Fruits mature a few weeks after flowering. In cultivation, this species is known to live for more than a decade (Service 1998b). Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors.

Historically and currently, *Nototrichium humile* is known from Oahu and Maui. Currently, on Oahu, it is found in Kapuhi Gulch, Pahole Gulch, Kealia, Kahanahaiki, Kaluakauila Gulch, along Makua-Keauu Ridge to Makaha-Waianae Kai Ridge, and Nanakuli, where it occurs on Federal, State, city, county, and private lands. There are a total of 25 occurrences containing between 775 and 995 individuals on Oahu (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Nototrichium humile* typically grows at elevations of 185 to 806 m (607 to 2,644 ft) on cliff faces, gulches, stream banks, or steep slopes in dry or mesic forests often dominated by *Sapindus oahuensis* or *Diospyros sandwicensis*. Associated native species include the endangered species *Abutilon sandwicense*, *Alyxia oliviformis*, *Antidesma pulvinatum*, *Artemisia australis*, *Bidens cervicata* (kookoolau), *Canavalia* sp., *Carex wahuensis*, *Charpentiera* sp., *Dodonaea viscosa*, *Elaeocarpus bifidus*, *Erythrina sandwicensis*, *Eugenia reinwartiana*, *Hibiscus* sp., *Melanthra tenuis*, *Metrosideros polymorpha*, *Myoporum sandwicense*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Peperomia* sp., *Pisonia umbellifera*, *Pleomele* sp., *Pouteria sandwicensis*, *Psydrax odorata*, *Rauvolfia sandwicensis*, *Reynoldsia sandwicensis*, *Sicyos* sp., *Stenogyne* sp., *Streblus pendulinus*, or *Syzygium sandwicensis*, (HINHP Database 2001; Service 1998b; 56 FR 55770).

On Oahu, the major threats to *Nototrichium humile* are habitat degradation by feral goats and pigs; potential impacts of military activities;

competition from the nonnative plant species *Adiantum hispidulum*, *Ageratina adenophora*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Buddleia asiatica*, *Caesalpinia decapetala*, *Coffea arabica*, *Cordyline fruticosa*, *Ficus microphylla*, *Grevillea robusta*, *Hyptis pectinata*, *Kalanchoe pinnata*, *Lantana camara*, *Leucaena leucocephala*, *Melia azedarach*, *Melinis minutiflora*, *Montanoa hibiscifolia*, *Oplismenus hirtellus*, *Panicum maximum*, *Passiflora suberosa*, *Pimenta dioica*, *Psidium cattleianum*, *Psidium guajava*, *Rivina humilis*, *Schefflera actinophylla*, *Schinus terebinthifolius*, *Spathodea campanulata*, *Syzygium cumini*, *Triumfetta semitriloba* (Sacramento bur), and *Toona ciliata*; road building and maintenance; and fire (HINHP Database 2001; Service 1998b; 56 FR 55770).

*Peucedanum sandwicense* (Makou)

*Peucedanum sandwicense*, a short-lived perennial and a member of the parsley family (Apiaceae), is a parsley-scented, sprawling herb. Hollow stems arise from a short, vertical, perennial stem with several fleshy roots. This species is the only member of the genus on the Hawaiian Islands (Constance and Affolter 1999).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown for this species (Service 1995b).

Historically and currently, *Peucedanum sandwicense* is known from Molokai, Maui, and Kauai. Discoveries in 1990 extended the known distribution of this species to Oahu. On Oahu, there are a total of 4 occurrences containing 51 individual plants on State, city, and county lands in Keauu Valley, Puu Kawiwi, Waianae Kai, and Kamaileunu Ridge (GDSI 2001; HINHP Database 2001).

*Peucedanum sandwicense* grows on cliffs, slopes, and ridges in *Metrosideros polymorpha* lowland mesic forest between 395 and 977 m (1,296 and 3,205 ft) elevation and is associated with native species such as *Artemisia australis*, *Carex meyenii*, *Dianella sandwicensis*, *Dodonaea viscosa*, *Eragrostis* sp., *Lepidium bidentatum* var. *o-waihiense*, *Melanthra integrifolia* (nehe), *Osteomeles anthyllidifolia*, *Peperomia remyi* (alaala wai nui), *Pittosporum halophilum* (hoawa), *Plechranthus parviflorus*, *Plumbago zeylanica*, *Portulaca lutea* (ihi), *Reynoldsia sandwicensis*, *Santalum ellipticum* (iliahialoe), *Scaevola sericea* (naupaka kahakai), *Schiedea globosa* (NCN), *Senna gaudichaudii*, and *Sida*

*fallax* (Constance and Affolter 1999; HINHP Database 2001; Service 1995b).

Threats to *Peucedanum sandwicense* on Oahu are habitat degradation by feral goats and pigs and competition with the nonnative plant species *Kalanchoe pinnata*, *Lantana camara*, *Melinis minutiflora*, and *Schinus terebinthifolius* (HINHP Database 2001).

*Phlegmariurus nutans* (Wawaeiole)

*Phlegmariurus nutans* is an erect or pendulous herbaceous epiphyte in the clubmoss family (Lycopodiaceae). This species can be distinguished from others of the genus in Hawaii by its epiphytic habit, simple or forking fruiting spikes, and larger and stiffer leaves (59 FR 14482).

This species has been observed fertile, with spores, in May and December. No other information is available on reproductive cycles, dispersal agents, longevity, specific environmental requirements, or limiting factors (Service 1998b).

Historically, *Phlegmariurus nutans* was known from the island of Kauai and from scattered locations in the Koolau Mountains of Oahu, bounded by Kaluanui Valley to the north, Paalaa to the west, and Mount Tantalus to the south. This species is now known only from Oahu in 3 occurrences containing seven individual plants on Federal and State lands in Kaukonahua Gulch, Kahana, and Kaipapau Gulch (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Phlegmariurus nutans* on Oahu grows on tree trunks, usually on open ridges, forested slopes, and cliffs in *Metrosideros polymorpha*-dominated wet forests and shrublands and occasionally mesic forests between 227 and 846 m (745 and 2,775 ft) in elevation. Associated native plant species include *Antidesma platyphyllum*, *Broussaisia arguta*, *Cyrtandra laxiflora*, *Dicranopteris linearis*, *Elaphoglossum* sp. (ekaha), *Hedyotis terminalis*, *Hibiscus* sp., *Machaerina angustifolia*, *Psychotria mariniana*, *Syzygium sandwicense*, or *Wikstroemia oahuensis* (HINHP Database 2001; Service 1998b; EDA, *in litt.* 2001).

The primary threat to *Phlegmariurus nutans* on Oahu is susceptibility to extinction from naturally caused events and decreased reproductive vigor because of the small number of remaining individuals and limited distribution of the species. Additional threats to *Phlegmariurus nutans* are habitat degradation by feral pigs; floods; and the nonnative plants *Clidemia hirta*, *Paspalum conjugatum*, *Psidium*

*cattleianum*, and *Sacciolepis indica* (HINHP Database 2001).

*Phyllostegia mollis* (NCN)

*Phyllostegia mollis*, a short-lived member of the mint family (Lamiaceae), grows as a nearly erect, densely hairy, nonaromatic, perennial herb. A suite of technical characteristics concerning the kind and amount of hair, the number of flowers in a cluster, and details of the various plant parts separate this species from other members of the genus (Wagner *et al.* 1999).

Individual *Phyllostegia mollis* plants live for approximately five years. The species is known to flower in late winter and spring. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1998b).

Historically, *Phyllostegia mollis* was known from Molokai, Maui, and Oahu from the central and southern Waianae Mountains, Mt. Kaala to Honouliuli, and Makiki in the Koolau Mountains.

Currently, this species is only known from Oahu and Maui. On Oahu, this species remains only in Kaluaa Gulch, Palawai Gulch, Puu Kumakalii, Mohiakea Gulch, Huliwai Gulch, Waieli Gulch, and Pualii Gulch on Federal and private lands. The 5 occurrences contain between 85 and 105 individuals (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Phyllostegia mollis* typically grows on steep slopes and in gulches in diverse mesic to wet forests at elevations of 519 to 928 m (1,702 to 3,044 ft). Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma platyphyllum*, *Carex meyenii*, *Chamaesyce multiformis*, *Claoxylon sandwicense*, *Diospyros hillebrandii*, *Dryopteris unidentata*, *Metrosideros polymorpha*, *Myrsine* sp., *Pipturus alba*, *Pisonia umbellifera*, *Pouteria sandwicensis*, *Psychotria hathewayi*, or *Urera glabra* (HINHP Database 2001; EDA, *in litt.* 2001).

The major threats to *Phyllostegia mollis* are competition from the nonnative plant species *Ageratina adenophora*, *Blechnum appendiculatum*, *Christella parasitica*, *Clidemia hirta*, *Heliocarpus popayanensis*, *Kalanchoe pinnata*, *Passiflora suberosa*, *Psidium cattleianum*, *Rubus rosifolius*, and *Schinus terebinthifolius*; rockslides; habitat degradation and predation by feral pigs and goats; and the small number of extant occurrences, which makes the species vulnerable to extinction and/or reduced reproductive vigor (HINHP Database 2001).

*Phyllostegia parviflora* (NCN)

*Phyllostegia parviflora*, a member of the mint family (Lamiaceae), is a perennial herb. The species is distinguished from others of the genus by the shape of the leaves and the length of the leaf stalks and lower corolla. The varieties of this species are differentiated by hairs on the inflorescence and leaves and by the branching of the inflorescence.

At the time of listing of this species in 1996, only two varieties were recognized, *Phyllostegia parviflora* var. *glabriuscula* and *P. parviflora* var. *parviflora*. Subsequently we became aware of Wagner *et al.*'s (1999) taxonomic treatment of this group in which *P. parviflora* var. *lydgatei* was recognized. This treatment is cited in the supplement in the revised edition of the *Manual of the Flowering Plants of Hawaii* (Wagner *et al.* 1999) as the basis for recognizing *P. parviflora* var. *lydgatei*. This name change will be addressed in a future **Federal Register** notice.

Historically, *Phyllostegia parviflora* was known from the islands of Oahu, Hawaii, and Maui. This species is now known only from six occurrences on Oahu. *Phyllostegia parviflora* var. *glabriuscula* was only known from the island of Hawaii on private land and has not been observed since the 1800s. *Phyllostegia parviflora* var. *parviflora* is now known from only 30 plants on the east side of Puu Pauao, on State and Federal lands. *Phyllostegia parviflora* var. *lydgatei* is known from only four plants in North Pualii Gulch on private land (GDSI 2001; HINHP Database 2001).

*Phyllostegia parviflora* var. *lydgatei* is typically found on moderate to steep slopes in mesic forest from 555 to 881 m (1,820 to 2,890 ft) elevation. Native vegetation associated with *Phyllostegia parviflora* var. *lydgatei* includes *Antidesma platyphyllum*, *Chamaesyce multiformis*, *Claoxylon sandwicense*, *Coprosma foliosa*, *Dryopteris unidentata*, *Myrsine lessertiana*, *Pipturus albidus*, *Pouteria sandwicensis*, *Selaginella arbuscula*, or *Xylosma hawaiiense*. *Phyllostegia parviflora* var. *parviflora* is typically found in *Metrosideros polymorpha* mixed lowland wet forest from 232 to 867 m (761 to 2,844 ft) elevation. Native vegetation associated with *Phyllostegia parviflora* var. *parviflora* includes *Antidesma* sp., *Broussaisia arguta*, *Cheirodendron* sp., *Cibotium* sp., *Cyrtandra* sp., *Dicranopteris linearis*, *Melicope* sp., *Phyllostegia glabra* (NCN), *Pipturus* sp., *Pritchardia* sp., *Syzygium sandwicensis*, *Tetraplasandra* sp., or

*Touchardia latifolia* (HINHP Database 2001).

The major threats to *Phyllostegia parviflora* var. *lydgatei* are habitat degradation and/or destruction by feral pigs; landslides or rockslides; competition with the nonnative plant species *Ageratina adenophora*, *Christella parasitica*, *Passiflora suberosa*, *Psidium cattleianum*, *Rivina humilis*, *Rubus rosifolius*, and *Schinus terebinthifolius*; and a risk of extinction and/or reduced reproductive vigor due to the small number of remaining individuals and occurrences. The major threats to *Phyllostegia parviflora* var. *parviflora* on Oahu are competition with the nonnative plant species *Ageratina* sp. and *Clidemia hirta*; and extinction and/or reduced reproductive vigor due to the small number of remaining individuals in each respective occurrence (HINHP Database 2001; Service 1999; 61 FR 53108).

*Plantago princeps* (laukahi kuahiwi)

*Plantago princeps*, a short-lived member of the plantain family (Plantaginaceae), is a small shrub or robust perennial herb. This species differs from other native members of the genus in Hawaii by its large branched stems, flowers at nearly right angles to the axis of the flower cluster, and fruits that break open at a point two-thirds from the base. The four varieties, vars. *anomala*, *laxiflora*, *longibracteata*, and *princeps*, are distinguished by the branching and pubescence of the stems; the size, pubescence, and venation of the leaves; the density of the inflorescence; and the orientation of the flowers (Wagner *et al.* 1999).

Individuals have been observed in fruit from April through September. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1999).

*Plantago princeps* was historically found on Kauai, Oahu, Molokai, Hawaii, and Maui. It is no longer extant on the island of Hawaii. *Plantago princeps* var. *longibracteata* was known from Kauai and Oahu, but there are currently no remaining Oahu populations. The 11 extant occurrences of var. *princeps* on Oahu consist of between 130 and 180 individuals on Federal, State, city, county, and private lands at Palawai Gulch, Ekahanui Gulch, Nanakuli-Lualualei Ridge, Makua-Makaha Ridge, Mohiakea Gulch, and Pahole Gulch (EDA Database 2001; GDSI 2001; HINHP Database 2001).

On Oahu, *Plantago princeps* var. *longibracteata* was typically found on the sides of waterfalls and wet rock

faces between 64 and 835 m (210 and 2,739 ft) elevation. Associated native plant species included *Bidens* sp., *Coprosma granadensis* (makole), *Eugenia* sp., *Lobelia gaudichaudii* (NCN), *Metrosideros rugosa*, or *Scaevola glabra*. *Plantago princeps* var. *princeps* is typically found on slopes and ledges in *Metrosideros polymorpha* lowland mesic forests and shrublands between 110 and 1,064 m (361 to 3,490 ft) elevation. Associated native plant species include *Artemisia australis*, *Bidens* sp., *Chamaesyce* sp., *Dubautia plantaginea*, *Eragrostis* sp., *Lysimachia* sp., *Pilea peplodes*, and *Viola* sp. (pamakani) (HINHP Database 2001; EDA, *in litt.* 2001).

The primary threats to *Plantago princeps* var. *longibracteata* on Oahu were predation and habitat degradation by feral pigs and goats and competition with various nonnative plant species. The primary threats to *Plantago princeps* var. *princeps* are rockslides and competition with the nonnative plant species *Erigeron karvinskianus*, *Melinis minutiflora*, and *Schinus terebinthifolius* (HINHP Database 2001; Service 1999; 59 FR 56333).

*Platanthera holochila* (NCN)

*Platanthera holochila*, a short-lived perennial member of the orchid family (Orchidaceae), is an erect, deciduous herb. The stems arise from underground tubers, the pale green leaves are lance-to egg-shaped, and the greenish-yellow flowers occur in open spikes. This is the only species of this genus that occurs on the Hawaiian Islands (Wagner *et al.* 1999). It is distinguished from other Hawaiian orchids by its underground tubers that lack roots at the nodes or pseudobulbs and by the shape and length of its dorsal sepal.

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown for this species (Service 1999).

Historically, *Platanthera holochila* was known from Maui, Oahu, Molokai, and Kauai. Currently, it is extant on Kauai, Molokai, and Maui. This species was last collected on Oahu in 1938 in the area from Puu Kainapuaa to Kawainui-Kaipapau summit ridge and Kipapa Gulch (HINHP Database 2001).

On Oahu, *Platanthera holochila* was found in *Metrosideros polymorpha-Dicranopteris linearis* wet forest or *M. polymorpha* mixed shrubland between 447 and 867 m (1,466 and 2,844 ft) elevation. Associated native plant species included *Broussaisia arguta*, *Cibotium* sp., *Clermontia* sp. (oha wai), *Coprosma* sp., *Dubautia* sp., *Gahnia* sp., *Leptecophylla tameiameiae*, *Luzula*

*hawaiiensis* (wood rush), *Lycopodiella cernua*, *Lythrum maritimum* (pukamole), *Polypodium pellucidum* (ae), *Sadleria* sp., *Scaevola* sp., *Vaccinium reticulatum*, and *Wikstroemia* sp. (akia) (Service 1999; 61 FR 53108).

The major threats to *Platanthera holochila* are habitat degradation and destruction by ungulates such as cattle and feral pigs, predation by slugs, competition with alien plants, over collection, and the small number of occurrences and individuals, which make the species highly vulnerable to extinction from random environmental events and reduced reproductive vigor (Service 1999).

*Pteris lidgatei* (NCN)

*Pteris lidgatei*, a short-lived member of the maidenhair fern family (Adiantaceae), is a coarse perennial herb, 0.5 to 1 m (1.6 to 3.3 ft) tall. It can be distinguished from other species of *Pteris* on the Hawaiian Islands by the texture of its fronds and the tendency of the sori along the leaf margins to be broken into short segments instead of being fused into continuous marginal sori (Wagner 1949; Wagner and Wagner 1992).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown for this species (Service 1998a).

Historically, *Pteris lidgatei* was found on Oahu, Molokai, and Maui. Currently, this species is known from Oahu and Maui. Nine occurrences with approximately 13 individuals occur on Oahu on Federal, State, and private lands Kaluanui, Kawainui drainage, Kaukonahua Gulch, Kawai Iki Stream, Waimano Stream, and Waimano Gulch (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Pteris lidgatei* on Oahu grows on steep stream banks and cliffs around 75 m (246 ft) elevation in wet *Metrosideros polymorpha-Dicranopteris linearis* forest with *Asplenium* sp. (NCN), *Broussaisia arguta*, *Cibotium chamissoi*, *Cyrtandra* sp., *Dicranopteris linearis*, *Diplopterygium pinnatum*, *Doodia lyonii* (NCN), *Dryopteris sandwicensis*, *Elaphoglossum crassifolium* (ekaha), *Isachne pallens*, *Machaerina angustifolia*, *Sadleria squarrosa*, *Selaginella arbuscula*, or *Sphenomeris chinensis* (palaa) (HINHP Database 2001; EDA, *in litt.* 2001).

The primary threats to *Pteris lidgatei* on Oahu are competition with the nonnative plant species *Ageratina riparia*, *Christella parasitica*, *Clidemia hirta*, *Paspalum conjugatum*, *Psidium cattleianum*, *Pterolepis glomerata*, and

*Sacciolepis indica*; habitat destruction by feral pigs; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals (HINHP Database 2001).

*Sanicula purpurea* (NCN)

*Sanicula purpurea*, a short-lived member of the parsley family (Apiaceae), is a stout herb, 8 to 36 cm (3 to 14 in) tall, arising from a massive perennial stem. This species is distinguished from others in the genus by the number of flowers per cluster and by the color of the petals (Constance and Affolter 1999).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors of *Sanicula purpurea* are unknown (Service 1999).

Historically and currently, *Sanicula purpurea* is known from Oahu and Maui. On Oahu, 5 occurrences totaling approximately 21 individuals are currently known from Kaukonahua-Kahana divide, Helemano-Punaluu divide, the summit between Aiea and Waimano, and North Kaukonahue-Punaluu on Federal, State, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Sanicula purpurea* on Oahu typically grows in open *Metrosideros polymorpha* mixed montane bogs and windswept shrublands within the cloud zone between 415 and 959 m (1,361 and 3,146 ft) elevation. Associated native plant species include *Bidens* sp., *Cheirodendron* sp., *Dicanthelium koolauense*, *Gahnia beechyi*, *Leptecophylla tameiameia*, *Lycopodium* sp., *Machaerina angustifolia*, *Plantago pachyphylla* (laukahi kuahiwi), *Sadleria pallida*, or *Vaccinium* sp. (HINHP Database 2001; EDA, *in litt.* 2001).

The major threats to *Sanicula purpurea* on Oahu are habitat degradation by feral pigs, a risk of extinction due to random environmental events and/or reduced reproductive vigor due to the small number of existing occurrences, and competition with the nonnative plant species *Axonopus fissifolius* and *Clidemia hirta* (HINHP Database 2001; Service 1999; 61 FR 53108).

*Schiedea hookeri* (NCN)

*Schiedea hookeri*, a member of the pink family (Caryophyllaceae), is a sprawling or clumped, long-lived, perennial herb. This species is distinguished from others in this endemic Hawaiian genus by its open, hairy, and sometimes sticky

inflorescence and by the size of the capsules (Wagner *et al.* 1999).

Based on field and greenhouse observations, *Schiedea hookeri* has bisexual flowers. Mature fruits have been observed in June and August. A series of experimental self-pollinations, within-population crosses, and crosses among populations has demonstrated that *S. hookeri* experiences moderately strong inbreeding depression. These results indicate that reductions in population size could result in expression of inbreeding depression among progeny, with potentially deleterious consequences for the long-term persistence of this species. *Schiedea hookeri* appears to be an out-crossing species. Under greenhouse conditions, flowers do not set seed unless hand-pollinated. In the field, the species is presumed to be pollinated by insects, although none have been observed (a related species, *S. lydgatei* on Molokai, is apparently pollinated by native, night-flying moths). Individuals of *S. hookeri* appear to be long-lived, but there is no evidence of reproduction from seed under field conditions. Seedlings of *Schiedea* species occurring in mesic or wet sites are apparently consumed by introduced slugs and snails. In contrast, *Schiedea* occurring in dry areas produce abundant seedlings following winter rains, presumably because the drier sites have fewer nonnative predators. *Schiedea hookeri* differs considerably through its range in potential for clonal growth. Plants from Kaluakauila Gulch are upright and show little potential for clonal spread. In contrast, clonal growth has been detected for individuals at Kaluaa Gulch, where the growth form is decumbent and plants apparently root at the nodes (HINHP Database 2001; Service 1999; Weller and Sakai, unpublished data). No further information is available on flowering cycles, seed dispersal agents, longevity, specific environmental requirements, or limiting factors.

Historically, *Schiedea hookeri* was known from the Waianae Mountains of Oahu and a single fragmentary collection from Maui that may represent a different species. Currently, this species is known from 17 occurrences on Oahu containing between 328 and 378 individuals in East Makaleha, Makaha-Waianae Kai Ridge, Kaluakauila Gulch, between Kalaulula and Kanewai Streams, Kaluaa Gulch, north of Puu Ku Makalii, Waianae Kai, Makua-Makaha Ridge, between Kolekole Pass and Puu Hapapa, southwest of Puu Kaua, Palikea Gulch, Makaha, Kamaileunu Ridge, and Kahanahaiki on Federal, State, city, county, and private lands (EDA

Database 2001; GDSI 2001; HINHP Database 2001; Service 1999).

*Schiedea hookeri* is usually found on slopes, cliffs and cliff bases, rock walls, and ledges in diverse mesic or dry lowland forest, often dominated by *Metrosideros polymorpha*, *Diospyros sandwicensis*, or *Diospyros hillebrandii*, and at elevations between 208 and 978 m (682 and 3,208 ft). Associated plant species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma pulvinatum*, *Artemisia australis*, *Bidens torta*, *Carex meyenii*, *Carex wahuensis*, *Charpentiera tomentosa*, *Dodonaea viscosa*, *Elaeocarpus bifidus*, *Eragrostis grandis*, *Hibiscus* sp., *Leptecophylla tameiameia*, *Melanthera tenuis*, *Pisonia sandwicensis*, *Pouteria sandwicensis*, *Psydrax odorata*, *Sida fallax*, or *Stenogyne* sp. (Service 1999).

The primary threats to *Schiedea hookeri* are habitat degradation and/or destruction by feral goats and pigs; competition with the nonnative plant species *Adiantum hispidulum*, *Ageratina adenophora*, *Ageratina riparia*, *Aleurites moluccana*, *Blechnum appendiculatum*, *Christella parasitica*, *Clidemia hirta*, *Cordyline fruticosa*, *Grevillea robusta*, *Heliocarpus popayanensis*, *Hyptis pectinata*, *Kalanchoe pinnata*, *Lantana camara*, *Melia azedarach*, *Melinis minutiflora*, *Panicum maximum*, *Passiflora suberosa*, *Pimenta dioica*, *Psidium cattleianum*, *Psidium guajava*, *Schinus terebinthifolius*, *Syzygium cumini*, and *Toona ciliata*; and predation by introduced slugs and snails. The Kaluakauila Gulch occurrence is also potentially threatened by fire and military activities (Service 1999).

*Schiedea nuttallii* (NCN)

*Schiedea nuttallii*, a long-lived perennial member of the pink family (Caryophyllaceae), is a generally hairless, erect subshrub. This species is distinguished from others in this endemic Hawaiian genus by its habit, length of the stem internodes, length of the inflorescence, number of flowers per inflorescence, and smaller leaves, flowers, and seeds (Wagner *et al.* 1999).

Flowers and fruits of *Schiedea nuttallii* are abundant in the wet season but can be found throughout the year. Plants located close to the Makua rim on Oahu have been under observation for 10 years, and they appear to be long-lived. Based on field and greenhouse observations, the species has bisexual flowers. *Schiedea nuttallii* appears to be an out-crossing species. Under greenhouse conditions, plants fail to set seed unless hand-pollinated, suggesting that this species requires insects for pollination. Seedlings of *Schiedea*

occurring in mesic or wet sites are apparently consumed by introduced slugs and snails. In contrast, *Schiedea* occurring in dry areas produce abundant seedlings following winter rains, presumably because there are fewer nonnative predators in drier sites. Other information about reproductive cycles, longevity, specific environmental requirements, and limiting factors is unknown (Service 1999).

Historically *Schiedea nuttallii* was known from scattered locations on Kauai, Oahu, Molokai, and Maui. Currently, it occurs on Kauai, Oahu, and Molokai. On Oahu, 7 occurrences with 49 individuals are found on Pahole-Makua Ridge, Pahole-Kahanahaiki Ridge, Ekahanui Gulch, Kahanahaiki Valley, and Pahole Gulch, on Federal, State, and private lands (EDA Database 2001; GDSI 2001; HINHP Database 2001; Service 1999).

*Schiedea nuttallii* on Oahu typically grows on steep rock walls and forested slopes in *Acacia koa*-*Metrosideros polymorpha* lowland mesic forest and *Metrosideros polymorpha*-*Dodonaea viscosa* forest at elevations between 436 and 1,185 m (1,430 and 3,887 ft). Associated native plant species include *Alyxia oliviformis*, *Antidesma platyphyllum*, *Bidens torta*, *Cibotium chamissoi*, *Coprosma* sp., the endangered *Cyanea longiflora*, *Hedyotis terminalis*, *Ilex anomala*, *Machaerina* sp., *Peperomia* sp., *Perrottetia sandwicensis*, *Pipturus* sp., or *Psydrax odorata* (HINHP Database 2001; EDA, *in litt.*, 2001).

*Schiedea nuttallii* on Oahu is seriously threatened by competition with the nonnative plant species *Andropogon virginicus*, *Clidemia hirta*, *Grevillea robusta*, *Melinis minutiflora*, *Paspalum conjugatum*, and *Psidium cattleianum*; predation by the black twig borer, slugs, and snails; habitat degradation by feral pigs; and a risk of extinction from naturally occurring events (e.g., landslides) and/or reduced reproductive vigor due to the small number of individuals (HINHP Database 2001; Service 1999; 61 FR 53108).

#### *Sesbania tomentosa* (Ohai)

*Sesbania tomentosa*, a short-lived perennial member of the pea family (Fabaceae), is typically a sprawling shrub but may also be a small tree. Each compound leaf consists of 18 to 38 oblong to elliptic leaflets that are usually sparsely to densely covered with silky hairs. The flowers are a salmon color tinged with yellow, orange-red, scarlet, or, rarely, pure yellow. *Sesbania tomentosa* is the only endemic Hawaiian species in the genus,

differing from the naturalized *S. sesban* by the color of the flowers, the longer petals and calyx, and the number of seeds per pod (Geesink *et al.* 1999).

The pollination biology of *Sesbania tomentosa* has been studied by David Hopper, University of Hawaii. His findings suggest that although many insects visit *Sesbania* flowers, the majority of successful pollination is accomplished by native bees of the genus *Hylaeus* and that occurrences at Kaena Point on Oahu are probably pollinator-limited. Flowering at Kaena Point is highest during the winter-spring rains and gradually declines throughout the rest of the year. Other aspects of this plant's life history are unknown (Service 1999).

Currently, *Sesbania tomentosa* occurs on six of the eight main Hawaiian Islands (Kauai, Oahu, Molokai, Kahoolawe, Maui, and Hawaii) and in the Northwestern Hawaiian Islands (Nihoa and Necker). It is no longer extant on Niihau and Lanai. On Oahu, *Sesbania tomentosa* is known from 3 occurrences of 54 to 55 wild and approximately 200 outplanted individuals on State-owned land within the Kaena Point NAR and from Keawaula on State and private lands (GDSI 2001; HINHP Database 2001; Service 1999; 59 FR 56333).

On Oahu, *Sesbania tomentosa* is found on cliff faces, broken basalt, and sand dunes with rock outcrops in *Scaevola sericea* coastal dry shrubland and *Sporobolus virginicus* (aki aki) mixed grasslands between sea level and 152 m (0 and 499 ft) elevation. Associated native plant species include *Heliotropium anomalum* (ahinahina), *Jacquemontia ovalifolia* ssp. *sandwicensis*, *Melanthera* sp., *Myoporum sandwicense*, or *Sida fallax* (HINHP Database 2001; Service 1999).

The primary threats to *Sesbania tomentosa* on Oahu are competition with the nonnative plant species *Lantana camara* and *Leucaena leucocephala*; lack of adequate pollination; seed predation by rats, mice, and, potentially, nonnative insects; fire; trampling by hikers, motorcycles, and all-terrain vehicles; and a risk of extinction from naturally occurring events (e.g. tsunami) and/or reduced reproductive vigor due to the small number of occurrences and individuals (HINHP Database 2001; Service 1999; 59 FR 56333).

#### *Silene lanceolata* (NCN)

*Silene lanceolata*, a member of the pink family, is an upright, short-lived perennial with stems 15 to 50 cm (6 to 20 in) long, which are woody at the base. The flowers are white with deeply-

lobed, clawed petals. This species is distinguished from other Hawaiian members of the genus by its erect stem, terminal inflorescence, and length of the calyx, clawed petals, and carpophore (ovary structure) (Wagner *et al.* 1999).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors for *Silene lanceolata* are unknown (Service 1996d).

The historical range of *Silene lanceolata* includes five Hawaiian Islands: Kauai, Oahu, Molokai, Lanai, and Hawaii. *Silene lanceolata* is presently extant on Molokai, Oahu, and Hawaii. On Oahu, there are 4 occurrences with 62 individuals located in Koiahi Gulch and Waianae Kai on Federal and State lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

On Oahu, *Silene lanceolata* grows on cliff faces and ledges of gullies in dry to mesic shrubland and cliff communities at elevations of about 351 to 978 m (1,151 to 3,208 ft). Associated native plant species include *Artemisia australis*, *Bidens* sp., *Carex* sp., *Chamaesyce* sp., *Dodonaea viscosa*, *Lysimachia* sp., *Osteomeles anthyllidifolia*, *Schiedea mannii*, or the endangered *Tetramolopium filiforme* (HINHP Database 2001).

The threats to *Silene lanceolata* on Oahu are habitat destruction by feral goats and pigs; wildfires; and competition with the nonnative plant species *Ageratina riparia*, *Erigeron karvinskianus*, *Lantana camara*, *Melinis minutiflora*, *Melinis repens*, and *Schinus terebinthifolius* (HINHP Database 2001; Service 1996d; 57 FR 46325).

#### *Solanum sandwicense* (Popolo aiakeakua)

*Solanum sandwicense*, a member of the nightshade family (Solanaceae), is a large sprawling shrub. The younger branches are more densely hairy than older branches, and the oval leaves usually have up to four lobes along the margins. This short-lived perennial species differs from other members of the genus by having dense hairs on young plant parts, a greater height, and lacking prickles (Symon 1999).

Little is known about the life history of *Solanum sandwicense*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995b).

Historically, *Solanum sandwicense* was known from both Oahu and Kauai. This species was last seen on Oahu in 2000. Currently, this species is only

known from Kauai (GDSI Database 2001; HINHP Database 2001; Service 1995b; 59 FR 09304; 65 FR 66808; J. Yoshioka, TNCH, pers. comm., 2000).

*Solanum sandwicense* was found on Oahu on talus slopes and in streambeds in open, sunny areas at elevations between 131 and 1,006 m (430 and 3,300 ft). Associated native plant species included *Pisonia* sp. or *Psychotria* sp. (HINHP Database 2001; Service 1995b; 59 FR 09304).

The major threats to occurrences of *Solanum sandwicense* on Oahu were habitat degradation by feral pigs; competition with the nonnative plant species *Passiflora suberosa*, *Psidium* sp., and *Schinus terebinthifolius*; fire; landslides; and a risk of extinction from naturally occurring events and reduced reproductive vigor due to the small number of existing individuals (HINHP Database 2001; Service 1995b; 59 FR 09304).

#### *Spermolepis hawaiiensis* (NCN)

*Spermolepis hawaiiensis*, a member of the parsley family (Apiaceae), is a slender annual herb with few branches. Its leaves are dissected into narrow, lance-shaped divisions. *Spermolepis hawaiiensis* is the only member of the genus native to Hawaii. It is distinguished from other native members of the family by being a nonsucculent annual with an umbrella-shaped inflorescence (Constance and Affolter 1999).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors of this species are unknown (Service 1999).

Historically, *Spermolepis hawaiiensis* was known from Kauai, Oahu, Lanai, and the island of Hawaii. It is currently known from Molokai and Maui as well as the above four islands. On Oahu, there are 6 known occurrences totaling between 110 and 910 individuals, on Makua-Keaau Ridge and near the entrance of Diamond Head on State, Federal, city, and county lands (EDA Database 2001; GDSI 2001; HINHP Database 2001).

*Spermolepis hawaiiensis* on Oahu typically grows on steep to vertical cliffs or at the base of cliffs and ridges in coastal dry cliff vegetation at elevations of 25 to 839 m (82 to 2,752 ft). Associated native plant species include *Artemisia australis*, *Bidens* sp.,

*Dodonaea viscosa*, *Doryopteris* sp., *Heteropogon contortus*, *Santalum ellipticum*, or *Waltheria indica* (HINHP Database 2001; EDA, *in litt.*, 2001).

The primary threats to *Spermolepis hawaiiensis* on Oahu are habitat degradation by feral goats; competition with nonnative plant species such as *Lantana camara*, *Melinis minutiflora*, and various grasses; and habitat destruction and death of plants due to erosion, landslides, and rock slides resulting from natural weathering (HINHP Database 2001; Service 1999; 59 FR 56333).

#### *Tetramolopium lepidotum* ssp. *lepidotum* (NCN)

*Tetramolopium lepidotum* ssp. *lepidotum*, a short-lived perennial member of the aster family (Asteraceae), is an erect shrub 12 to 36 cm (4.7 to 14 in) tall, branching near the ends of the stems. Leaves are lance-shaped and wider at the leaf tip. This taxon can be distinguished from the other extant species on Oahu by its bisexual disk flowers and its inflorescence of 6 to 12 heads (Lowrey 1999).

*Tetramolopium lepidotum* ssp. *lepidotum* produces flowers and fruit from April through July. Little else is known about its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors (Service 1995b; 59 FR 09304).

Historically, *Tetramolopium lepidotum* ssp. *lepidotum* was known from Lanai and nearly the entire length of the Waianae Mountains, from Makua Valley to Cachexia Ridge, on Oahu. It is now known only from Oahu. A total of 5 occurrences of approximately 15 individual plants are currently known from Federal, State, and private lands on Mauna Kapu, Ekahanui-Lualualei summit, Waianae Kai, and Puu Hapapa. TNCH has outplanted three individuals in a fenced enclosure within Honouliuli Preserve. These plants have since died, yet two healthy individuals have sprouted near the enclosure (EDA Database 2001; GDSI 2001; HINHP 2001; Lowrey 1999; Service 1998b; 56 FR 55770).

*Tetramolopium lepidotum* ssp. *lepidotum* typically grows on grassy ridge tops, slopes, or cliffs in windblown dry forests at elevations of 330 to 1,157 m (1,082 to 3,795 ft).

Associated native species include *Bidens* sp., *Carex wahuensis*, *Eragrostis* sp., or *Metrosideros polymorpha* (HINHP Database 2001).

The major threats to *Tetramolopium lepidotum* ssp. *lepidotum* on Oahu are competition from the nonnative plant species *Andropogon virginicus*, *Melinis minutiflora*, and *Schinus terebinthifolius*; habitat degradation and predation by feral goats and pigs; fire; and a risk of extinction and/or reduced reproductive vigor due to the small number of occurrences and individuals (HINHP Database 2001; Service 1998b; 56 FR 55770).

#### *Vigna o-wahuensis* (NCN)

*Vigna o-wahuensis*, a member of the pea family (Fabaceae), is a slender, twining, short-lived perennial herb with fuzzy stems. Each leaf is made up of three leaflets that vary in shape from round to linear. This species differs from others in the genus by its thin yellowish petals, sparsely hairy calyx, and thin pods that may or may not be slightly inflated (Geesink *et al.* 1999).

Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors of this species are unknown (Service 1999).

Historically, *Vigna o-wahuensis* was known from Niihau, Oahu, Molokai, Lanai, Kahoolawe, Maui, and the island of Hawaii. Currently, *V. o-wahuensis* is known from the islands of Molokai, Lanai, Kahoolawe, Maui, and Hawaii. There are no currently known occurrences on Oahu. The last collection on Oahu was made in 1938 on the Mokulua Islets and North Islet (HINHP Database 2001).

*Vigna o-wahuensis* on Oahu occurred on open dry fossil reef, climbing over shrubs and grasses on limestone deposit, and on fairly steep slopes from sea level to 609 m (0 to 1,998 ft) in elevation. The associated native plant species on Oahu are unknown (HINHP Database 2001).

Nothing is known of the threats for *Vigna o-wahuensis* on Oahu (Service 1999).

A summary of occurrences and landownership for the 101 plant species reported from the island of Oahu is given in Table 1.

TABLE 1.—SUMMARY OF EXISTING OCCURRENCES ON OAHU, AND LANDOWNERSHIP FOR 101 SPECIES REPORTED FROM OAHU

Species	Number of current occurrences	Landownership/Jurisdiction		
		Federal	State	Private
<i>Abutilon sandwicense</i>	30	X <sup>2,6</sup>	X	X
<i>Adenophorus periens</i>	0			
<i>Alectryon macrococcus</i>	82	X <sup>1,2,6</sup>	X	X
<i>Alsinidendron obovatum</i>	6	X <sup>1</sup>	X	
<i>Alsinidendron trinerve</i>	13	X <sup>2</sup>	X	
<i>Bonamia menziesii</i>	18	X <sup>1,6</sup>	X	X
<i>Cenchrus agrimonioides</i>	7	X <sup>1,2</sup>	X	X
<i>Centaurium sebaeoides</i>	2		X	X
<i>Chamaesyce celastroides</i> var. <i>kaenana</i>	15	X <sup>1</sup>	X	
<i>Chamaesyce deppeana</i>	1		X	
<i>Chamaesyce herbstii</i>	4		X	X
<i>Chamaesyce kuwaleana</i>	5	X <sup>6</sup>	X	
<i>Chamaesyce rockii</i>	20	X <sup>2,3,8</sup>	X	X
<i>Colubrina oppositifolia</i>	5		X	X
<i>Ctenitis squamigera</i>	8	X <sup>1,2</sup>	X	X
<i>Cyanea acuminata</i>	20	X <sup>2,3,8</sup>	X	X
<i>Cyanea crispa</i>	11	X <sup>3</sup>	X	X
<i>Cyanea grimesiana</i> ssp. <i>grimesiana</i>	7	X <sup>2</sup>	X	X
<i>Cyanea grimesiana</i> ssp. <i>obatae</i>	8		X	X
<i>Cyanea humboltiana</i>	9	X <sup>3,8</sup>	X	X
<i>Cyanea koolauensis</i>	42	X <sup>2,3,4,8</sup>	X	X
<i>Cyanea longiflora</i>	4		X	X
<i>Cyanea pinnatifida</i>	0			
<i>Cyanea st.-johnii</i>	7	X <sup>3</sup>	X	X
<i>Cyanea superba</i>	0			
<i>Cyanea truncata</i>	2		X	X
<i>Cyperus trachysanthos</i>	6	X <sup>7</sup>	X	
<i>Cyrtandra crenata</i>	0			
<i>Cyrtandra dentata</i>	11	X <sup>1,3</sup>	X	
<i>Cyrtandra polyantha</i>	1		X	X
<i>Cyrtandra subumbellata</i>	5	X <sup>2,8</sup>	X	X
<i>Cyrtandra viridiflora</i>	23	X <sup>3,8</sup>	X	X
<i>Delissea subcorata</i>	21	X <sup>1,2</sup>	X	X
<i>Diellia erecta</i>	1		X	X
<i>Diellia falcata</i>	30	X <sup>1,2,6</sup>	X	X
<i>Diellia unisora</i>	4		X	X
<i>Diplazium molokaiense</i>	0			
<i>Dubautia herbstobatae</i>	12	X <sup>1</sup>	X	
<i>Eragrostis fosbergii</i>	4	X <sup>2</sup>	X	
<i>Eugenia koolauensis</i>	12	X <sup>3,4</sup>	X	X
<i>Euphorbia haeleeeleana</i>	8	X <sup>1</sup>	X	X
<i>Flueggea neowawraea</i>	23	X <sup>1,2,6</sup>	X	X
<i>Gardenia mannii</i>	49	X <sup>2,3,4,8</sup>	X	X
<i>Gouania meyenii</i>	4		X	X
<i>Gouania vitifolia</i>	2		X	X
<i>Hedyotis coriacea</i>	0			
<i>Hedyotis degeneri</i>	4	X <sup>1</sup>	X	
<i>Hedyotis parvula</i>	7	X <sup>1,6</sup>	X	
<i>Hesperomannia arborescens</i>	36	X <sup>3,4,8</sup>	X	X
<i>Hesperomannia arbuscula</i>	6		X	X
<i>Hibiscus brackenridgei</i>	6	X <sup>1,6</sup>	X	X
<i>Isodendron laurifolium</i>	5		X	X
<i>Isodendron longifolium</i>	7	X <sup>2</sup>	X	X
<i>Isodendron pyriform</i>	0			
<i>Labordia cyrtandrae</i>	9		X	X
<i>Lepidium arbuscula</i>	12	X <sup>1,2,6</sup>	X	
<i>Lipochaeta lobata</i> var. <i>leptophylla</i>	4	X <sup>2,6</sup>	X	
<i>Lipochaeta tenuifolia</i>	41	X <sup>1,2,6</sup>	X	
<i>Lobelia gaudichaudii</i> ssp. <i>koolauensis</i>	5	X <sup>2,3,8</sup>	X	X
<i>Lobelia monostachya</i>	1		X	X
<i>Lobelia niihauensis</i>	40	X <sup>1,2,6</sup>	X	
<i>Lobelia oahuensis</i>	12	X <sup>1,2,3,8</sup>	X	X
<i>Lysimachia filifolia</i>	1		X	
<i>Mariscus pennatifolius</i>	0			
<i>Marsilea villosa</i>	5	X <sup>6</sup>	X	X
<i>Melicope lydgatei</i>	18	X <sup>3</sup>	X	X
<i>Melicope pallida</i>	1		X	X
<i>Melicope saint-johnii</i>	6	X <sup>6</sup>		X
<i>Myrsine juddii</i>	3	X <sup>3</sup>	X	



TABLE 1.—SUMMARY OF EXISTING OCCURRENCES ON OAHU, AND LANDOWNERSHIP FOR 101 SPECIES REPORTED FROM OAHU—Continued

Species	Number of current occurrences	Landownership/Jurisdiction		
		Federal	State	Private
<i>Neraudia angulata</i>	27	X <sup>1,2,6</sup>	X	
<i>Nototrichium humile</i>	25	X <sup>1,2,6</sup>	X	X
<i>Peucedanum sandwicense</i>	4		X	
<i>Phlegmariurus nutans</i>	3	X <sup>2,3,8</sup>	X	
<i>Phyllostegia hirsuta</i>	26	X <sup>2,3,6,8</sup>	X	X
<i>Phyllostegia kaalaensis</i>	7		X	X
<i>Phyllostegia mollis</i>	5	X <sup>2</sup>	X	
<i>Phyllostegia parviflora</i>	6	X <sup>3</sup>	X	X
<i>Plantago princeps</i>	11	X <sup>1,2,3,6,8</sup>	X	X
<i>Platanthera holochila</i>	0			
<i>Pritchardia kaalae</i>	6	X <sup>1,2</sup>	X	
<i>Pteris lidgatei</i>	9	X <sup>2,3,8</sup>	X	X
<i>Sanicula mariversa</i>	4	X <sup>1,6</sup>	X	
<i>Sanicula purpurea</i>	5	X <sup>2,3,8</sup>	X	X
<i>Schiedea hookeri</i>	17	X <sup>1,2,6</sup>	X	X
<i>Schiedea kaalae</i>	7		X	X
<i>Schiedea kealiae</i>	4	X <sup>5</sup>	X	X
<i>Schiedea nuttallii</i>	7	X <sup>1,2</sup>	X	X
<i>Sesbania tomentosa</i>	3		X	X
<i>Silene lanceolata</i>	4	X <sup>1</sup>	X	
<i>Silene perlmanii</i>	0			
<i>Solanum sandwicense</i>	0			
<i>Spermolepis hawaiiensis</i>	6	X <sup>1</sup>	X	
<i>Stenogyne kanehoana</i>	1			X
<i>Tetramolopium filiforme</i>	21	X <sup>1,6</sup>	X	
<i>Tetramolopium lepidotum</i> ssp. <i>lepidotum</i>	5	X <sup>2,6</sup>	X	X
<i>Tetraplasandra gymnocarpa</i>	30	X <sup>2,3,4,8</sup>	X	X
<i>Trematolobelia singularis</i>	3		X	X
<i>Urera kaalae</i>	12	X <sup>2,6</sup>	X	X
<i>Vigna o-wahuensis</i>	0			
<i>Viola chamissoniana</i> ssp. <i>chamissoniana</i>	15	X <sup>1,2,6</sup>	X	
<i>Viola oahuensis</i>	18	X <sup>2,3,8</sup>	X	X

<sup>1</sup> Makua Military Reservation

<sup>2</sup> Schofield Barracks Military Reservation/Schofield Barracks East Range

<sup>3</sup> Kawaihoa Training Area

<sup>4</sup> Kahuku Training Area

<sup>5</sup> Dillingham Military Reservation

<sup>6</sup> Naval Magazine Pearl Harbor Lualualei Branch and Naval Computer and Telecommunication Area Master Station Pacific Transmitting Facility at Lualualei

<sup>7</sup> Hawaii Army National Guard

<sup>8</sup> Oahu Forest National Wildlife Refuge

*Previous Federal Action*

On May 28, 2002, we published the court-ordered proposed critical habitat designations for the 101 plant species from Oahu (67 FR 37108). In that proposed rule (beginning on page

37147), we included a detailed summary of the previous Federal actions completed prior to publication of the proposal. We now provide updated information on the actions that we have completed since the proposed

critical habitat designation. In Table 2, we list the final critical habitat designations or nondesignations previously completed for 41 of the 101 plant species from Oahu, which also occur on other islands.

TABLE 2.—SUMMARY OF PREVIOUS FINAL CRITICAL HABITAT ACTIONS FOR THE 101 PLANT SPECIES FROM OAHU

Species	Final critical habitat designation or nondesignation	
	Date(s)	Federal Register
<i>Adenophorus perians</i>	02/27/03	68 FR 9116
<i>Alectryon macrococcus</i>	05/18/03	68 FR 12982
	02/27/03	68 FR 9116
<i>Bonamia menziesii</i>	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
	02/27/03	68 FR 9116
<i>Cenchrus agrimonoides</i>	05/14/03	68 FR 25934
	05/14/03	68 FR 25934
<i>Centaurium sebaeoides</i>	02/27/03	68 FR 9116
	03/18/03	68 FR 12982

TABLE 2.—SUMMARY OF PREVIOUS FINAL CRITICAL HABITAT ACTIONS FOR THE 101 PLANT SPECIES FROM OAHU—  
Continued

Species	Final critical habitat designation or nondesignation	
	Date(s)	Federal Register
<i>Colubrina oppositifolia</i> .....	05/14/03	68 FR 25934
<i>Ctenitis squamigera</i> .....	05/14/03	68 FR 25934
	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Cyanea grimesiana</i> ssp. <i>grimesiana</i> .....	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Cyperus trachysanthos</i> .....	02/27/03	68 FR 9116
<i>Diellia erecta</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Diplazium molokaiense</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Eugenia koolauensis</i> .....	03/18/03	68 FR 12982
<i>Euphorbia haeleeeleana</i> .....	02/27/03	68 FR 9116
<i>Flueggea neowawraea</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Gouania meyenii</i> .....	02/27/03	68 FR 9116
<i>Gouania vitifolia</i> .....	05/14/03	68 FR 25934
<i>Hedyotis coriacea</i> .....	05/14/03	68 FR 25934
<i>Hesperomannia arborescens</i> .....	03/18/03	68 FR 12982
<i>Hesperomannia arbuscula</i> .....	05/14/03	68 FR 25934
<i>Hibiscus brackenridgei</i> .....	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Isodendron laurifolium</i> .....	02/27/03	68 FR 9116
<i>Isodendron longifolium</i> .....	02/27/03	68 FR 9116
<i>Isodendron pyriform</i> .....	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Lobelia niihauensis</i> .....	02/27/03	68 FR 9116
<i>Lysimachia filifolia</i> .....	02/27/03	68 FR 9116
<i>Mariscus pennatiformis</i> .....	02/27/03	68 FR 9116
	05/14/03	68 FR 25934
	05/22/03	68 FR 25934
<i>Melicope pallida</i> .....	02/27/03	68 FR 9116
<i>Nototrichium humile</i> .....	05/14/03	68 FR 25934
<i>Peucedanum sandwicense</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Phlegmarius nutans</i> .....	02/27/03	68 FR 9116
<i>Phyllostegia mollis</i> .....	05/14/03	68 FR 25934
<i>Plantago princeps</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Platanthera holochila</i> .....	02/27/03	68 FR 9116
	05/14/03	68 FR 25934
<i>Pteris lidgatei</i> .....	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Sanicula purpurea</i> .....	05/14/03	68 FR 25934
<i>Schiedea nuttallii</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
<i>Sesbania tomentosa</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
	05/22/03	68 FR 28054
<i>Silene lanceolata</i> .....	03/18/03	68 FR 12982
<i>Solanum sandwicense</i> .....	02/27/03	68 FR 9116
<i>Spermolepis hawaiiensis</i> .....	02/27/03	68 FR 9116
	03/18/03	68 FR 12982
	05/14/03	68 FR 25934
<i>Vigna o-wahuensis</i> .....	05/14/03	68 FR 25934

For many of 101 plant species from Oahu, the issue of whether critical habitat would be prudent was discussed in previous proposals and incorporated into the May 28 proposal (see 65 FR 79192; 65 FR 83158; 67 FR 3939; 67 FR 15856; 67 FR 9806; 67 FR 16492; 67 FR 36968; 67 FR 37108). In the May 28, 2002 proposed rule, we proposed that critical habitat designation was not prudent for *Cyrtandra crenata* because it had not been seen recently in the wild, and no genetic material of the species was known to exist. We also proposed that critical habitat designation was not prudent for *Pritchardia kaalae*, because it would likely increase the threat from vandalism or collection of the species. Critical habitat for the remaining 99 (*Abutilon sandwicense*, *Adenophorus periens*, *Alectryon macrococcus*, *Alsinidendron obovatum*, *Alsinidendron trinerve*, *Bonamia menziesii*, *Cenchrus agrimonioides*, *Chamaesyce celastroides* var. *kaenana*, *Chamaesyce deppeana*, *Chamaesyce herbstii*, *Chamaesyce kuwaleana*, *Chamaesyce rockii*, *Colubrina oppositifolia*, *Ctenitis squamigera*, *Cyanea acuminata*, *Cyanea crispa*, *Cyanea grimesiana* ssp. *grimesiana*, *Cyanea grimesiana* ssp. *obatae*, *Cyanea humboltiana*, *Cyanea koolauensis*, *Cyanea longiflora*, *Cyanea pinnatifida*, *Cyanea st.-johnii*, *Cyanea superba*, *Cyanea truncata*, *Cyperus trachysanthos*, *Cyrtandra dentata*, *Cyrtandra polyantha*, *Cyrtandra subumbellata*, *Cyrtandra viridiflora*, *Delissea subcordata*, *Diellia erecta*, *Diellia falcata*, *Diellia unisora*, *Diplazium molokaiense*, *Dubautia herbstobatae*, *Eragrostis fosbergii*, *Eugenia koolauensis*, *Euphorbia haeleleana*, *Flueggea neowawraea*, *Gardenia mannii*, *Gouania meyenii*, *Gouania vitifolia*, *Hedyotis coriacea*, *Hedyotis degeneri*, *Hedyotis parvula*, *Hesperomannia arborescens*, *Hesperomannia arbuscula*, *Hibiscus brackenridgei*, *Isodendron laurifolium*, *Isodendron longifolium*, *Isodendron pyrifolium*, *Labordia cyrtandrae*, *Lepidium arbuscula*, *Lipochaeta lobata* var. *leptophylla*, *Lipochaeta tenuifolia*, *Lobelia gaudichaudii* ssp. *koolauensis*, *Lobelia monostachya*, *Lobelia niihauensis*, *Lobelia oahuensis*, *Lysimachia filifolia*, *Mariscus pennatififormis*, *Marsilea villosa*, *Melicope lydgatei*, *Melicope pallida*, *Melicope saint-johnii*, *Myrsine juddii*, *Neraudia angulata*, *Nototrichium humile*, *Pelea lydgatei*, *Peucedanum sandwicense*, *Phlegmariurus nutans*, *Phyllostegia hirsuta*, *Phyllostegia kaalaensis*, *Phyllostegia mollis*, *Phyllostegia parviflora*, *Plantago*

*princeps*, *Platanthera holochila*, *Pteris lidgatei*, *Sanicula mariversa*, *Sanicula purpurea*, *Schiedea hookeri*, *Schiedea kaalae*, *Schiedea kealiae*, *Schiedea nuttallii*, *Sesbania tomentosa*, *Silene lanceolata*, *Silene perlmanii*, *Solanum sandwicense*, *Spermolepis hawaiiensis*, *Stenogyne kanehoana*, *Tetramolopium filiforme*, *Tetramolopium lepidotum* ssp. *lepidotum*, *Tetraplasandra gymnocarpa*, *Trematolobelia singularis*, *Urera kaalae*, *Vigna o-wahuensis*, *Viola chamissoniana* ssp. *chamissoniana*, and *Viola oahuensis*) of the 101 plant species was proposed on approximately 45,067 ha (111,364 ac) of land on the island of Oahu (67 FR 37108).

The publication of the proposed rule opened a 60-day public comment period, which closed on July 29, 2002. On July 11, 2002, we submitted joint stipulations to the U.S. District Court with Earthjustice requesting extension of the court orders for the final rules to designate critical habitat for plants from Lanai (December 30, 2002), Kauai and Niihau (January 31, 2003), Molokai (February 28, 2003), Maui and Kahoolawe (April 18, 2003), Oahu (April 30, 2003), the Northwestern Hawaiian Islands (April 30, 2003), and the island of Hawaii (May 30, 2003), citing the need to conduct additional review of the proposals, address comments received during the public comment periods, and conduct a series of public workshops on the proposals. The joint stipulations were approved and ordered by the court on July 12, 2002. On August 26, 2002, we published a notice (67 FR 54766) reopening the public comment period until September 30, 2002, on the proposal to designate critical habitat for plants from Oahu. On October 10, 2002, we published a notice (67 FR 63066) announcing the reopening of the comment period until November 30, 2002 and announcing a public hearing. On October 15, 2002, we held a public information meeting at the McCoy Pavilion, Honolulu, Oahu. On October 17, 2002, we held a public information meeting at Nanakuli High School, Nanakuli, Oahu. On November 19, 2002, we held a public hearing at the Ala Moana Hotel, Honolulu, Oahu. On December 26, 2002, we published a notice (67 FR 78763) announcing the availability of the draft economic analysis and reopening the comment period until January 27, 2003.

In the final rule designating critical habitat for plants on Lanai, published in the **Federal Register** on January 9, 2003 (68 FR 1220), we indicated that critical habitat was prudent for the following 17 multi-island species that also occur on Oahu: *Adenophorus periens*, *Bonamia menziesii*, *Cenchrus agrimonioides*,

*Centaurium sebaeoides*, *Ctenitis squamigera*, *Cyanea grimesiana* ssp. *grimesiana*, *Cyperus trachysanthos*, *Diellia erecta*, *Diplazium molokaiense*, *Hesperomannia arborescens*, *Hibiscus brackenridgei*, *Isodendron pyrifolium*, *Sesbania tomentosa*, *Silene lanceolata*, *Spermolepis hawaiiensis*, *Tetramolopium lepidotum* ssp. *lepidotum*, and *Vigna o-wahuensis*. In the final rule designating critical habitat for plants on Kauai and Niihau, published on February 27, 2003 (68 FR 9116), we indicated that critical habitat was prudent for the following 16 multi-island species that are also found on Oahu: *Alectryon macrococcus*, *Euphorbia haeleleana*, *Flueggea neowawraea*, *Gouania meyenii*, *Isodendron laurifolium*, *Isodendron longifolium*, *Lobelia niihauensis*, *Lysimachia filifolia*, *Mariscus pennatififormis*, *Melicope pallida*, *Peucedanum sandwicense*, *Phlegmariurus nutans*, *Plantago princeps*, *Platanthera holochila*, *Schiedea hookeri*, and *Solanum sandwicense*. In the final rule designating critical habitat for plants on Molokai (68 FR 12982), we indicated that critical habitat was prudent for the following four multi-island species that are also found on Oahu: *Eugenia koolauensis*, *Isodendron pyrifolium*, *Marsilea villosa*, *Phyllostegia mollis*, and *Pteris lidgatei*. In the final rule designating critical habitat for plants on Maui and Kahoolawe, published on May 14, 2003 (68 FR 25934) we indicated that critical habitat was prudent for the following eight multi-island species that are also found on Oahu: *Colubrina oppositifolia*, *Gouania vitifolia*, *Hedyotis coriacea*, *Hesperomannia arbuscula*, *Isodendron pyrifolium*, *Nototrichium humile*, *Phyllostegia parviflora*, *Sanicula purpurea*, and *Schiedea hookeri*. In the final rule designating critical habitat for plants in the Northwestern Hawaiian Island, published on May 22, 2003 (68 FR 28054) we indicated that critical habitat was prudent for the following two multi-island species that are also found on Oahu: *Mariscus pennatififormis* and *Sesbania tomentosa*.

#### Summary of Comments and Recommendations

We received a total of seven oral and 694 written comments during the four comment periods. These included responses from 7 State offices, 13 local agencies, and 36 private organizations or individuals. Of the written comments, we received approximately 638 letters by electronic mail or coupon/postcard that stated general support for the proposed critical habitat

designations but that did not provide substantive comments. Of the other 56 comments, 12 supported the proposed designation, 31 were opposed to it, and 13 provided information or declined to oppose or support the designation. We reviewed all comments received for substantive issues and new information regarding critical habitat and the Oahu plants. Similar comments were grouped into six general issues relating specifically to the proposed critical habitat designations and the draft economic analysis on the proposed determinations. These are addressed in the following summary.

#### Peer Review

In accordance with our policy published on July 1, 1994 (59 FR 34270), we solicited independent opinions from 17 knowledgeable individuals with expertise in one or several fields, including familiarity with the species, the geographic region, or the principles of conservation biology. We received comments from eight. All eight generally supported our methodology and conclusion, but none expressed a position for or against the designation of critical habitat. Comments received from the peer reviewers are summarized in the following section and were considered in developing the final rule.

#### Issue 1: Biological Justification and Methodology

(1) *Comment:* One commenter stated that the proposal designates areas that are not essential to the species.

*Our Response:* In accordance with our policy on peer review published on July 1, 1994 (59 FR 34270), we solicited the expert opinions of appropriate and independent specialists regarding the proposed rule. The purpose of this peer review was to ensure that our method of designating critical habitat for Oahu plants was based on scientifically sound data, assumptions, and analysis. The comments of the peer reviewers were taken into consideration in the development of this final designation. The majority of our peer reviewers support our methodology. Changes in this final rule that decrease the boundaries of some units are based on additional information received during the public comment periods. The changes in boundaries reflected in this final rule are based on additional information regarding the lack of primary constituent elements or additional information regarding the degradation of some of the proposed critical habitat areas and low probability of restoration that affect the areas' essentiality to the species. Areas that

were inadvertently included in the proposed unit and found to be nonessential have also been removed from the final designation.

(2) *Comment:* One commenter stated that the broad brush of primary constituent elements has resulted in the proposed designation of large amounts of State land with little companion scientific effort to identify limiting factors or management actions needed. Another commenter stated that the critical habitat designations are based on guesswork.

*Our Response:* The Act requires us to use the best scientific and commercial information available in undertaking species listing and recovery actions, including the designation of critical habitat as set forth in this rule. In this final rule, we concluded that some areas were not essential for the conservation of the Oahu plant species, based on newly available information concerning status of the species in specific areas and level of habitat degradation. Several of the units proposed as critical habitat have been excluded because they are not essential for the conservation of the species. These excluded units are nonessential because either they lack the species' primary constituent elements or other habitat exists for these species that has more primary constituent elements and/or is less degraded. See the "Summary of Changes from the Revised Proposed Rule" section.

The magnitude of additional research and investigations required to determine limiting factors and specific management actions needed for each species at each location is beyond the scope of critical habitat designation. The Act requires us to designate critical habitat on the basis of the best scientific and commercial data available. Based on the information available at the time the proposal was prepared and taking into consideration additional information received during the public comment periods on the proposal and draft economic analysis, we believe we have designated scientifically appropriate areas for the conservation of these species.

(3) *Comment:* The Army requested exclusion of grass-dominated portions of Makua Military Reservation and exclusion of grass-dominated habitat and forested areas dominated by nonnative plants (*e.g. Eucalyptus* sp. and *Schinus terebinthifolius*) at Schofield Barracks.

*Our Response:* These areas were excluded from the final critical habitat designation because they do not contain the primary constituent elements

necessary for the conservation of the Oahu plant species.

(4) *Comment:* One commenter did not believe that the Service has demonstrated that designating this large an area, absent any active management by the Federal government, can lead to the recovery of the identified species.

*Our Response:* We agree that active management is a necessary part of achieving recovery for these species and that the ultimate purpose of critical habitat is to contribute to the conservation of listed species. This can be best be achieved by cooperation between the Service and other partners. A critical habitat designation alone will not lead to the recovery of these species. Recovery of the species will require the cooperation of Federal and non-Federal land managers to manage lands in a manner that is compatible with species' recovery. We have numerous programs for assisting landowners with management for the conservation of these species.

(5) *Comment:* One peer reviewer indicated that the general goal of establishing at least 8 to 10 viable populations for each species may not apply to some rare, localized island endemics that likely never had 8 to 10 populations throughout their evolutionary history.

*Our Response:* Fewer than eight populations are being designated for some very restricted species for which adequate habitat does not exist, and which were likely always rare, since they are very narrow endemics (*Alsinidendron trinerve*, *Chamaesyce celastroides* var. *kaenana*, *Chamaesyce deppeana*, *Chamaesyce herbstii*, *Chamaesyce kuwaleana*, *Cyanea pinnatifida*, *Cyrtandra polyantha*, *Cyrtandra subumbellata*, *Diellia unisora*, *Dubautia herbstobatae*, *Eragrostis fosbergii*, *Lipochaeta tenuifolia*, *Lobelia monostachya*, *Melicope saint-johnii*, *Sanicula mariversa*, *Schiedea kealiae*, *Silene perlmanii*, *Stenogyne kanehoana*, *Tetramolopium filiforme*, and *Trematalobelia singularis*). The recovery plan for some more well understood species may also have different recovery objectives (*Marsilea villosa*), and the designation reflects these differences. However, in general, the recovery objectives found in recovery plans for these species state that 8 to 10 viable populations are required for recovery of each species. Establishing and conserving 8 to 10 viable populations on one or more islands within the historic range of the species will provide each species with a reasonable expectation of persistence and eventual recovery, even with the

high potential that one or more of these populations will be eliminated by normal or random adverse events, such as fires and nonnative plant invasions (Hawaii and Pacific Plant Recovery Committee (HPPRCC) 1994; Luijten *et al.* 2000; Mangel and Tier 1994; Pimm *et al.* 1998; Stacey and Taper 1992). We conclude that designation of adequate suitable habitat for 8 to 10 populations as critical habitat is essential to give most species a reasonable likelihood of long-term survival and recovery, based on currently available information. Each recovery plan states that these recovery goals will be revised as more specific information becomes available for each species.

(6) *Comment:* One peer reviewer commented that we should be wary of making propagation or reintroduction decisions based on the preservation of interpopulational genetic diversity. Observed or measurable genetic diversity is always at neutral loci, which gives absolutely no indication of differences in relative fitness. Another peer reviewer asked if the consequences of small, isolated populations on genetic drift or inbreeding have been addressed, *e.g.*, through occasional gene flow.

*Our Response:* Many of the species have been reduced to such low numbers that the recovery plans identify propagation and reintroduction as a key step. While we do not have direct evidence for most species to indicate that reduced reproductive vigor or inbreeding are problems, we believe they should be considered, based on current conservation biology theory and practice. This is particularly important to consider when developing a propagation and reintroduction program, to ensure that recovery efforts do not cause or exacerbate genetic issues. While measures of genetic diversity do not directly measure relative fitness, it is reasonable to assume that the two are correlated. The issue of gene flow and genetic drift will be addressed through research actions identified as needed in the recovery plans.

(7) *Comment:* The proposal failed to contain the total of historically known listed plants, and therefore failed to propose critical habitat for all listed plants Statewide. About 10 percent of the historically known listed endangered plant species from the Hawaiian Islands are missing from the proposals. The following Oahu plants are listed as endangered, but not included in proposed critical habitat designations: *Abutilon menziesii*, *Achyranthes splendens* var. *rotundata*, *Caesalpinia kawaiensis*, *Chamaesyce skottsbergii* var. *skottsbergii*, *Panicum*

*fauriei* var. *carteri*, *Scaevola coriacea*, and *Scheidea adamantis*. It is unclear why critical habitat was not discussed with respect to *Abutilon menziesii*, *Achyranthes splendens* var. *rotundata*, *Caesalpinia kawaiensis*, *Chamaesyce skottsbergii* var. *skottsbergii*, and *Gardenia brighamii*. For example, the recovery plan for *G. brighamii* specifically calls for the establishment of three populations on Oahu. This is a serious concern since the proposed rule states "the U.S. Fish and Wildlife Service proposes critical habitat for 99 of the 101 plant species known historically from the island of Oahu that are listed under the ESA." This statement is incorrect. The above-mentioned species are found on Oahu, they are listed under the ESA, and they are not addressed in the proposed rule.

*Our Response:* We have corrected the statement cited above in this final rule. The following species were not part of the 1998 court order and subsequent stipulations, and therefore were not included in this rulemaking: *Abutilon menziesii*, *Achyranthes rotundata* (currently *Achyranthes splendens* var. *rotundata*), *Euphorbia skottsbergii* var. *kalaeloana*, *Gardenia brighamii*, *Mezouneuron kawaiense* (currently *Caesalpinia kawaiensis*), *Scaevola coriacea*, and *Scheidea adamantis*. Critical habitat for these species will be considered if funding and resources become available. In addition, critical habitat has already been designated for *Panicum carteri* (currently *Panicum fauriei* var. *carteri*) on the island of Mokolii (48 FR 46328).

(8) *Comment:* One peer reviewer expressed concern that the Service may remove areas from designation if the landowner provides sufficient assurance that the land is adequately managed for a particular species. The Service cannot lawfully exclude areas from critical habitat based on a finding that they are adequately managed or protected. Critical habitat should be determined independent of the management situation. Another peer reviewer stated that none of the lands should be excluded from proposed critical habitat because of their existing land management.

*Our Response:* In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12, in determining which areas to propose as critical habitat, we are required to base critical habitat determinations on the best scientific and commercial data available and to consider those physical and biological features (primary constituent elements) that are essential to the conservation of the species and that may require special management

considerations or protection. If an area is covered by a plan that meets our management criteria, we believe it does not constitute critical habitat as defined by the Act because the primary constituent elements found there are not considered to be in need of special management or protection. For a detailed explanation of this evaluation see the "Analysis of Managed Lands Under Section 3(5)(A)" section below. However, to the extent that special management considerations and protection may be required for any of these areas and they, therefore, would meet the definition of critical habitat according to section 3(5)(A)(i), they are also properly excluded from designation under section 4(b)(2) of the Act (see *Analysis of Impacts under Section 4(b)(2)*).

(9) *Comment:* One peer reviewer and many commenters stated that focusing conservation efforts on the most pristine, least degraded sites is a logical, efficient, and cost-effective strategy whenever possible. Unfortunately, for many of the listed plant species, there is simply not enough suitable habitat remaining. Another peer reviewer stated that, in general, as much habitat should be protected as possible. Many peer reviewers were optimistic about the potential for degraded areas to be restored. One peer reviewer commented that populations could be established in the most degraded habitat if sufficient funds and person hours are dedicated toward follow-up maintenance after restoration. Another commenter stated that there is only a nominal possibility that the endangered native plants would survive in highly degraded areas and areas dominated by nonnative plants that are proposed as critical habitat. Yet another commenter stated that designations in degraded habitats are unrealistic and could waste resources on impractical restoration efforts. The commenter went on to suggest that low elevation areas may not be adequately represented; therefore it is important that the proposal not be trimmed back in any lower elevation areas. Another peer reviewer stated that the Service should designate lowland areas for potential future restoration and population recovery efforts.

*Our Response:* We agree that recovery of a species is more likely in designated critical habitat in the least degraded areas containing the primary constituent elements. To this end, several units have been excluded for some species, as sufficient numbers of alternative critical habitat units are available in less degraded areas. However, for some species, especially those only known from low elevation areas, only degraded

habitat remains. Therefore, some units still contain degraded habitat, but we believe that these areas can be restored if the landowner is supportive and resources are made available.

(10) *Comment:* One peer reviewer questioned why some areas designated as essential habitat by the HPPRCC are not included in the proposed critical habitat.

*Our Response:* In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12, in determining which areas to propose as critical habitat, we are required to use the best scientific and commercial data available and to consider those physical and biological features (primary constituent elements) that are essential to the conservation of the species and that may require special management considerations or protection. The HPPRCC used a different set of criteria to select the areas they deemed to be essential plant habitat. They selected habitat for all endangered, threatened, proposed, and candidate species. Some of these species were not included in the selection of critical habitat. Therefore, the essential plant habitat and critical habitat areas will not completely overlap.

(11) *Comment:* One peer reviewer recommended additional consultations with academic and professional experts. Some reviewers stated that no assessment of the quality of any of the data sources is provided, and no information is given as to how data sources of varying qualities were weighted in making delineations of critical habitat or how decisions were made as to what to rely on in the absence of rigorous assessments of relative quality. These commenters agreed with the Service's statement that "lack of detailed scientific data makes it impossible for us to develop a quantitative model." Lack of knowledge means that the proposed critical habitat designation is based only on the general habitat features of the areas in which the plants currently occur. While this approach may be expedient, it has resulted in designations based on best-guess estimations, rather than on science or the realities of plant recovery. The Service needs to give greater weight to scientific or commercial data that is empirical and has been field tested or verified, and the Service needs to allow peer review by a panel of unbiased scientists. One reviewer stated that the scientific basis for critical habitat designation is weak. Other commenters felt that the data on which the proposed critical habitat is based are 30 years old and may need updating.

*Our Response:* In an expansion of our policy on peer review published on July 1, 1994 (59 FR 34270), we solicited the expert opinions of 19 appropriate and independent specialists regarding the proposed rule. The purpose of this peer review was to ensure that our methodology for designation of critical habitat for Oahu plants was based on scientifically sound data, assumptions, and analysis. The comments of the peer reviewers were taken into consideration in the development of this final designation. The majority of peer reviewers support our methodology. We also met with field botanists from the Hawaii Natural Heritage Program, the Department of Land and Natural Resources, the Hawaii Army National Guard, and the Department of the Army. All data and information on species status received in preparation of this rule were weighted equally and considered to come from reliable sources. Where discrepancies existed between different data sources, the most current data were used.

New information indicated that some of the areas identified as essential habitat in the "Recovery Plan for Multi Island Plants" (USFWS 1999) do not contain the primary constituent elements necessary for the conservation of any of the 99 plant species included in this final designation. The essential plant habitat maps take into consideration all listed endangered plants on Oahu, as well as species of concern. We agree that additional time would be beneficial for the preparation of these final rules and the collection of more scientific information, but we are required under the court-approved stipulation to finalize this designation by April 30, 2003, using the best information currently available. If provided with new information, we may propose revisions in the critical habitat designation in the future.

(12) *Comment:* Some reviewers commented that deletion of significant portions of any of the proposed critical habitat units is likely to prevent the recovery of, and lead to the extinction of, listed species. Smaller units present real management challenges and may be so small that their ecological integrity and the viability of listed plants cannot be maintained.

*Our Response:* In this final rule, we concluded that many areas were not essential for the conservation of the Oahu plant species, based on information received during the public comment periods concerning the status of the species in specific areas and degree of habitat degradation. Several units or portions of units proposed as critical habitat have been excluded

because they are not essential for the conservation of the species. These excluded units or portions of units are not essential because they either lack the species' primary constituent elements or other areas exist that provide for the conservation of the species. See the "Summary of Changes from the Proposed Rule" section.

We realize that smaller areas will most likely require more management to maintain the plant populations and their habitat, but in many cases they are the only areas with the primary constituent elements needed by each species. We concur with the importance of protecting the ecosystems on which these species depend, as stated in purpose of the Act (section 2(b)), and of managing areas large enough to maintain and expand populations. We considered the importance of this, as well as the location of primary constituent elements, when delineating the boundaries of critical habitat for these final designations of critical habitat. We included areas that provide the biological and other processes essential for the conservation of the species. We acknowledge the potential negative impacts of edge effects on small habitat fragments. However, these species' primary constituent elements are found only within the areas that were designated critical habitat, and expanding the designated critical habitats would add areas that lack the primary constituent elements. All of the changes from the proposed critical habitat are based on the best available information and information received during comment periods and are based on biological issues, not political or social issues. If new information becomes available indicating that the existing critical habitat designations are not essential for the conservation of the species and/or that other areas are, we may propose new designations for those species at that time.

(13) *Comment:* A peer reviewer stated that the absence of native pollinators may demographically doom populations of facultative and obligate out-crossing species. The same peer reviewer commented that relationships among breeding systems (out-crossing or selfing), effective population size, levels of genetic exchange, and spatial distribution need to be considered.

*Our Response:* We agree; however, this information is unknown for the majority of the 99 plant species on Oahu for which we are designating critical habitat. If new information becomes available, we will reevaluate critical habitat based on the new information for that species at that time.



*Issue 2: Effects of Designation*

(14) *Comment:* A strongly preferred approach is to encourage the establishment of voluntary partnerships with landowners to bring about the desired species conservation.

*Our Response:* We realize that designation of critical habitat alone will not achieve recovery. Many threatened and endangered species occur on private lands and we recognize the importance of conservation actions by private landowners. Cooperation from private landowners is an important element of our conservation efforts, and we have had considerable success in developing partnerships with large and small landowners, government agencies, and non-governmental organizations for conservation activities on Oahu, elsewhere in the State of Hawaii, and throughout the Nation. We also recognize the importance of partnerships with other Federal and State agencies and land managers.

We administer several programs aimed at providing incentives for landowners to conserve endangered and threatened species on their lands; one of these incentives is the Endangered Species Landowner Incentive Program, which was first funded by Congress in fiscal year 1999. Under this program, we provide technical assistance and funding to landowners for carrying out conservation actions on their lands. In the first year alone, 145 proposals totaling \$21.1 million competed for \$5 million in grant money. Additional information on our landowner incentive programs may be found on our Web site (<http://endangered.fws.gov/landowner/index.html>). In addition, we have excluded areas under 4(b)(2) of the Act from the final designation of critical habitat on several islands because landowners have developed voluntary partnerships to manage the resources on their lands. We believe that the benefits of excluding these areas outweigh the benefits of including these areas in a final critical habitat designation.

(15) *Comment:* One peer reviewer stated that it is both prudent and necessary to designate critical habitat for these rare species. This provides the needed long-term management stability that allows government agencies and private organizations to cooperate and concentrate on recovery efforts. It may provide additional incentives for securing funding to research and recover populations. Designation of critical habitat also provides for additional protection of habitat that is unoccupied by a particular species, therefore allowing for future reintroduction of the species. In the

absence of critical habitat protection, much of the currently unoccupied habitat will continue to be destroyed by nonnative plants and animals, urban sprawl, and other development. On the other hand, one commenter stated that if site-specific locality information will have to be published in the final rule for every species, then the potential harm (from trespassing and theft of the species) far outweighs any potential benefit from designating critical habitat. Another commenter failed to see how imposing the proposed designation of critical habitat on privately owned, privately managed lands with no Federal nexus can lead to the recovery of the identified species.

*Our Response:* See **SUPPLEMENTARY INFORMATION** above.

(16) *Comment:* One commenter stated that all species should be offered protection, but they cannot support protection for some and not for others. They are concerned about the nonnative animals, whose fate would be decided by agencies that consider them invasive and kill them. The current interpretation of critical habitat allows the Federal government and its partners to utilize any methodology they wish in dealing with feral animals with impunity, although such methods may be cruel and environmentally unsound.

*Our Response:* The designation of critical habitat does not give the Federal government and its partners the authority to utilize any methodology they wish in dealing with feral animals. Any potential animal control program would be subject to all applicable State, Federal, and local laws. Also, critical habitat does not allow or enable the Federal government to control feral animals on non-Federal land. Such decisions will still be made by the landowner and are not regulated by critical habitat.

(17) *Comment:* The designation of critical habitat in areas actively used by the 25th Infantry Division (Light Infantry) for national defense purposes will adversely affect the Army's ability to carry out its essential mission. Training is essential to maintain specific proficiencies that are critical to wartime performance. Designating the proposed areas as critical habitat would have a negative effect on the Army's ability to carry out its national defense mission as well as to undergo the proposed transformation of its forces in the State of Hawaii. Designations of critical habitat will negatively impact the missions of the United States Marine Corps units who rely on the Army lands for their training. The skills learned at Makua and Schofield Barracks are critical to our Marines' ability to

perform all manner of combat operations, because the natural and physical attributes of the training areas mirror battlefield conditions found in other nations in the Pacific region and are found nowhere else in the United States. The Army has a comprehensive conservation program that provides better accountability and management of endangered plant species than the speculative benefit of critical habitat. The Army's natural resource programs provide sufficient management of rare plants, negating the need for critical habitat designation. For example, the Makua Implementation Plan details the actions required to stabilize 28 plant taxa and the Oahu tree snail. Further, the Army has worked with the Service to develop Integrated Natural Resource Management Plans (INRMPs) for its installations on Oahu.

*Our Response:* We have removed Makua Military Reservation, Schofield Barracks, Schofield Barracks East Range, Kahuku Training Area, Kawaiiloa Training Area, and Dillingham Military Reservation from final critical habitat designation because the benefits of excluding these lands under 3(5)(A) and 4(b)(2) outweigh the benefits of including these lands in a final designation (see "*Analysis of Impacts Under Section 4(b)(2): Other Impacts*"). We agree that the Army has implemented a comprehensive program of endangered species management on its lands under the INRMP process and appreciate the amount of financial and manpower resources they have provided for this effort. Army cooperation and support will be required to prevent the extinction and promote the recovery of all of the listed species on this island due to the need to implement proactive conservation actions such as ungulate management, weed control, fire suppression, and plant propagation.

(18) *Comment:* One landowner was concerned that their past cooperative efforts were not considered in this designation. In particular, this landowner had conveyed to the Service the southern portion of the Oahu Forest National Wildlife Refuge. In conveying the southern portion of the refuge to the Service, the landowner understood that a primary motivation for and purpose of the conveyance was to protect the native forest and certain native plant species therein, and therefore, the parties worked together to include certain lands in the conveyance. By its proposed rules, the Service appears to ignore or fails to consider this process, with the result being that the conveyance is treated as if it occurred in a vacuum.

*Our Response:* As summarized in the "Summary of Changes to the Proposed

Rule" section, the lands referred to in this comment were excluded from critical habitat designation because the primary constituent elements for the plant species proposed in this area are not present (former Oahu L unit).

(19) *Comment:* The draft economic analysis states that if a landowner needs a Federal permit or receives Federal funding for a specific activity, the Federal agency issuing the permit or dispersing the funds would consult with the Service to determine how the action may affect the designated critical habitat. The commenter questioned what is meant by the term "consult." The nature of the consultation could result in control over whether the Federal government conducts its proposed action on those lands or not, thereby controlling the land to the extent that the private landowner could or could not do business with the Federal government. What would the consultation result in when a proposed Federal action is benign compared to the activities not affected by critical habitat designation, such as, grazing, farming, hunting, or recreational use?

*Our Response:* Under section 7 of the Act, all Federal agencies must consult with the Service to insure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. If the Service finds that the proposed actions are likely to jeopardize the continued existence of an endangered or threatened species or result in destruction or adverse modification of critical habitat, we suggest reasonable and prudent alternatives that would allow the Federal agency to implement their proposed action without such adverse consequences.

Every consultation is unique, and it is impossible to comment on what the results of a future consultation will be without details of the proposed activity and the status of the species and its critical habitat at the time of the consultation. However, the consultation is focused on the direct and indirect effects of the proposed Federal action on the species or critical habitat and on effects of activities that be interrelated or interdependent. If the effects of the action, when added to the environmental baseline in the project area, would not destroy or adversely modify critical habitat or jeopardize the species, the project could proceed without modification.

### *Issue 3: Site-Specific Biological Comments*

(20) *Comment:* One landowner stated that, based on the methodology used and the fact that many areas are not occupied by any listed species in the 7,500 acres in units I and M that they own, and which are either within the agricultural district and in agricultural use or which are in the conservation district and developed for and in active use for telecommunications, these lands should be excluded.

*Our Response:* Based on comments received from field experts, these areas were removed from the final critical habitat designation because either they do not contain the primary constituent elements necessary for the conservation of these species or there are less degraded areas on Oahu that provide habitat essential for the conservation of these species.

(21) *Comment:* One landowner indicated that the boundary of a particular proposed critical habitat area runs through a small eucalyptus grove that is used quite extensively for educational purposes. By moving the boundary line in this location as requested in a map supplied by the landowner, there would be no impact upon existing operations (cattle ranching or otherwise).

*Our Response:* This area was removed from the final critical habitat designation because it does not contain the primary constituent elements necessary for the conservation of the species in this area.

(22) *Comment:* Two commenters were unclear how water source and distribution facilities in Unit L and other units in which the Waiahole Ditch is included will be affected if additional irrigation water is allocated for delivery to the central Oahu isthmus. They also expressed concern that routine ditch operations and maintenance may become problematic, especially if a section 7 consultation becomes necessary. Another commenter stated that the proposed rule identifies the alteration of watersheds and water diversion as activities that could trigger section 7 consultation if there is Federal involvement. If the ability to divert or take water from these sources or systems is restricted or limited, the impact would affect all lands served by such water sources or systems. In some cases, these water systems are very extensive and therefore the impacts could be quite substantial and far-reaching.

*Our Response:* Water infrastructure, including ditch irrigation systems, are considered manmade features and therefore are not critical habitat. As

such, their operation and maintenance are not likely to be subject to the critical habitat provisions of section 7 because these features and structures normally do not affect critical habitat.

(23) *Comment:* One peer reviewer commented that Unit L could be potentially expanded to include valley corridors linking the unit at its northern end to lowland/coastal habitats, thus allowing for an elevational gradient to be protected. These areas include the Hauula Beach Park area and the Kawaihoa area. Similarly, a corridor linking Unit L with Unit O would also provide additional protected potential habitat. Extending Unit L at its extreme southeastern tip to include remaining ridge top habitat and possibly providing an elevational corridor with Unit X may also prove beneficial.

*Our Response:* We believe that the area we have designated meets the recovery goals of 8 to 10 populations for these 99 plant species. Areas outside of the designated critical habitat may be important for the conservation of the species; however, at this time, we do not believe that they are essential to the conservation of these species.

(24) *Comment:* The Navy believes that the designation of critical habitat is redundant and subjects their Federal installations to unnecessary burdens when applied to species whose protection is addressed and managed under an installation's INRMP. Naval Magazine Pearl Harbor is the largest ammunition storage and ordnance operation in Hawaii. Consistent with this mission, large areas of land and water are constrained by the need for safety buffers. Naval Computer and Telecommunication Area Master Station Pacific (NCTAMS PAC) is the largest communications station in the world, and its mission is to provide communications for command and control to all naval commands ashore and afloat in the Pacific and to a wide variety of Army, Marine Corps, Coast Guard, and Air Force commands. The existing and future national defense operations to be conducted in these areas may present incompatibilities with species preservation.

*Our Response:* We have reviewed the 2001 INRMP for Navy lands on Oahu. It is currently not adequate to outweigh the benefit of including these areas in a final designation (See "*Analysis of Impacts Under Section 4(b)(2): Other Impacts*"). It does not include specific information on the conservation of the listed species found on Navy lands or information about conservation of unoccupied habitat for species historically known from the area. As far as we are aware, this INRMP has not yet

been updated to address management needs of these species. We look forward to working with the Navy in developing management for these areas that is compatible with species recovery.

We have removed some portions of the units on Navy lands, based on additional information received during the comment periods and visits to the base. We determined these areas to be nonessential because of the lack of primary constituent elements or because there are other places for these species that have more primary constituent elements and/or are less degraded. See the "Summary of Changes from the Proposed Rule" section for the justification for each unit's changes.

#### Issue 4: Species-Specific Biological Comments

(25) *Comment*: There are only three occurrences of the identified species on Damon Estate's land, all three located in the very back of Moanalua Valley, nearly 1.5 miles from the makai (directional term in the Hawaiian language that means towards the ocean) boundary of the proposed critical habitat designation. The landowner does not believe that the Service has established that these reported occurrences, some of them decades old, justify the designation of nearly 1,500 acres, much of which is highly altered from its original native vegetation.

*Our Response*: This area is currently occupied by eight species (*Chamaesyce rockii*, *Cyanea acuminata*, *Cyanea humboldtiana*, *Gardenia manni*, *Lobelia oahuensis*, *Tetraplasandra gymnocarpa*, *Trematolobelia singularis*, and *Viola oahuensis*) and contains habitat essential to the conservation of seven species (*Cyanea crispa*, *Cyanea humboldtiana*, *Lobelia oahuensis*, *Sanicula purpurea*, *Tetraplasandra gymnocarpa*, *Trematolobelia singularis*, and *Viola oahuensis*). Therefore, we could not remove this area from final critical habitat designation. Although this area is highly altered, information provided by botanists both in compiling the proposed rule and during the public periods indicates that the area contains the habitat elements essential for the conservation of the above mentioned plant species. This area is located within the following critical habitat units: Oahu 20—*Cyanea crispa*—b, Oahu 20—*Cyanea humboldtiana*—d, Oahu 20—*Lobelia oahuensis*—a, Oahu 20—*Sanicula purpurea*—a, Oahu 20—*Tetraplasandra gymnocarpa*—b, Oahu 20—*Trematolobelia singularis*—b, and Oahu 20—*Viola oahuensis*—a.

(26) *Comment*: Two commenters stated that failure to designate critical habitat for *Cyrtandra crenata*, as long as

this species remains on the endangered species list, denies it the habitat protection that Congress intended. The Service's conclusion in 67 FR 37155 that *Cyrtandra crenata* would not benefit from critical habitat designation is based on a faulty interpretation of the Endangered Species Act to designate critical habitat "to the maximum extent prudent." Another commenter added that given the vast areas on Oahu yet to be surveyed or inventoried, there is no valid basis for the Service to assume that *Cyrtandra crenata* is extinct. The mere fact that this plant has not been seen on Oahu recently does not justify the Service's refusal to protect its critical habitat, as it is common for field biologists to rediscover plant species that have not been seen for decades. The recent discovery of *Asplenium fragile* var. *insulare* (on Maui) and *Phyllostegia waimeae* (on Kauai) are cases in point. Several other commenters stated that the final rule should extend critical habitat protection to *Cyrtandra crenata*.

*Our Response*: At the present time, we do not believe it would be beneficial to designate critical habitat for this species. It was last observed in the wild in 1947, and we do not know of any genetic material in cultivation. In addition, we are unable to identify the physical and biological features essential for the conservation of this species or any exact location in the wild essential to the conservation of this species. Until the species is rediscovered, we are unable to identify habitat that is essential to its conservation due to lack of information in the historical record. Therefore, no change is made to our not prudent determination here. If this species is rediscovered, we may propose critical habitat for the species at that time.

(27) *Comment*: Several commenters stated that the final rule should extend critical habitat protection to the loulu palm, *Pritchardia kaalae*. As recently as 1999, the Service found that proposed live-fire training at Makua Military Reservation threatened *Pritchardia kaalae* with extinction. This species needs critical habitat protection from military and other threats if it is to have any chance of increasing its numbers and range from the six populations remaining in the wild. In contrast, the Service's claim that designation, which would identify primarily unoccupied habitat and increase threats to the species, is pure speculation.

*Our Response*: Since the listings of the three *Pritchardia* species on Kauai and Niihau as endangered, and prior to our proposed rules for the designation of critical habitat, we received information verifying vandalism and

collection threats to *Pritchardia* throughout the Hawaiian Islands. This information is included in the proposed rules. No additional information was provided during the comment periods demonstrating that the threats to the *Pritchardia* species on any Hawaiian Island from vandalism or collection would not be increased if critical habitat was designated. We still believe that the benefits of designating critical habitat do not outweigh the potential threats from vandalism and collection of any species of *Pritchardia*. Makua Military Reservation has been removed from critical habitat designation under 4(b)(2) of the Act because the benefits of excluding the area outweigh the benefits of including the area in the final designation (See "Analysis of Impacts Under Section 4(b)(2): Other Impacts").

(28) *Comment*: In the **Federal Register** notice of May 28, 2002 (FR 37108), Table 1 indicates that it includes 101 plants. In fact, the table appears to include 102 plants. Should *Colubrina squamigera* be included? It is neither a listed species nor a candidate species.

*Our Response*: Table 1 should contain 101 plant species from the island of Oahu listed under the Act for which critical habitat designations are being proposed. The inclusion of *Colubrina squamigera* was the result of a typographical error. No such plant species is historically or currently known.

(29) *Comment*: Coastal habitats may not be well represented in proposed critical habitat. For example, there are few sand dune areas with seasonal pools included in the critical habitat proposal, which will limit the ability to establish multiple populations of several species.

*Our Response*: The final critical habitat designations published for all Hawaiian Islands except the island of Hawaii, the critical habitat proposed for the island of Hawaii, and habitat located within adequately managed lands provide the habitat necessary for the conservation of 8 to 10 populations of each of the coastal plant species in this rule. Although habitat outside of these areas may be important for the recovery of one or more of these species, it is not essential to their conservation. The best existing habitat for 8 to 10 populations of each of the coastal plant species has been captured in the final critical habitat designation.

(30) *Comment*: One peer reviewer proposes expanding the critical habitat designation to include more (or all) of the conservation district lands in the southeastern Koolau Mountains for the benefit of the southern Koolau endemic species, *Cyanea grimesiana*, *Lipochaeta lobata*, and *Trematolobelia singularis*.

*Our Response:* Although we agree that this habitat may be important to the recovery of these species, it has not been identified as essential to the conservation of these species. The Service has identified habitat for 8 populations of *Cyanea grimesiana* elsewhere on Oahu and habitat for 10 populations of *Lipochaeta lobata*. In addition, the Service identified enough habitat for six populations of *Trematolobelia singularis*. Although this does not reach the goal of 8 to 10 populations listed in the recovery plan for this species, the Service did not have sufficient information on the habitat suggested by the commenter to determine that it is essential to the conservation of the species.

(31) *Comment:* One peer reviewer commented that any and all suitable habitat in the geographic ranges of the following species should be protected because of potential seed banks and impending climatic changes that could render existing sites unsuitable: *Alsinidendron trinerve*, *Dubautia herbstobatae*, *Hedyotis degeneri* var. *degeneri*, and *Scheidea kealiae*.

*Our Response:* We have designated all habitat considered to be essential for the conservation of *Alsinidendron trinerve* (habitat for seven populations), *Dubautia herbstobatae* (habitat for six populations), *Hedyotis degeneri* var. *degeneri* (habitat for nine populations), and *Schiedea kealiae* (habitat for four populations). The only areas not included in the final designation of critical habitat for these species were those areas that do not contain the primary constituent elements necessary for the conservation of these species.

#### *Issue 5: Mapping and Primary Constituent Elements*

(32) *Comment:* The State Department of Transportation (DOT) stated that the proposed designations near State routes would restrict the design, maintenance, and construction of highways. In particular, Units A and I may impact Route 93 (Farrington Highway), Unit L may impact Interstate Highway H-3, and Unit W may impact Route 72 (Kalaniana'ole Highway). The DOT recommends that buffer zones on each side of the State highway right-of-way should be excluded from critical habitat. The buffer zones should be based on topography and be a minimum of 100 feet in width. The map of proposed critical habitat units that shows Interstate Highway H-3 ending in the middle of Unit L should be corrected.

*Our Response:* The DOT's comments did not identify any planned widening or other significant improvement project within these units. Rather, their

concerns focused on the impact to routine repair and maintenance. Operation and maintenance of existing manmade features and structures adjacent to critical habitat are not likely to affect critical habitat and therefore are not likely to be subject to section 7 consultation. Because the areas identified in the proposed rule are essential to the conservation of several of the plant species on Oahu, they are included within the final designation. The land area located over the Interstate Highway H-3 tunnel is essential for the conservation of 7 of the 99 Oahu plant species (*Cyanea crispa*, *Cyanea st.-johnii*, *Lobelia oahuensis*, *Lysimachia filifolia*, *Sanicula purpurea*, *Tetraplasandra gymnocarpa*, and *Viola oahuensis*) and is included in the final designated critical habitat.

(33) *Comment:* Several commenters suggested that roads and trails be excluded from critical habitat.

*Our Response:* Existing manmade features and structures within the boundaries of the mapped units, such as buildings; roads; aqueducts and other water system features, including but not limited to pumping stations, irrigation ditches, pipelines, siphons, tunnels, water tanks, gaging stations, intakes, reservoirs, diversions, flumes, and wells; existing trails; campgrounds and their immediate surrounding landscaped area; scenic lookouts; remote helicopter landing sites; existing fences; telecommunications equipment towers and associated structures and electrical power transmission lines and distribution and communication facilities and regularly maintained associated rights-of-way and access ways; radars; telemetry antennas; missile launch sites; arboreta and gardens, heiau (indigenous places of worship or shrines) and other archaeological sites; airports; other paved areas; and lawns and other rural residential landscaped areas do not contain, and are not likely to develop, primary constituent elements and are specifically excluded from designation under this rule. Therefore, unless a Federal action related to such features or structures indirectly affects nearby habitat containing the primary constituent elements, operation and maintenance of such features or structures generally would not be impacted by the designation of critical habitat.

(34) *Comment:* One commenter expressed concern over proposed critical habitat designation of approximately 800 acres of land in Unit I, which has been in cultivation for over 50 years.

*Our Response:* This area was removed from the final designation because it does not contain the primary constituent elements necessary for the recovery of any of the 99 plant species on Oahu.

(35) *Comment:* The configuration of units will be difficult to identify on the ground and will have irregular boundaries. These boundaries will complicate management and increase the risk of fragmentation and edge effects on populations within units.

*Our Response:* We realize that these areas have irregular boundaries, but in many cases they are the only areas with the primary constituent elements needed for each species. We included areas that provide the biological and other processes that are essential for the conservation of the species. We acknowledge the potential negative impacts of edge effects on small habitat fragments. However, these species' primary constituent elements are found only within the areas that were designated as critical habitat, and making them larger would add areas that lack the primary constituent elements and that are not essential to conservation of the species. All of the changes in critical habitat from the proposal are based on the best available information received during comment periods. If new information becomes available indicating the existing critical habitat designations are not essential for the conservation of the species or that other areas are, we may propose new designations for those species at that time.

(36) *Comment:* One commenter believed that the Service considered most of the key elements required for assigning areas crucial for the persistence of plant species; however, one element that appears to have been overlooked and that requires serious consideration in designating critical habitat is the presence of appropriate pollinators for species that do not self-pollinate, or feasible and sustainable alternatives to key pollinators that may be absent.

*Our Response:* We agree; however, this information is unknown for the majority of these plant species. As new information becomes available, we may reevaluate the critical habitat designations as necessary.

(37) *Comment:* One commenter stated that it appears that a portion of unit M is in the Urban District.

*Our Response:* This area was removed from the final designation because it does not contain the primary constituent elements necessary for the conservation of *Sesbania tomentosa* or *Centaurium sebaeoides*.

(38) *Comment*: The large scale maps of the designated critical habitat make it impossible to determine the exact boundaries of the critical habitat. This, in turn, makes it impossible to be precise in commenting on economic impacts.

*Our Response*: The maps in the **Federal Register** provide the general location and shape of critical habitat and are provided for reference purposes to guide Federal agencies and other interested parties in locating the general boundaries of the critical habitat; the maps do not constitute the definition of the boundaries of a critical habitat (50 CFR 17.94). The legal descriptions are the definition of the boundaries of critical habitat, are readily plotted, are transferable to a variety of mapping formats, and were made available electronically upon request for use with GIS programs. Unit boundaries were defined by giving the coordinates in UTM Zone 5 with units in meters using North American Datum of 1983 (NAD83). These coordinates can be used to determine boundaries with some accuracy. At the public hearing, the maps were expanded to wall-size to assist the public in better understanding the proposed critical habitat. These larger scale maps were also provided to individuals upon request. Furthermore, we provided direct assistance in response to written or telephone questions with regard to mapping and landownership within the proposed critical habitat.

#### *Issue 6: Policy and Regulations*

(39) *Comment*: Two commenters stated that the Service's suggestion that current management efforts can render otherwise "critical" habitat no longer "critical" illegally reads into section 3(5) of the Act an additional, unstated requirement that habitat cannot be "critical" unless the Service finds it needs more management or protection than it currently receives.

*Our Response*: Please refer to the response to comment 8.

(40) *Comment*: The proposal violated the commerce clause and exceeds the constitutional limits of the Service's delegated authority. The listed species are not interstate; they exist only in Hawaii and do not cross State lines.

*Our Response*: The Federal government has the authority under the Commerce Clause of the U.S. Constitution to apply the protections of the Act to species that occur within a single State. A number of court cases have specifically addressed this issue. The *National Association of Homebuilders v. Babbitt*, 130 F. 3d 1041 (D.C. Cir. 1997), *cert. denied*, 1185 S.Ct.

2340 (1998), involved a challenge to application of Act's prohibitions to protect the listed Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*). As with the species at issue here, the Delhi Sands flower-loving fly is endemic to only one State. The court held that application of the ESA to this fly was a proper exercise of Commerce Clause power because it prevented loss of biodiversity and destructive interstate competition. Similar conclusions have been reached in other cases, see *Gibbs v. Babbitt*, No. 99-1218 (4th Cir. 2000) and *Rancho Viejo v. Norton*, No. 01-5373 (D.C. Cir. 2003).

(41) *Comment*: One commenter disagreed with the Service's approach of proposing critical habitat designations in advance of any economic analysis. Another commenter stated that economic analysis must be completed before critical habitat can be prudently designated.

*Our Response*: We agree that the economic analysis must be completed before critical habitat can be designated, and we do so in all cases, including this regulation. The Service must first decide upon a specific area, or set of areas, to propose as critical habitat before the economic analysis of the proposal can begin. In cases such as this rulemaking, where we are under a court-ordered deadline to make a decision by a fixed date, we frequently issue the critical habitat proposal for public comment while the economic analysis is still being prepared, so as to maximize the time available for the public to review and comment on the proposal. When the economic analysis is prepared, it is also issued for public comment. The critical habitat proposal and the economic analysis are then revised as appropriate based on information received during the public comment period, and the economic and other relevant impacts of the proposal are evaluated, along with the available biological information, in making the final critical habitat determination.

(42) *Comment*: One commenter stated that the Service must exclude an area from critical habitat if that area is not "essential" to conservation of the species and if the cost-benefit analysis indicates that it is better to exclude the area. Absent proper completion of the procedure for designation of critical habitat outside the geographic area currently occupied by the species, when such areas are essential for the conservation of the species, "there is no evidence that Congress intended to allow the USFWS to regulate any parcel of land that is merely capable of supporting a protected species"

(*Arizona Cattle Growers Association v. USFWS*, 273 F. 3d 1229 (9th Cir. 2001)).

*Our Response*: As explained in the Methods section of the proposed rule (67 FR 37108) and this final rule, and in accordance with the Act and regulations (section 4(b)(2) and 50 CFR 424.12), we used the best scientific information available to determine areas that are essential for the conservation of these 99 Oahu plant species, not simply those areas that are capable of supporting the species. This information included the known locations; site-specific species information from the HINHP database and our own rare plant database; species information from the Center for Plant Conservation's (CPC) rare plant monitoring database housed at the University of Hawaii's Lyon Arboretum; island-wide Geographic Information System (GIS) coverages (e.g., vegetation, soils, annual rainfall, elevation contours, land ownership); the final listing rules for these 99 species; discussions with botanical experts; recommendations from the HPPRCC; and public comments (Service 1994, 1995a, 1995b, 1996a, 1996b, 1996c, 1996d, 1997, 1998a, 1998b, 1999; HPPRCC 1998; HINHP Database 2000, CPC *in litt.* 1999; J. Lau *et al.*, pers. comm., 2001). The cost of designating these areas as critical habitat was determined in the draft economic analysis and the addendum to the draft economic analysis. Neither the draft economic analysis nor the addendum found that the financial benefit of excluding these areas was so great that it outweighs the non-financial benefit of including these areas in a final critical habitat designation.

(43) *Comment*: The draft economic analysis concedes that State law protects "habitats" of endangered species and therefore protects federally designated critical habitat, including unoccupied habitat. Thus, designation is not necessary because State law already protects the habitat. In addition, Federal environmental impact analyses provide additional protection for federally listed species.

*Our Response*: As discussed above in "Previous Federal Action," we were ordered by U.S. District Court (Haw.) to publish proposed and final critical habitat designations or nondesignations for 255 Hawaiian plant species (*Conservation Council for Hawaii v. Babbitt*, 1998, 1999, 2000). In addition, under section 4(a)(3) of the Act, we are required to designate critical habitat for a species at the time it is federally listed as an endangered or threatened species, and on the basis of the best scientific data available and after taking into consideration the economic impact, and

any other relevant impact, of specifying an area as critical habitat (section 4(b)(2)). Further, see response to comment 42.

*Issue 7: Economic Issues*

(44) *Comment:* The Army believes that the direct and indirect costs and the anticipated costs of project modification, as they relate to military activities, are not adequately considered.

*Our Response:* Chapter VI, Section 3.q. of the DEA presented estimates of section 7 costs associated with activities in 10 separate areas on Oahu that are under the control of the U.S. military. During public comment, the U.S. Army stated that the cost-estimates for consultations and for possible project modifications on their installations were too low. The addendum revisits the sections of the analysis addressing Army installations and provides revised cost-estimates based upon further discussions with the Service and additional information gathered since completion of the DEA, including the Oahu Training Areas Integrated Natural Resources Management Plan 2002–2006 (OTA INRMP).

However, based on the considerations given in “Analysis of Impacts Under Section 4(b)(2)” and consistent with the direction provided in this section of the Act, we have determined that the benefits of excluding lands under jurisdiction of the U.S. Army on Oahu outweigh the benefits of including them as critical habitat for 76 species of listed plants. Therefore, these lands have been excluded from the critical habitat designations in this final rulemaking.

(45) *Comment:* The DEA does not indicate that the designation of critical habitat will generate any “new” money. It does show that increased regulation due to designation of critical habitat will increase economic risks, drive down profits, and drive away potential investors, thereby reducing “new” money entering Hawaii.

*Our Response:* The DEA states that a portion of the expenditures on conservation management by the Service, NRCS, and the military could be “new” money. Based on State multipliers, each additional \$1 million of new money spent in Hawaii would generate approximately \$1.8 million in direct and indirect sales in Hawaii and would support approximately 22 direct and indirect jobs in Hawaii (DEA, Chapter VI, Section 7.f.).

Regarding development projects and “new” investment money that could be lost, the DEA noted in Chapter VI, Section 4.h. that: “Over the next 10 years, the number of affected

(development) projects is expected to be small because most of the proposed critical habitat units are: (1) In mountainous areas that are unsuitable for development due to difficult access and terrain, and (2) within the State Conservation District where land-use controls severely limit development.” The development projects that were addressed in Chapter VI of the DEA included: (1) Communications facilities (Sections 3.e. and 4.d.), (2) residential development (Section 3.o.), and (3) a private landfill (Sections 3.p. and 4.e.). The intended designation does not include the large communications complexes at Palehua and Koko Head, urban land suitable for residential development, or the site for the proposed landfill. Only a few of the smaller communications complexes remain in the intended designation. Because of the small footprints of communications towers and for other reasons, the analysis does not anticipate costly project modifications (Section 3.p.). Thus, the analysis anticipates no significant loss of “new” money.

(46) *Comment:* The DEA argues that because critical habitat is mandated by law, it must therefore have economic value. The alleged benefits of species preservation are not economic at all.

*Our Response:* As noted in Chapter VI, Section 6.a. of the DEA, “[m]any economic studies have demonstrated benefits associated with the conservation and recovery of endangered and threatened species and their ecosystems.

The DEA continues, “However, the additional economic benefits of conservation and recovery that would be attributable to the designation of critical habitat are difficult to estimate because of the scarcity of (1) scientific studies on the magnitude of the recovery and ecosystem changes resulting from the critical habitat designation, and (2) economic studies on the per-unit value of many of the changes. \* \* \* And while some economic studies have been done on the per-unit value of some of these changes, studies have not been done for most.”

The DEA concludes, “As a result, it is not possible, given the information that is currently available, to estimate the value of many of the benefits that could be ascribed to critical habitat designation.”

(47) *Comment:* The DEA dismisses the “worst-case” impacts and does not consider the major adverse impacts from secondary effects or indirect costs. Indirect costs are not considered in the bottom line analysis of the cost of designating critical habitat.

*Our Response:* Chapter VI, Section 4 of the DEA and Section 5 of the Addendum discuss various indirect costs that can result from the critical habitat designation. These indirect costs are not “worst-case” estimates. Instead, most of them are conditioned upon actions and decisions by the State, the county, investors, etc. Because critical habitat has a limited history in Hawaii, and other States have environmental laws that differ from Hawaii’s laws, uncertainty exists regarding the outcome of these actions and decisions.

Also, these indirect impacts are not dismissed. Rather, they receive the same importance that direct costs receive. The reason the indirect costs are not summed is that many of them should be weighted by the probability of occurrence, but information is not available to determine these probabilities beyond a subjective estimate. As indicated in the DEA, several of the probabilities are “small.” In the case of property values, a loss is expected, but uncertainty exists over the magnitude of this loss.

(48) *Comment:* One commenter stated that the DEA lacks a thorough benefits analysis. Multiple commenters stated that the DEA ignored the benefit of keeping other native species off the endangered species list, of maintaining water quality and quantity, of promoting ground water recharge, and of preventing siltation of the marine environment, thus protecting coral reefs. Another commenter noted that additional benefits of critical habitat include combating global warming, providing recreational opportunities, attracting ecotourism, and preserving Hawaii’s natural heritage. Although the DEA makes general observations of the benefits associated with designating critical habitat, it makes no attempt to quantify these acknowledged benefits. The Service must use the tools available, such as a University of Hawaii Secretariat for Conservation Biology study that estimated the value of ecosystem services, to determine the benefits of critical habitat. On the other hand, one commenter stated that the DEA overestimates economic benefits, and many of the alleged benefits are entirely speculative, unquantifiable, or lack any commercial value.

*Our Response:* Chapter VI, Sections 6 and 7 of the DEA discussed potential direct and indirect benefits that can result from the proposed designation, including those addressed in the above comment. However, the DEA also indicated that these benefits are not quantified due to lack of information on the value of the environmental benefits that would be attributable specifically to



the critical habitat designations (*i.e.*, the benefits over and above those that will occur due to other existing protections, and over and above the benefits from other conservation projects).

Specifically, there is a lack of (1) scientific studies regarding ecosystem changes due to critical habitat, and (2) economic studies on the per-unit value of many of the changes.

The 1999 analysis by University of Hawaii (UH) economists on the total value of environmental services provided by Oahu's Koolau Mountains was in fact used in the DEA as a resource document for concepts, for identifying documents that report the original research on certain subjects, and for illustrating the economic value of an assumed incremental increase in environmental services.

However, as noted in the DEA, estimating the total value of the ecosystem services provided by the Koolau Mountains is a difficult task, requiring some assumptions that are open to challenge, including estimates of the magnitude of the environmental services provided by the Koolau Mountains and estimates of the per-unit value of each service. Also, the UH study does not address all of the benefits of the Koolau Mountains or any of the benefits of the Waianae Mountains.

More to the point, the UH study has limited applicability for valuing the benefits of the intended designation for the 99 Oahu plant species. Since the purpose of the UH study was to estimate the total value of environmental benefits provided by the entire Koolau Mountains on the island of Oahu, it does not address the value of the more limited benefits provided by the intended critical habitat for the 99 Oahu plant species. Specifically, the UH study provides no estimates of the changes in biological and/or environmental conditions resulting from changes in land management due to critical habitat designation.

In any case, the DEA reported that the value of the ecosystem services provided by the Koolaus is very large. Since the intended designation covers nearly all of the Koolau Mountains, as well as parts of the Waianae Mountains, and since some project modifications can affect large portions of the mountains, even a very small percentage improvement to ecosystem services can translate into large economic benefits.

In summary, the discussion presented in the DEA on the biological and environmental benefits of critical habitat designation provides an overview of potential benefits, but we did not intend for it to provide a

complete quantitative analysis of the benefits. Instead, we believe that the benefits of critical habitat designation are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.

(49) *Comment:* Treating "better siting of projects by developers so as to avoid costly project delays" as an economic benefit is circular. The costly project delays result from regulations. They could be avoided by not imposing the regulations in the first place.

*Our Response:* As noted in Chapter VI, Section 6.c. of the DEA, the benefit applies to proposed units or portions of units that the Service regards as occupied. Even without critical habitat, developers must consult with the Service on projects that have Federal involvement and that affect listed species. By knowing the critical habitat boundaries, and if developers have the flexibility, they can site projects outside the boundaries, thereby avoiding certain issues related to threatened and endangered species. But even if there is no flexibility in siting a project, it can still be helpful to developers to know the boundaries of a critical habitat unit. If a project is located outside the unit boundaries, then the developer can proceed with project planning with less risk of facing issues related to critical habitat. On the other hand, if a project is located inside a critical habitat boundary and there is Federal involvement, then the developer and action agency could enter into informal consultations with the Service before proceeding with detailed site plans. Since the discussion applies only to areas that are occupied and would be subject to regulation with or without critical habitat, the logic for the benefit to developers is not circular.

(50) *Comment:* The DEA fails to adequately address the economic value represented by the time, money, and energy that the people of Hawaii invest in the conservation of native Hawaiian plants, including the ethnobotanical value of these plants to the culture of native Hawaiians.

*Our Response:* Chapter VI, Sections 6 and 7 of the DEA discussed the benefits of critical habitat. While the time, money and energy that the people of Hawaii invest in the conservation of native plants could function as an indicator for residents' "willingness to pay" to protect these species, this information has not been gathered or analyzed comprehensively, and, given the scope of the economic analysis, no primary economic research was conducted. Moreover, as noted in the DEA, even if this information were

available, the economic value of these benefits attributable to critical habitat designation would still be difficult to estimate because of (1) scientific studies on the magnitude of the recovery and ecosystem changes resulting from the critical habitat designation, and (2) economic studies on the per-unit value of many of the changes.

(51) *Comment:* The analysis used in the DEA for Oahu is not consistent with the analysis used in the DEA for the island of Hawaii. The Service should use a consistent methodology in all of its economic analyses.

*Our Response:* This specific comment objected to differences in the methodology used to estimate direct economic costs related to Army activities and the fact that the estimated costs were much lower for Oahu. The economic analysis for both Oahu and the Big Island (island of Hawaii) used the same methodology. But the direct costs were lower for Oahu because of: (1) Differences in the extent of the overlap between the proposed designations and the Army installations on Oahu versus the installation on the Big Island; (2) differences in the planned military uses of land in the proposed designations; and (3) differences in information available to the analysts regarding project modifications. The addendum revisits the direct costs associated with Army activities and revises them based on updated information.

(52) *Comment:* One private landowner states that designated critical habitat affects over half of his land holdings and will result in impacts to land value, extraordinary levels of governance, and long-term economic impacts.

*Our Response:* For grazing land in critical habitat, the DEA addressed the possible direct section 7 costs for ranching activities (DEA, Chapter VI, Section 3.h), the indirect impacts of critical habitat on State and county development approvals (DEA, Chapter VI, Section 4.h.), and the possible loss of property value (DEA, Chapter VI, Section 4.i). Because the intended critical habitat would cover less grazing land than the proposed critical habitat, the addendum revisited the possible direct section 7 costs on ranching activities and the potential loss of property value (Sections 4.e and 5.g, respectively). For about 2,070 acres of privately owned agricultural land in the intended critical habitat, the analysis found that the loss in property value would be a small to moderate fraction of \$18.6 million.

(53) *Comment:* The DEA ignores the topic of subsistence gathering.

*Our Response:* The DEA did not address the potential indirect impact of the proposed critical habitat designation on subsistence activities for three reasons. First, subsistence activity is less extensive, and less important economically, on Oahu than it is on the other islands. This reflects the fact that Oahu has a comparatively large and diverse economy. Second, much of the subsistence hunting that does take place on Oahu is also recreational hunting, which is addressed in the DEA. Third, the DEA did not expect critical habitat to affect subsistence activities and the subsistence lifestyle.

Nevertheless, in response to the comment, the addendum addresses subsistence activities. The analysis found that it is unlikely that new or additional restrictions on access and prohibitions on subsistence will result from critical habitat designation. This assessment is partly based on the Hawaii State Constitution, which protects traditional subsistence activities. The analysis estimates that it is more likely that restrictions (if any) will occur in small, localized areas that have significant biological importance, *i.e.*, areas containing populations of the plants. However, because of the strong stewardship and conservation values associated with those who practice subsistence activities, combined with the cultural tradition of protecting environmentally sensitive areas, subsistence activities are likely to be consistent with any conservation restrictions in localized areas. Thus, the analysis anticipates no significant impact on subsistence activities as a result of the intended designation.

(54) *Comment:* Several commenters stated the following: The DEA fails to consider economic impacts of critical habitat that result through interaction with State law, specifically Hawaii's Land Use Law. Critical habitat could result in downzoning under State law. Hawaii Revised Statutes (HRS) § 205-2(e) states that conservation districts shall include areas necessary for conserving endangered species. HRS § 195D-5.1 states that DLNR shall initiate amendments in order to include the habitat of rare species. Even if DLNR does not act, the Land Use Commission (LUC) might initiate such changes, or they might be forced by citizen lawsuits. Areas for endangered species are placed in the protected subzone with the most severe restrictions. While existing uses can be grandfathered in, downzoning will prevent landowners from being able to shift uses in the future, reduce market value, and make the land unmortgageable. Although the Service acknowledges that there could be

substantial indirect costs relating to redistricting of land to the Conservation District, several commentators disagreed with the characterization of these costs as unlikely. The DEA fails to consider additional third-party lawsuits to force redistricting of lands into the conservation district.

*Our Response:* Chapter VI, Section 4.g. of the DEA and Section 5.e. of the addendum discuss possible costs associated with redistricting land in critical habitat. Most of the land in the urban district and much of the land in the agricultural district initially proposed for designation are removed in the intended designation. As indicated in Section 5.e. of the addendum, the intended designation includes (1) approximately 3,319 acres of agricultural land, of which 2,070 acres are privately owned; and (2) approximately 0.6 acre of urban land, of which about 0.2 acre is privately owned. Under a worst-case scenario, where all land in the agricultural district is redistricted to Conservation, the reduction in land values would be approximately \$18.6 million.

As discussed more fully in Chapter VI, Section 4.g. of the DEA and Section 5.e. of the addendum, agency-initiated and court-ordered redistricting of some of the privately owned land is reasonably foreseeable (moderate to high probability). Further, this analysis judges the probability that all of the parcels will be redistricted to be very low to low. Tables ES-1 and VI-3 in the DEA characterized the risk of redistricting all of the parcels in the proposed designation as "undetermined," not as "unlikely." To more accurately reflect the analysis, this analysis changes the probability to "very low to low." But even if land is not redistricted, the DEA and the addendum noted that the State may seek agreements with landowners to protect the habitats of listed species in order to retain existing district designations.

The DEA recognized that a real or perceived risk of redistricting can cause a loss of land value that continues until the uncertainty is resolved by (1) the passage of time that reveals the extent of redistricting due to critical habitat, or (2) possibly a State court decision on issues raised by critical habitat designation. Over the long-term, a permanent loss of land value (if any) would depend on how the uncertainty is resolved.

(55) *Comment:* The Service has failed to mention the Federal court ruling on the *New Mexico Cattlegrowers Association v. U.S. Fish and Wildlife Service*, which requires consideration of the impact of listing as well as the

impact of designating an area as critical habitat.

*Our Response:* The DEA and the addendum considered the economic impacts of section 7 consultations related to critical habitat even if they are attributable coextensively to the listed status of the species. In addition, the DEA and the addendum examined the indirect costs of critical habitat designation, *e.g.*, the relationship between critical habitat designation and a State or local statute.

(56) *Comment:* Any activity that could degrade critical habitat, including activities that are not subject to section 7 consultation, could be seen as an "injury" to (and therefore, under State law, a "taking" of) an endangered plant species under the State of Hawaii's endangered species law (Chapter 195D). It is important that this receive due consideration in evaluating the proposed critical habitat designations (for example, in completing the economic analysis) and that the Service explain to what extent it has considered the potential interplay between the Federal Endangered Species Act and Hawaii's endangered species laws.

*Our Response:* Chapter VI, Sections 4.b. and 4.f. of the DEA and Section 5.d. of the addendum discuss possible indirect costs resulting from the interplay of the Federal Endangered Species Act and Hawaii State law (*e.g.*, court-ordered mandates to manage private lands for conservation of the plants or to reduce game-mammal populations that harm plants or their habitats). Both the DEA and the addendum considered the economic impacts of section 7 consultations related to critical habitat even if they are attributable coextensively to the listed status of the species. In addition, the DEA and the addendum examined any indirect costs of critical habitat designation. However, the impacts are not attributable to critical habitat designation when the listing of a species prompts action at the State or local level. Take prohibitions under Hawaii law are purely attributable to a listing decision and do not occur as a result of critical habitat designations. There are no take prohibitions associated with the plants' critical habitat.

(57) *Comment:* Several commenters stated the following: The Service did not adequately address the takings of private property as a result of designating critical habitat for endangered plants on Oahu. If the proposed designation of critical habitat precipitates conversion of agricultural lands to conservation land that has no economically beneficial use, then the