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50 CFR Part 17

**Endangered and Threatened Wildlife and
Plants; Final Designation or
Nondesignation of Critical Habitat for 95
Plant Species From the Islands of Kauai
and Niihau, HI; Final Rule**

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018-AG71

Endangered and Threatened Wildlife and Plants; Final Designation or Nondesignation of Critical Habitat for 95 Plant Species From the Islands of Kauai and Niihau, 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 83 of the 95 species known historically from the Hawaiian islands of Kauai and Niihau. A total of approximately 21,266 hectares (ha) (52,549 acres (ac)) of land on the island of Kauai and 144 ha (357 ac) of land on the island of Niihau fall within the boundaries of the 217 critical habitat

units designated for the 83 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 seven species. 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 March 31, 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, P.O. 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:

Background

In the Lists of Endangered and Threatened Plants (50 CFR 17.12), there are 95 plant species that, at the time of listing, were reported from the islands of Kauai and/or Niihau (Table 1). Fifty-seven of these species are endemic to the islands of Kauai and Niihau, while 38 species are reported from one or more other islands, as well as Kauai and/or Niihau. Each of these species is described in more detail below in the section, "Discussion of Plant Taxa." Although we considered designating critical habitat on Kauai for each of the 95 plant species, for the reasons described below, the final designation includes critical habitat for 83 of 95 plant species. Species that also occur on other islands may have critical habitat designated on other islands in subsequent rulemakings.

TABLE 1.—SUMMARY OF ISLAND DISTRIBUTION OF 95 SPECIES FROM KAUAI AND NIIHAU

Species	Island distribution						
	Kauai	Oahu	Molokai	Lanai	Maui	Hawaii	N.W. Isles, Kahoolawe, Niihau
<i>Acaena exigua</i> (liliwai)	H				H		
<i>Achyranthes mutica</i> (NCN*)	H					C	
<i>Adenophorus periens</i> (pendent kihi fern)	C	H	C	R	R	C	
<i>Alectryon macrococcus</i> (mahoe)	C	C	C		C		
<i>Alsinidendron lychnoides</i> (kuawawaenohu)	C						
<i>Alsinidendron viscosum</i> (NCN)	C						
<i>Bonamia menziesii</i> (NCN)	C	C	H	C	C	C	
<i>Brighamia insignis</i> (olulu)	C						Ni (C)
<i>Centaurium sebaeoides</i> (awiwi)	C	C	C	C	C		
<i>Chamaesyce halemanui</i> (NCN)	C						
<i>Ctenitis squamigera</i> (pauoa)	H	C	C	C	C	H	
<i>Cyanea asarifolia</i> (haha)	C						
<i>Cyanea recta</i> (haha)	C						
<i>Cyanea remyi</i> (haha)	C						
<i>Cyanea undulata</i> (NCN)	C						
<i>Cyperus trachysanthos</i> (puukaa)	C	C	H	H			Ni (C)
<i>Cyrtandra cyaneoides</i> (mapele)	C						
<i>Cyrtandra limahuliensis</i> (haiwale)	C						
<i>Delissea rhytidosperma</i> (NCN)	C						
<i>Delissea rivularis</i> (oha)	C						
<i>Delissea undulatra</i> (NCN)	C						Ni (H)
<i>Diellia erecta</i> (NCN)	C	C	C	H	C	C	
<i>Diellia pallida</i> (NCN)	C						
<i>Diplazium molokaiense</i> (NCN)	H	H	H	H	C		
<i>Dubautia latifolia</i> (koholapehu)	C						
<i>Dubautia pauciflorula</i> (naenae)	C						
<i>Euphorbia haeleeleana</i> (akoko)	C	C					
<i>Exocarpos luteolus</i> (heau)	C						
<i>Flueggea neowawraea</i> (mehamehame)	C	C	H		C	C	
<i>Gouania meyenii</i> (NCN)	C	C					
<i>Hedyotis cookiana</i> (awiwi)	C	H	H			H	
<i>Hedyotis st.-johnii</i> (Na Pali beach hedyotis)	C						
<i>Hesperomannia lydgatei</i> (NCN)	C						
<i>Hibiscadelphus woodii</i> (hau kuahiwi)	C						
<i>Hibiscus brackenridgei</i> (mao hau hele)	H	C	H	C	C	C	Ka (R)

TABLE 1.—SUMMARY OF ISLAND DISTRIBUTION OF 95 SPECIES FROM KAUAI AND NIIHAU—Continued

Species	Island distribution						
	Kauai	Oahu	Molokai	Lanai	Maui	Hawaii	N.W. Isles, Kahoolawe, Niihau
<i>Hibiscus clayi</i> (Clay's hibiscus)	C						
<i>Hibiscus waimeae</i> ssp. <i>hannerae</i> (kokio keokeo)	C						
<i>Ischaemum byrone</i> (Hilo ischaemum)	C	H	C		C	C	
<i>Isodendron laurifolium</i> (aupaka)	C	C					
<i>Isodendron longifolium</i> (aupaka)	C	C					
<i>Isodendron pyrifolium</i> (wahine noho kula)		H	H	H	H	C	Ni (H)
<i>Kokia kauaiensis</i> (kokio)	C						
<i>Labordia lydgatei</i> (kamakahala)	C						
<i>Labordia tinifolia</i> var. <i>wahiawaensis</i> (kamakahala)	C						
<i>Lipochaeta fauriei</i> (nehe)	C						
<i>Lipochaeta micrantha</i> (nehe)	C						
<i>Lipochaeta waimeaensis</i> (nehe)	C						
<i>Lobelia niihauensis</i>	C	C					Ni (H)
<i>Lysimachia filifolia</i> (NCN)	C	C					
<i>Mariscus pennatifolius</i> (NCN)	H	H			C	H	NW (C)
<i>Melicope haupuensis</i> (alani)	C				C		
<i>Melicope knudsenii</i> (alani)	C				C		
<i>Melicope pallida</i> (alani)	C	C					
<i>Melicope quadrangularis</i> (alani)	H						
<i>Munroidendron racemosum</i> (NCN)	C						
<i>Myrsine linearifolia</i> (kolea)	C						
<i>Nothoecstrum peltatum</i> (aiea)	C						
<i>Panicum niihauense</i> (lau ehū)	C						Ni (H)
<i>Peucedanum sandwicense</i> (makou)	C	C	C		C		
<i>Phlegmariurus mannii</i> (wawaeiole)	H				C	C	
<i>Phlegmariurus nutans</i> (wawaeiole)	H	C					
<i>Phyllostegia knudsenii</i> (NCN)	C						
<i>Phyllostegia waimeae</i> (NCN)	C						
<i>Phyllostegia wawrana</i> (NCN)	C						
<i>Plantago princeps</i> (laukahi kuaj)	C	C	C		C	H	
<i>Platanthera holochila</i> (NCN)	C	H	C		C		
<i>Poa mannii</i> (Mann's bluegrass)	C						
<i>Poa sandwicensis</i> (Hawaiian bluegrass)	C						
<i>Poa siphonoglossa</i> (NCN)	C						
<i>Pritchardia aylmer-robinsonii</i> (wahane)							Ni (C)
<i>Pritchardia napaliensis</i> (loulou)	C						
<i>Pritchardia viscosa</i> loulou	C						
<i>Pteralyxia kauaiensis</i> (kaulu)	C						
<i>Remya kauaiensis</i> (NCN)	C						
<i>Remya montgomeryi</i> (NCN)	C						
<i>Schiedea apokremnos</i> (maolioli)	C						
<i>Schiedea helleri</i> (NCN)	C						
<i>Schiedea kauaiensis</i> (NCN)	C						
<i>Schiedea membranacea</i> (NCN)	C						
<i>Schiedea nuttallii</i> (NCN)	C	C	C		R		
<i>Schiedea spergulina</i> var. <i>leiopoda</i> (NCN)	C						
<i>Schiedea spergulina</i> var. <i>spergulina</i> (NCN)	C						
<i>Schiedea stellarioides</i> (NCN)	C						
<i>Sesbania tomentosa</i> (ohai)	C	C	C	H	C	C	Ni (H), Ka (C), NW Isles (C)
<i>Silene lanceolata</i> (NCN)	H	C	C	H		C	
<i>Solanum incompletum</i> (popolo ku mai)	H		H	H	H	C	
<i>Solanum sandwicense</i> (aiakeakua, popolo)	C	H					
<i>Spermolepis hawaiiensis</i> (NCN)	C	C	C	C	C	C	
<i>Stenogyne campanulata</i> (NCN)	C						
<i>Vigna o-wahuensis</i> (NCN)		H	C	C	C	C	Ni (H), Ka, (C)
<i>Viola helenae</i> (NCN)	C						
<i>Viola kauaiensis</i> var. <i>wahiawaensis</i> (nani waialeale) ..	C						
<i>Wilkesia hobydyi</i> (dwarf iliau)	C						
<i>Xylosma crenatum</i> (NCN)	C						
<i>Zanthoxylum hawaiiense</i> (ae)	C		C	H	C	C	

KEY

C (Current)—population last observed within the past 30 years

H (Historical)—population not seen for more than 30 years

R (Reported)—reported from undocumented observations

*NCN—No Common Name

The Islands of Kauai and Niihau

Because of its age and relative isolation, Kauai has levels of floristic diversity and endemism that are higher than on any other island in the Hawaiian archipelago. However, the vegetation on Kauai has undergone extreme alterations because of past and present land use. Land with rich soils was altered by the early Hawaiians and, more recently, converted to agricultural use or pasture. Intentional or inadvertent introduction of nonnative plant and animal species has also contributed to the reduction of native vegetation on the island of Kauai. Native forests are now limited to the upper elevation mesic (moist) and wet regions within Kauai's Conservation District. The land that supports the habitat essential to the conservation of the 83 plant taxa is owned by various private parties, the State of Hawaii (including State parks, forest reserves, natural area reserves, and a wilderness area), and the Federal government. Most of the taxa included in this final rule persist on steep slopes, precipitous cliffs, valley headwalls, and other regions where unsuitable topography has prevented agricultural development, or where inaccessibility has limited encroachment by nonnative plant and animal species (Gagne and Cuddihy 1999).

Niihau's relative isolation and severe environmental conditions have produced a few endemic species. Unfortunately, human disturbance, primarily ungulate ranching, has drastically changed the vegetation and hydrological parameters of the island, leaving few of the native vegetation communities. Niihau has been privately owned since 1864 and access has been, and continues to be, restricted (Department of Geography 1998). Therefore, current information on plant locations and population status is extremely limited.

Discussion of Plant Taxa

Species Endemic to Kauai and Niihau

Alsinidendron lychnoides (kuawawaenohu)

Alsinidendron lychnoides, a member of the pink family (Caryophyllaceae), is a weakly climbing or sprawling subshrub, woody at the base, with a dense covering of fine glandular hairs throughout. This short-lived perennial species is distinguished from others in this endemic Hawaiian genus by the weakly climbing or sprawling habit, color of the sepals (modified leaves), number of flowers per cluster, and size of the leaves. It is closely related to *A.*

viscosum, which differs primarily by having narrower leaves, fewer capsule valves (fruit chambers), and fewer flowers per cluster (Wagner *et al.* 1999).

This species has been observed with fruits during February. No additional life history information for this species is currently known (Service 1998a).

Historically, *Alsinidendron lychnoides* was found on the island of Kauai on the east rim of Kalalau Valley near Keanapuka, the western and southeastern margins of the Alakai Swamp, and southwest of the Swamp near Kaholuamano. Currently, there are four occurrences with a total of eight individual plants. This species is extant on State-owned land in the Alakai Swamp, the Mohihi-Waialae Trail, Keanapuka and Pihea in the Alakai Wilderness Preserve, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve (Geographic Decision Systems International (GDSI) 2000; Hawaii Natural Heritage Program (HINHP) Database 2000).

Alsinidendron lychnoides typically grows on steep riparian clay or silty soil banks in montane wet forests dominated by *Metrosideros polymorpha* (ohia) and *Cheirodendron* spp. (olapa), or by *M. polymorpha* and *Dicranopteris linearis* (uluhe), at elevations between 828 and 1,344 meters (m) (2,715 and 4,408 feet (ft)). Associated native plant species include *Asplenium* spp. (no common name (NCN)), *Astelia* spp. (painiu), *Broussaisia arguta* (kanawao), *Carex* spp. (NCN), *Cyrtandra* spp. (haiwale), *Diplazium sandwichianum* (NCN), *Elaphoglossum* spp. (ekaha), *Hedyotis terminalis* (manono), *Machaerina* spp. (uki), *Peperomia* spp. (ala ala wai nui), or *Vaccinium* spp. (ohelo) (61 FR 53070; Ken Wood, National Tropical Botanical Garden (NTBG), pers. comm., 2001).

The major threats to this species are competition from the aggressive nonnative plant species *Rubus argutus* (prickly Florida blackberry); habitat degradation by feral pigs (*Sus scrofa*); trampling by humans; risk of extinction from naturally occurring events, such as landslides or hurricanes; and reduced reproductive vigor due to the small number of extant individuals (61 FR 53070).

Alsinidendron viscosum (no common name (NCN))

Alsinidendron viscosum, a member of the pink family (Caryophyllaceae), is a weakly climbing or sprawling subshrub densely covered with fine glandular hairs. This short-lived perennial species is distinguished from others in this endemic Hawaiian genus by the weakly climbing or sprawling habit, color of the sepals, number of flowers per cluster,

and size of the leaves. It is closely related to *A. lychnoides*, which differs primarily in having wider leaves and more capsule valves and flowers per cluster (Wagner *et al.* 1999).

Alsinidendron viscosum has been observed in flower during January, February, and April. No additional life history information for this species is currently known (Service 1998a).

Historically, *Alsinidendron viscosum* was found at Kaholuamano, Kokee, Halemanu, Nawaimaka, and Waialae areas of northwestern Kauai. Currently, there are a total of seven occurrences containing about 319 individuals on the island of Kauai. These occurrences are on State-owned land at the Halemanu-Kokee Trail, Mohihi-Waialae Trail, Kawaiiki Valley, Waialae Falls, and Nawaimaka Valley in the Alakai Wilderness Preserve, Kokee State Park, and the Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000; 61 FR 53070).

Alsinidendron viscosum is typically found at elevations between 754 and 1,224 m (2,474 and 4,016 ft), on steep slopes in *Acacia koa* (koa)-*Metrosideros polymorpha* lowland and montane mesic forest. Associated native plant species include *Alyxia oliviformis* (maile), *Asplenium polyodon* (punana manu), *Bidens cosmoides* (poola nui), *Bobea* spp. (ahakea), *Carex meyenii* (NCN), *Carex wahuensis* (NCN), *Coprosma* spp. (pilo), *Dianella sandwicensis* (ukiuki), *Dodonaea viscosa* (aalii), *Doodia kunthiana* (ohupuku pulauui), *Dryopteris glabra* (kilau), *Dryopteris unidentata* (akole), *Dryopteris wallichiana* (ionui), *Dubautia laevigata* (naena), *Gahnia* spp. (NCN), *Ilex anomala* (aiea), *Melicope* spp. (alani), *Panicum nephelophilum* (konakona), *Pleomele aurea* (hala pepe), *Psychotria* spp. (kopiko), *Pteridium aquilinum* var. *decompositum* (bracken fern), *Schiedea stellarioides* (lauhilihi), or *Vaccinium dentatum* (ohelo) (K. Wood, pers. comm., 2001).

The major threats to this species are destruction of habitat by feral pigs and goats (*Capra hircus*); competition with the nonnative plant species *Lantana camara* (lantana), and *Melinis minutiflora* (molasses grass), *Rubus argutus*; a risk of extinction from naturally occurring events, such as landslides or hurricanes; and reduced reproductive vigor due to the small number of extant populations and individuals (61 FR 53070).

Brighamia insignis (olulu)

Brighamia insignis, a member of the bellflower family (Campanulaceae), is an unbranched plant with a succulent stem that is bulbous at the bottom and

tapers toward the top, ending in a compact rosette of fleshy leaves. This short-lived perennial species is a member of a unique endemic Hawaiian genus with only one other species, *B. rockii* (pua ala), presently known only on Molokai, from which it differs by the color of its petals, its shorter calyx (sepals) lobes, and its longer flower stalks (Lammers 1999; 59 FR 9304).

Current reproduction is not thought to be sufficient to sustain populations of this species, with poor seedling establishment due to competition with nonnative grasses as the limiting factor. Pollination by native sphingid moths (Sphingidae family) is likely; however, pollination failure is common, due to either a lack of pollinators or a reduction in genetic variability. The flower structure appears to favor outcrossing (pollination between different parent plants). Some vegetative cloning has been observed and flower and leaf size appear to be dependent on moisture availability. Seeds of this species are undoubtedly dispersed by gravity. Although they may be blown for short distances, they are not adapted for wind dispersal, being ovoid to ellipsoid, smooth, and lacking any sort of wing or outgrowth (Service 1995; 59 FR 9304).

Historically, *Brighamia insignis* was known from the headland between Hoolulu and Waiahuakua Valleys along the Na Pali Coast on the island of Kauai, and from Kaali Spring on the island of Niihau. Currently, there are a total of four occurrences containing a total of about 42 to 62 individuals on the islands of Kauai and Niihau. It is reported on State land (Hono O Na Pali Natural Area Reserve (NAR)) and privately owned lands at Hoolulu and Waiahuakua Valleys, Haupu, and Keopaweo, and on the privately owned island of Niihau (GDSI 2000; HINHP Database 2000; Service 1995; Steve Perlman, NTBG, pers. comm., 2000).

Brighamia insignis is found at elevations between 0 and 748 m (0 and 2,453 ft) on rocky ledges with little soil or on steep sea cliffs in lowland dry grasslands or shrublands with annual rainfall that is usually less than 165 centimeters (cm) (65 inches (in)). Associated native plant species include *Artemisia australis* (ahinahina), *Chamaesyce celastroides* (akoko), *Eragrostis variabilis* (kawelu), *Heteropogon contortus* (pili grass), *Hibiscus kokio* (kokio), *Hibiscus kokio* ssp. *saintjohnianus* (kokio), *Lepidium serra* (anaunau), *Lipochaeta succulenta* (nehe), *Munroidendron racemosum* (NCN), or *Sida fallax* (ilima) (59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to this plant are browsing and habitat degradation by

feral goats; human disturbance; fire; the introduced carmine spider mite (*Tetranychus cinnabarinus*); a risk of extinction from naturally occurring events, such as landslides or hurricanes, due to the small number of individuals; restricted distribution; reduced reproductive vigor; and competition from nonnative plant species such as *Ageratum conyzoides* (maile hohono), *Kalanchoe pinnata* (air plant), *Lantana camara*, *Melinis minutiflora*, *Psidium cattleianum* (strawberry guava), *Psidium guajava* (guava), *Setaria parviflora* (yellow foxtail), *Sporobolus africanus* (smutgrass), or *Stachytarpheta dichotoma* (owi) (59 FR 9304).

Chamaesyce halemanui (NCN)

Chamaesyce halemanui, a short-lived perennial member of the spurge family (Euphorbiaceae), is a scandent (climbing) shrub. It is distinguished from closely related species by its decussate leaves (arranged in pairs at right angles to the next pair above or below), persistent stipules (bract- or leaf-like structures), more compact flower clusters, shorter stems on cyathia (flower cluster), and smaller capsules (Koutnik 1987; Koutnik and Huft 1999; 57 FR 20580).

Little is known about the life history of *Chamaesyce halemanui*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995).

Historically, *Chamaesyce halemanui* was found in Kauhao and Makaha Valleys in the Na Pali-Kona Forest Reserve, Mahanaloa Valley in Kuia NAR, the Halemanu drainage in Kokee State Park, and Olokele Canyon on the island of Kauai. Currently, there are a total of nine occurrences, containing about 85 to 135 individuals, in Kuia Valley, Poopooiki Valley, Kauhao Valley, Kaha Ridge, Awaawapuhi Valley, Waipio Falls, Halemanu, and Kaluahaulu in the Kokee State Park, Kuia NAR, and Na Pali-Kona Forest Reserve on State-owned land (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999; K. Wood, pers. comm., 2001).

Chamaesyce halemanui is typically found on the steep slopes of gulches in mesic *Acacia koa* forests at elevations between 556 and 1,249 m (1,825 and 4,097 ft). Associated native plant species include *Alphitonia ponderosa* (kauila), *Antidesma platyphyllum* (hame), *Asplenium* spp., *Bobea brevipes* (ahakea lau lii), *Carex meyenii*, *Carex wahuensis*, *Cheirodendron trigynum* (olapa), *Coprosma* spp., *Diospyros sandwicensis* (lama), *Dodonaea viscosa*,

Elaeocarpus bifidus (kalia), *Hedyotis terminalis*, *Kokia kauaiensis* (kokio), *Leptecophylla tameiameiae* (pukiawe), *Melicope haupuensis* (alani), *Metrosideros polymorpha*, *Microlepia strigosa* (palapalai), *Panicum nephelophilum*, *Pisonia* spp. (papala kepa), *Pittosporum* spp. (hoawa), *Pleomele aurea*, *Pouteria sandwicensis* (alaa), *Psychotria greenwelliae* (kopiko), *Psychotria mariniana* (kopiko), or *Santalum freycinetianum* (iliahi) (57 FR 20580; K. Wood, pers. comm., 2001).

The major threats to this species are competition from nonnative plants, such as *Lantana camara*, *Psidium cattleianum*, and *Stenotaphrum secundatum* (St. Augustine grass); habitat degradation by feral pigs; restricted distribution; small population size; increased potential for extinction resulting from naturally occurring events, such as landslides or hurricanes; and depressed reproductive vigor (57 FR 20580).

Cyanea asarifolia (haha)

Cyanea asarifolia, a member of the bellflower family (Campanulaceae), is a sparingly branched shrub. This short-lived perennial species is distinguished from others of the genus that grow on Kauai by the shape of the leaf base, the leaf width in proportion to the length, and the presence of a leaf stalk (Lammers 1999; 59 FR 9304).

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

Historically, *Cyanea asarifolia* was known only from along the bank of Anahola Stream on Kauai. Currently, two occurrences with approximately four or five individuals are reported from the headwaters of the Wailua River in central Kauai on State-owned land in the Lihue-Koloa Forest Reserve (GDSI 2000; HINHP Database 2000).

This species typically grows in pockets of soil on sheer wet rock cliffs and waterfalls in lowland wet forests at elevations between 182 and 1,212 m (597 and 3,976 ft). Associated native plant species include ferns, *Bidens* spp. (kookoolau), *Dubautia plantaginea* (naenae), *Hedyotis centranthoides* (NCN), *Hedyotis elatior* (awiwi), *Lysimachia filifolia* (kolokolo kuahiwi), *Machaerina angustifolia* (uki), *Metrosideros polymorpha*, or *Panicum lineale* (NCN) (59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to this species are a risk of extinction from naturally occurring events, such as hurricanes

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

Cyanea recta (haha)

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

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

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

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

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

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

Cyanea remyi (haha)

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

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

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

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

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

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

Cyanea undulata (haha)

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

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

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

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

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

cooperi (Australian tree fern), *Deparia petersenii*, *Elephantopus mollis* (NCN), *Erechtites valerianifolia*, *Melaleuca quinquenervia* (paperbark tree), *Melastoma candidum*, *Oplismenus hirtellus* (basketgrass), *Paspalum conjugatum*, *Paspalum urvillei* (Vasey grass), *Pluchea carolinensis* (sourbush), *Psidium cattleianum*, *Rhodomyrtus tomentosa* (rose myrtle), *Rubus rosifolius*, *Sacciolepis indica*, *Setaria parviflora*, *Stachytarpheta australis*, or *Youngia japonica*; trampling by feral pigs; landslides; seed predation by rats; herbivory by introduced slugs; loss of pollinators; hurricanes; and decreased reproductive vigor, restricted distribution, and extinction due to unforeseen circumstances because of small population size (Service 1994; 56 FR 47695).

Cyrtandra cyaneoides (mapele)

Cyrtandra cyaneoides, a member of the African violet family (Gesneriaceae), is an erect or ascending, fleshy, usually unbranched shrub with opposite toothed leaves which have impressed veins on the lower surface that are sparsely covered with long hairs. This short-lived perennial species differs from others of the genus that grow on Kauai by being a succulent, erect or ascending shrub; a bilaterally symmetrical calyx that is spindle-shaped in bud and falls off after flowering; leaves that are 41 to 56 cm (16 to 22 in) long and 23 to 35 cm (9 to 14 in) wide and have a wrinkled surface; and berries with shaggy hairs (Wagner *et al.* 1999).

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

Historically, *Cyrtandra cyaneoides* was known to occur only along the trail to Waialae Valley on Kauai until recently discovered in other areas. It is currently known from five occurrences, containing about 354 to 454 individuals, on private and State lands (including Halelea Forest Reserve and Alakai Wilderness Preserve) at Pihea, Waioli Valley, Lumahai, the left branch of Wainiha Valley, and Makaleha (GDSI 2000; HINHP Database 2000; 61 FR 53070).

Cyrtandra cyaneoides typically grows on talus rubble on steep slopes or cliffs with water seeps running below, near streams or waterfalls in lowland or montane wet forest or shrubland dominated by *Metrosideros polymorpha* or a mixture of *M. polymorpha*, *Cheirodendron* spp., and *Dicranopteris*

linearis at elevations between 157 and 1,406 m (514 and 4,614 ft). Associated native species include *Bidens* spp., *Boehmeria grandis* (akolea), *Coprosma* spp., *Cyanea* spp. (haha), *Cyrtandra longifolia* (haiwale), *Cyrtandra kauaiensis* (ulunahale), *Cyrtandra limahuliensis* (haiwale), *Diplazium sandwichianum*, *Freycinetia arborea*, *Gunnera kauaiensis* (ape ape), *Hedyotis terminalis*, *Hedyotis trybium* (NCN), *Machaerina* spp., *Melicope clusiifolia* (kukaemoa), *Melicope puberula* (alani), *Perrottetia sandwicensis*, *Pipturus* spp., *Psychotria* spp., *Pritchardia* spp. (loulou), or *Stenogyne purpurea* (NCN) (61 FR 53070; K. Wood, pers. comm., 2001).

The major threats to this species are competition with nonnative plant species such as *Deparia petersenii*, *Drymaria cordata* (pipili), *Paspalum conjugatum*, and *Rubus rosifolius*; predation of seeds by rats; reduced reproductive vigor and a risk of extinction from naturally occurring events, such as landslides and hurricanes, due to the small number of populations; and habitat degradation by feral pigs (61 FR 53070).

Cyrtandra limahuliensis (haiwale)

Cyrtandra limahuliensis, a member of the African violet family (Gesneriaceae), is an unbranched or few-branched shrub with moderately or densely hairy leaves. The following combination of characteristics distinguishes this short-lived perennial species from others of the genus: the leaves are usually hairy (especially on lower surfaces), the usually symmetrical calyx is tubular or funnel-shaped and encloses the fruit at maturity, and the flowers are borne singly (Wagner *et al.* 1990).

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

Historically, *Cyrtandra limahuliensis* was known from three locations on Kauai: Wainiha Valley, Lumahai Valley, and near Kilauea River, until it was recently discovered in additional areas. Currently, a total of 13 occurrences, containing approximately 2,746 to 3,024 individuals, are reported on private and State lands (including the Halelea, Kealia, and Lihue-Koloa Forest Reserves) at Limahuli Falls, Lumahai Valley, Waipa Valley, Waioli Valley, Kekoiki, Makaleha, the right fork of Wainiha Valley, Kualapa, Blue Hole, Kepalaoa, and Puu Kolo (GDSI 2000; HINHP Database 2000).

This species typically grows along streambanks in lowland wet forests at

elevations between 208 and 1,594 m (681 and 5,228 ft). Associated native plant species include *Antidesma platyphyllum*, *Bidens* spp., *Boehmeria grandis*, *Charpentiera* spp. (papala), *Cibotium glaucum* (hapuu), *Cyanea* spp., *Cyrtandra kealiae* (haiwale), *Dicranopteris linearis*, *Diplazium sandwichianum*, *Dubautia* spp. (naeae), *Eugenia reinwardtiana* (nioi), *Gunnera kauaiensis*, *Hedyotis terminalis*, *Hibiscus waimeae* (kokio keokeo), *Metrosideros polymorpha*, *Perrottetia sandwicensis*, *Pipturus* spp., *Pisonia* spp., *Pritchardia* spp., *Psychotria* spp., *Touchardia latifolia*, or *Urera glabra* (59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to this species are competition from nonnative plant species (*Blechnum occidentale*, *Clidemia hirta*, *Erechtites valerianifolia*, *Hedyochium flavescens* (yellow ginger), *Melastoma candidum*, *Paspalum conjugatum*, *Psidium cattleianum*, *Psidium guajava*, *Rubus rosifolius*, or *Youngia japonica*); habitat degradation by feral pigs; natural landslides; and hurricanes (59 FR 9304).

Delissea rhytidosperma (NCN)

Delissea rhytidosperma, a member of the bellflower family (Campanulaceae), is a branched shrub with lance-shaped or elliptic toothed leaves. This short-lived perennial species differs from other species of the genus by the shape, length, and margins of the leaves and by having hairs at the base of the anthers (part of stamen that produces pollen) (Lammers 1999).

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

Historically, *Delissea rhytidosperma* was known from as far north as Wainiha and Limahuli Valleys, as far east as Kapaa and Kealia, and as far south as the Haupu Range, between the elevations of 122 and 915 m (400 and 3,000 ft) on the island of Kauai. Currently, three occurrences on private and State lands (including Kuia NAR), with a total of 11 individuals, are reported from Kuia Valley, Puhakukane, and the Haupu Range (GDSI 2000; HINHP Database 2000).

This species generally grows in well-drained soils with medium or fine-textured subsoil in *Diospyros* (lama) diverse lowland mesic forests or diverse *Metrosideros polymorpha*-*Acacia koa* forests at elevations between 167 and 895 m (547 and 2,935 ft). Associated native plant species include grammitid

ferns, *Adenophorus* spp., *Cyanea* spp., *Dianella sandwicensis*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Doodia kunthiana*, *Euphorbia haeleleana* (akoko), *Hedyotis* spp. (NCN), *Leptecophylla tameiameia*, *Microlepia strigosa*, *Nestegis sandwicensis* (olopua), *Pisonia* spp., *Psychotria hobbyi* (kopiko), or *Pteralyxia kauaiensis* (kaulu) (59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to this species are predation and/or habitat degradation by mule deer (*Odocoileus hemionus columbianus*), feral pigs, and goats; herbivory by rats and introduced slugs; fire; and competition with the nonnative plants *Cordyline fruticosa* (ti), *Lantana camara*, *Passiflora ligularis* (sweet bananilla), and *Passiflora tarminiana* (banana poka); and a risk of extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of existing individuals (Service 1995; 59 FR 9304).

Delissea rivularis (oha)

Delissea rivularis, a member of the bellflower family (Campanulaceae), is a shrub, unbranched or branched near the base, with hairy stems and leaves arranged in a rosette at the tips of the stems. This short-lived perennial species is distinguished from others of the genus by the color, length, and curvature of the corolla, shape of the leaves, and presence of hairs on the stems, leaves, flower clusters, and corolla (Lammers 1999).

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

Historically, *Delissea rivularis* was found at Waiakealoha Waterfall, Waialae Valley, Hanakoa Valley, and Kaholuamanu on the island of Kauai (61 FR 53070). Currently, this species is known from two occurrences with a total of 40 individuals. The occurrences are reported from Moaalele and Hanakapiai on State land within the Hono o Na Pali NAR (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Delissea rivularis is found on steep slopes near streams in *Metrosideros polymorpha*-*Cheirodendron trigynum* montane wet or mesic forest at elevations between 722 and 1,306 m (2,370 and 4,286 ft). Associated native plant species include *Boehmeria grandis*, *Broussaisia arguta*, *Carex* spp., *Coprosma* spp., *Dubautia knudsenii* (naena), *Diplazium sandwichianum*,

Hedyotis foggiana (NCN), *Ilex anomala*, *Machaerina angustifolia*, *Melicope anisata* (mokihana), *Melicope clusiiifolia*, *Pipturus* spp., *Psychotria hexandra*, or *Sadleria* spp. (amau) (61 FR 53070; K. Wood, pers. comm., 2001).

The major threats to this species are competition with the encroaching nonnative plant *Rubus argutus*; habitat destruction by feral pigs; predation by rats; and reduced reproductive vigor and a risk of extinction from naturally occurring events, such as landslides or hurricanes, due to the small number of remaining individuals (Service 1998a; 61 FR 53070).

Diellia pallida (NCN)

Diellia pallida, a member of the spleenwort family (Aspleniaceae), is a fern that grows in tufts of three to four light green, lance-shaped fronds along with a few persistent dead ones, and reproduces by spores, the minute, reproductive dispersal unit of ferns and fern allies. This short-lived perennial species differs from others of this endemic Hawaiian genus by the color and sheen of the midrib, the presence and color of scales on the midrib, and the frequent fusion of sori (a group or cluster of spore cases) (Wagner 1952, 1987).

Little is known about the life history of *Diellia pallida*. Its reproductive cycles, dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995).

Diellia pallida was known historically from Halemanu on the island of Kauai. More recently additional occurrences have been found and currently, there is a total of six occurrences with 43 to 48 individuals in Mahanaloa and Kuia Valleys, Makaha Valley, Waimea Canyon, and Koaie Canyon, all on State-owned land including Kuia NAR, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve (GDSI 2000; HINHP Database 2000; 59 FR 9304; K. Wood, *in litt.* 1999).

This species grows on bare granular soil with dry to mesophytic leaf litter with a pH of 6.9 to 7.9 on steep talus slopes in lowland mesic forests at elevations between 445 and 1,027 m (1,460 and 3,371 ft). Associated native plant species include *Acacia koa*, *Alectryon macrococcus*, *Alphitonia ponderosa*, *Alyxia oliviformis*, *Antidesma platyphyllum*, *Asplenium* spp., *Carex meyenii*, *Diospyros hillebrandii* (lama), *Diospyros sandwicensis*, *Doodia kunthiana*, *Hedyotis knudsenii* (NCN), *Leptecophylla tameiameia*, *Metrosideros polymorpha*, *Microlepia strigosa*, *Myrsine lanaiensis* (kolea),

Nestegis sandwicensis, *Psychotria mariniana*, *Psydrax odorata* (alahee), *Pteralyxia kauaiensis*, *Rauwolfia sandwicensis* (hao), *Tetraplasandra kavaiensis* (ohe ohe), *Wilkesia gymnoxiphium* (iliau), or *Zanthoxylum dipetalum* (ae) (59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to this species include competition with the nonnative plants *Aleurites moluccana* (kukui), *Cordyline fruticosa*, *Lantana camara*, *Melia azedarach* (Chinaberry), *Oplismenus hirtellus*, or *Stenotaphrum secundatum*; predation and habitat degradation by feral goats, pigs, and deer; fire; and a risk of extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of existing individuals (59 FR 9304).

Dubautia latifolia (koholapehu)

Dubautia latifolia, a member of the aster family (Asteraceae), is a diffusely branched, woody perennial vine with leaves that are conspicuously net-veined, with the smaller veins outlining nearly square areas. A vining habit, distinct petioles (leaf stalks), and broad leaves with conspicuous net veins outlining squarish areas separate this from closely related species (Carr 1982b, 1985, 1999a).

Individual plants of this species do not appear to be able to fertilize themselves. Since at least some individuals of *Dubautia latifolia* require cross-pollination, the wide spacing of individual plants (e.g., each 0.5 kilometer (km) (0.3 mile (mi)) apart) may pose a threat to the reproductive potential of the species. The very low seed set noted in plants in the wild indicates a reproductive problem, possibly asynchronous flowering or lack of pollinators. Seedling establishment and survival to juvenile stage is also rare. *Dubautia latifolia* experiences seasonal vegetative decline during the spring and summer, often losing most of its leaves. New growth and flowering occur in the fall, with fruits developing in November. Pollinators and seed dispersal agents are unknown (Carr 1982b; Service 1995).

Historically, *Dubautia latifolia* was found in the Makaha, Awaawapuhi, Waialae, Kawaiula, and Kauhao Valleys of the Na Pali-Kona Forest Reserve, Nualolo Trail and Valley in Kuia NAR; Halemanu in Kokee State Park; along Mohihi Road in both Kokee State Park and Na Pali-Kona Forest Reserve, along the Mohihi-Waialae Trail on Mohihi and Kohua Ridges in both Na Pali-Kona Forest Reserve and Alakai Wilderness Preserve; and at Kaholuamanu on the

island of Kauai. Currently, there are a total of 26 occurrences containing approximately 65 to 84 individuals on State-owned land in Kauhao Valley, Makaha Valley headwaters, Kuia Valley, Kawaiula Valley, Kumuwela Ridge, Awaawapuhi Valley, Waiakoali picnic area, Alakai picnic area, Honopu Trail, Nualolo Trail, Waioneke Swamp, Noe Stream, Kumuwela Ridge, Mohihi Ditch, Mohihi-Waialae Trail, and Kaluahaulu Ridge in the Alakai Wilderness Preserve, Kokee State Park, Kuia NAR, Na Pali-Kona Forest Reserve, and Waimea Canyon State Park (Carr 1982b; GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

This species typically grows on gentle to steep slopes in well drained soil in semi-open or closed, diverse montane mesic forest dominated by *Acacia koa* and/or *Metrosideros polymorpha*, at elevations between 544 and 1,277 m (1,786 and 4,189 ft). Commonly associated native plant species are *Alphitonia ponderosa*, *Antidesma platyphyllum*, *Bobea* spp., *Claoxylon sandwicense* (poola), *Coprosma waimeae* (olena), *Cyrtandra* spp., *Dicranopteris linearis*, *Diplazium sandwicianum*, *Dodonaea viscosa*, *Elaeocarpus bifidus*, *Hedyotis terminalis*, *Ilex anomala*, *Melicope anisata*, *Nestegis sandwicensis*, *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria mariniana*, *Scaevola* spp. (naupaka), or *Xylosma* spp. (maua) (59 FR 9304; K. Wood, pers. comm., 2001).

The threats to this species include competition from the nonnative plants *Acacia mearnsii* (black wattle), *Erigeron karvinskianus* (daisy fleabane), *Hedychium* spp. (ginger), *Lonicera japonica* (Japanese honeysuckle), *Passiflora tarminiana*, *Psidium cattleianum*, or *Rubus argutus*; damage from trampling and grazing by feral pigs and deer; vehicle traffic and road maintenance; seasonal dieback; the small number of extant individuals; and restricted distribution (59 FR 9304).

Dubautia pauciflorula (naenae)

Dubautia pauciflorula, a member of the aster family (Asteraceae), is a somewhat sprawling shrub or erect small tree with narrowly lance-shaped or elliptic leaves clustered toward the ends of the stems. The tiny, two- to four-flowered heads distinguish this short-lived perennial species from its relatives (Carr 1985, 1999a).

Few details are known about the life history of any *Dubautia* species under natural conditions. Certain species produce viable seed when self-pollinated (self-fertile), although others fail to do so (self-infertile). Low pollinator numbers resulting in reduced

cross-pollination and consequently low numbers of viable seeds could explain the small population sizes. Because of their structure and small size, flowers of *D. pauciflorula* are presumably pollinated by small generalist insects, although field observations are lacking. The bristle-like pappus (tuft of appendages that crowns the ovary or fruit) probably represents an adaptation for wind dispersal. Very little is known about the life cycle of this species, including growth rates, longevity of the plants, and number of years the plants remain reproductive (Carr 1985; Service 1994; 56 FR 47695).

Historically and currently, this species is found only on State (including the Lihue-Koloa Forest Reserve) and privately owned lands in the Wahiawa drainage on Kauai. There are four occurrences containing 42 individual plants (GDSI 2000; HINHP Database 2000).

These populations are found in *Metrosideros polymorpha-Dicranopteris linearis* lowland wet forest within stream drainages at elevations between 564 and 1,093 m (1,849 and 3,587 ft). Associated native plant species include *Antidesma platyphyllum*, *Broussaisia arguta*, *Cheirodendron* spp., *Dubautia laxa* (naenae pua meleleme), *Embelia pacifica* (kilioe), *Hesperomannia lydgatei*, *Labordia waialealae* (kamakahala lau lili), *Melicope* spp., *Nothoperanema rubiginosa* (NCN), *Pritchardia* spp., *Psychotria* spp., *Sadleria* spp., *Scaevola mollis* (naupaka kuahiwi), *Syzygium sandwicensis*, or *Tetraplasandra* spp. (ohe ohe) (K. Wood, pers. comm., 2001).

The threats to this plant include direct competition with nonnative plant species such as *Melastoma candidum* or *Psidium cattleianum*, and potential threats from *Clidemia hirta*, *Cyathea cooperi*, *Deparia petersenii*, *Elephantopus mollis*, *Erechtites valerianifolia*, *Melaleuca quinquenervia*, *Oplismenus hirtellus*, *Paspalum conjugatum*, *Paspalum urvillei*, *Pluchea carolinensis*, *Rhodomyrtus tomentosa*, *Rubus rosifolius*, *Sacciolepis indica*, *Setaria parviflora*, *Stachytarpheta australis*, or *Youngia japonica*; trampling by feral pigs; landslides and erosion; restricted distribution; and hurricanes (Service 1994; 56 FR 47695).

Exocarpos luteolus (heau)

Exocarpos luteolus, a member of the sandalwood family (Santalaceae), is a moderately to densely branched shrub with knobby branches and leaves that are either minute scales or typical leaves. This short-lived perennial species is distinguished from others of the genus by its generally larger fruit

with four indentations and by the color of the receptacle and fruit (Wagner *et al.* 1999).

Little is known about the life history of *Exocarpos luteolus*. This species tends to grow at habitat edges where there is adequate light and is likely to be semi-parasitic. Flowering cycles, pollination vectors, seed dispersal agents, longevity, other specific environmental requirements, and limiting factors are unknown (Service 1995).

Historically, *Exocarpos luteolus* was known from three general locations on Kauai: Wahiawa Bog, Kaholuamanu, and Kumuwela Ridge. Currently, there is a total of nine occurrences containing approximately 75 individual plants. This species has a scattered distribution on State (Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve) and privately owned lands and is reported from Pohakua, the right fork and left fork of Kalalau Valley, Hipalau Valley, Koaie Canyon, Mahanaloa Valley, Kuia Valley, Poopooiki Valley, Nualolo Trail, Makaha Valley, and Haeleele Valley (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

This species is found at elevations between 361 and 1,465 m (1,183 and 4,808 ft) in wet places bordering swamps or open bogs and on open, dry ridges in lowland or montane mesic *Acacia koa-Metrosideros polymorpha*-dominated forest communities with *Dicranopteris linearis*. Associated native plant species include *Bobea brevipes*, *Cheirodendron trigynum*, *Claoxylon sandwicense*, *Dianella sandwicensis*, *Dodonaea viscosa*, *Dubautia laevigata*, *Elaeocarpus bifidus*, *Hedyotis terminalis*, *Leptecophylla tameiameiae*, *Melicope haupuensis*, *Peperomia* spp., *Pleomele aurea*, *Poa sandwicensis* (Hawaiian bluegrass), *Pouteria sandwicensis*, *Psychotria greenwelliae*, *Psychotria mariniana*, *Santalum freycinetianum*, or *Schiedea stellarioides* (Service 1995; 59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to this species are feral goats and pigs; competition with the nonnative plants *Acacia mearnsii*, *Corynocarpus laevigata* (karakanut), *Erigeron karvinskianus*, *Morella faya* (firetree), or *Rubus argutus*; seed predation by rats; fire; and erosion (Service 1995; 59 FR 9304).

Hedyotis st.-johnii (Na Pali beach hedyotis)

Hedyotis st.-johnii, a member of the coffee family (Rubiaceae), is a succulent perennial herb with slightly woody, trailing, quadrangular stems and fleshy leaves clustered towards the base of the

stem. This species is distinguished from related species by its succulence, basally clustered fleshy leaves, shorter floral tube, and large leafy calyx lobes when in fruit (Wagner *et al.* 1999).

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

Currently, there are a total of eleven occurrences, containing approximately 227 to 292 individuals, on State-owned land in Nualolo Valley, Nualolo Kai, Kaahole Valley, Keawanui, Kawaiula Valley, Milolii Spring, Makaha Point, Polihale Spring, Kalepa Valley, and Nakeikionaiwi Caves within the Na Pali Coast State Park and Puu Ka Pele Forest Reserve (GDSI 2000; HINHP Database 2000).

This plant grows in the crevices of north-facing, near-vertical coastal cliff faces within the spray zone in sparse dry coastal shrubland at elevations between 0 and 187 m (0 and 613 ft). Associated native plant species include *Artemisia australis*, *Bidens* spp., *Capparis sandwichiana* (maiapilo), *Chamaesyce celastroides*, *Eragrostis variabilis*, *Heteropogon contortus*, *Lipochaeta connata* (nehe), *Lycium sandwicense* (ohelo kai), *Myoporum sandwicense* (naio), *Nototrichium sandwicense* (kului), or *Schiedea apokremnos* (maolioli) (56 FR 49639; K. Wood, pers. comm., 2001).

The major threats to this species are herbivory and habitat degradation by feral goats; competition from nonnative plant species, especially *Pluchea carolinensis*; landslides; fire; trampling and grazing by cattle (*Bos taurus*); and a risk of extinction due to naturally occurring events, such as landslides or hurricanes, as well as decreased reproductive vigor because of the small population sizes and restricted distribution (Service 1995; 56 FR 49639).

Hesperomannia lydgatei (NCN)

Hesperomannia lydgatei, a member of the aster family (Asteraceae) is a sparsely branched, small, long-lived perennial tree 2 to 4 m (6.5 to 13 ft) tall with lance-shaped or elliptic leaves. The flower heads are clustered at the ends of branches and pendant (hanging) when mature. The species is distinguished from other members of this endemic Hawaiian genus by its pendant flower heads, longer and narrower hairless flower stalks, and shorter involucrel (floral) bracts (Wagner *et al.* 1999).

Almost no mature fruits develop, and it is possible that *Hesperomannia*

lydgatei is self-infertile and fails to set seed unless cross-pollinated with other individuals. The flower heads with long, tubular yellow florets suggest pollination by long-tongued insects such as moths or butterflies, although field observation is required to confirm this. Absence of the appropriate pollinator(s) could be responsible for the observed lack of viable seeds. The plume-like hairs crowning the fruit strongly suggests dispersal by wind, as in many members of the aster family. This species grows almost exclusively along streams, however, so dispersal by water currents is also likely. Specific details regarding growth rates, age trees begin flowering in the wild, length of time they remain reproductive, and longevity of the plants are unknown (Service 1994).

Historically, *Hesperomannia lydgatei* was found in the Wahiawa Mountains of Kauai. Currently, this species is known from State (Halelea Forest Reserve) and privately owned lands in the Pali Elelee, Waiole Valley, Wahiawa and Kapalaoa areas. There are four occurrences containing a total of 304 individual plants (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Hesperomannia lydgatei is found at elevations between 207 and 1,570 m (680 and 5,151 ft) along streambanks and forested slopes in rich brown soil and silty clay in *Metrosideros polymorpha* or *M. polymorpha-Dicranopteris linearis* lowland wet forest. Associated native plant species include *Adenophorus periens* (pendent kihi fern), *Antidesma platyphyllum*, *Broussaisia arguta*, *Cheirodendron* spp., *Cyanea* spp., *Dubautia knudsenii*, *Dubautia laxa*, *Dubautia pauciflora*, *Dubautia raillardiioides* (naenae), *Elaphoglossum* spp., *Freycinetia arborea*, *Hedyotis terminalis*, *Labordia lydgatei* (kamakahala), *Machaerina angustifolia*, *Peperomia* spp., *Pritchardia* spp., *Psychotria hexandra*, or *Syzygium sandwicense* (HINHP Database 2000; Service 1994; K. Wood, pers. comm., 2001).

Threats to the species include nonnative plants, feral goats, rats, landslides, and erosion (Service 1994).

Hibiscadelphus woodii (hau kuahiwi)

Hibiscadelphus woodii, a member of the mallow family (Malvaceae), is a small branched, long-lived perennial tree with a rounded crown. *Hibiscadelphus woodii* differs from the other Kauai species in the genus by characteristics of the leaf surface and whorled leaves and by bract and flower color (Bates 1999; Lorence and Wagner 1995).

Flowering material has been collected in March, April, and September, but no fruit set has been observed in spite of efforts to manually outcross the flowers. A museum specimen of a flower contains three adult Nitidulidae (sap) beetles, probably an endemic species. The damage by these larvae may be responsible for the observed lack of fruit set in *Hibiscadelphus woodii* (Lorence and Wagner 1995; Service 1998a). No additional life history information for this species is currently known.

Hibiscadelphus woodii has been found only at the site of its original discovery on State-owned land in the left branch of Kalalau Valley, within the Na Pali Coast State Park on Kauai. Only two trees of this species are currently known (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 2001).

Hibiscadelphus woodii is found at elevations between 219 and 1,197 m (717 and 3,926 ft) on basalt talus or cliff walls in *Metrosideros polymorpha* montane mesic forest. These forests contain one or more of the following associated native plant species:

Artemisia australis, *Bidens sandwicensis* (kookoolau), *Carex meyenii*, *Chamaesyce celastroides* var. *hanapeyensis* (akoko), *Dubautia* spp., *Hedyotis* spp., *Lepidium serra*, *Lipochaeta* spp. (nehe), *Lobelia niihauensis* (NCN), *Lysimachia glutinosa* (kolokolo kuahiwi), *Melicope pallida* (alani), *Myrsine* spp. (kolea), *Nototrichium* spp. (kului), *Panicum lineale*, *Poa mannii* (NCN), or *Stenogyne campanulata* (NCN) (HINHP Database 2000; Lorence and Wagner 1995; 61 FR 53070; K. Wood, pers. comm., 2001).

Major threats to *Hibiscadelphus woodii* are habitat degradation by feral goats and pigs; competition from the nonnative plant species *Erigeron karvinskianus*; nectar robbing by the Japanese white-eye (*Zosterops japonicus*), an introduced bird; and a risk of extinction from naturally occurring events (e.g., rock slides), and reduced reproductive vigor due to the small number of existing individuals at the only known site (Lorence and Wagner 1995; 61 FR 53070).

Hibiscus clayi (Clay's hibiscus)

Hibiscus clayi, a member of the mallow family (Malvaceae), is a long-lived perennial shrub or small tree. This species is distinguished from other native Hawaiian members of the genus by the lengths of the calyx, calyx lobes, and capsule and by the margins of the leaves (Bates 1999).

Little is known about the life history of *Hibiscus clayi*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific

environmental requirements, and limiting factors are unknown (Service 1995).

Historically, *Hibiscus clayi* was known from scattered locations on Kauai: the Kokee region on the western side of the island, Moloaa Valley to the north, Nounou Mountain in Wailua to the east, and as far south as Haiku near Hali Stream. At this time, only one occurrence on State land in the Nounou Mountains, with a total of four individuals, is known to be extant (GDSI 2000; HINHP Database 2000).

Hibiscus clayi generally grows on slopes at elevations between 9 and 765 m (29 and 2,509 ft) in *Acacia koa* or *Diospyros* spp.-*Pisonia* spp.-*Metrosideros polymorpha* lowland dry or mesic forest with *Artemisia australis*, *Bidens* spp., *Cyanea hardyi* (haha), *Gahnia* spp., *Hedyotis acuminata* (au), *Munroidendron racemosum* (NCN), *Pandanus tectorius* (hala), *Panicum tenuifolium* (mountain pili), *Pipturus* spp., *Pleomele aurea*, *Psychotria* spp., or *Psydrax odorata* (HINHP Database 2000; 59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to this species are herbivory and habitat degradation by feral pigs; competition from the nonnative plant species *Araucaria columnaris* (Norfolk Island pine) and *Psidium cattleianum*; trampling by humans; and a risk of extinction due to naturally occurring events, such as landslides or hurricanes, as well as decreased reproductive vigor because of the small population size and restricted distribution (HINHP Database 2000; 59 FR 9304).

Hibiscus waimeae ssp. *hannerae* (kokio keokeo)

Hibiscus waimeae ssp. *hannerae*, a member of the mallow family (Malvaceae), is a gray-barked tree with star-shaped hairs densely covering its leaf and flower stalks and branchlets. The long-lived perennial species is distinguished from others of the genus by the position of the anthers along the staminal column, length of the staminal column relative to the petals, color of the petals, and length of the calyx. Two subspecies, ssp. *hannerae* and ssp. *waimeae*, both endemic to Kauai, are recognized. Subspecies *hannerae* is distinguishable from ssp. *waimeae* by its larger leaves and smaller flowers (Bates 1999).

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

Historically, *Hibiscus waimeae* ssp. *hannerae* was known from Kalihiiwai and adjacent valleys, Limahuli Valley, and Hanakapiai Valley. This subspecies is no longer extant at Kalihiiwai. Currently, there are two occurrences containing 27 individuals on State (Na Pali Coast State Park) and privately owned lands in Hanakapiai Valley, Limahuli Valley, and Pohakuao (Bates 1999; GDSI 2000; HINHP Database 2000).

Hibiscus waimeae ssp. *hannerae* grows at elevations between 174 and 1,154 m (570 and 3,787 ft). It is found in *Metrosideros polymorpha*-*Dicranopteris linearis* or *Pisonia* spp.-*Charpentiera elliptica* (papala) lowland wet or mesic forest with *Antidesma* spp., *Bidens* spp., *Bobea* spp., *Cibotium* spp., *Cyanea* spp., *Cyrtandra* spp., *Perrottetia sandwicensis*, *Pipturus* spp., *Psychotria* spp., *Sadleria* spp., or *Syzygium sandwicensis* (Bates 1999; HINHP Database 2000; Service 1998a; K. Wood, pers. comm., 2001).

Major threats to *Hibiscus waimeae* ssp. *hannerae* are habitat degradation by feral pigs, competition with nonnative plant species, and a risk of extinction from naturally occurring events (e.g., landslides and hurricanes) and/or reduced reproductive vigor due to the small number of remaining populations (HINHP Database 2000; 61 FR 53070).

Kokia kauaiensis (kokio)

Kokia kauaiensis, a member of the mallow family (Malvaceae), is a small tree. This long-lived perennial species is distinguished from others of this endemic Hawaiian genus by the length of the bracts surrounding the flower head, number of lobes and the width of the leaves, the length of the petals, and the length of the hairs on the seeds (Bates 1999).

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

Historically, *Kokia kauaiensis* was found as seven scattered occurrences on northwestern Kauai. Currently, there are a total of 21 occurrences with 166 to 171 individuals, found in Pohakuao, the left branch of Kalalau Valley, Paaiki Valley, Kuia Valley, Koaie Canyon, Kipalau Valley, and Kawaiiki Valley, all on State-owned land within Kuia NAR, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Kokia kauaiensis typically grows in diverse mesic forest at elevations between 215 and 1,049 m (707 and

3,441 ft). Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma* spp., *Bobea* spp., *Chamaesyce celastroides*, *Claoxylon sandwicense*, *Dicranopteris linearis*, *Diellia pallida*, *Diospyros hillebrandii*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Flueggea neowawraea* (mehamehame), *Hedyotis* spp., *Hibiscus* spp. (aloalo), *Isodendron laurifolium* (aupaka), *Lipochaeta fauriei* (nehe), *Melicope* spp., *Metrosideros polymorpha*, *Nestegis sandwicensis*, *Nototrichium* spp., *Pisonia* spp., *Pleomele aurea*, *Pouteria sandwicensis*, *Psydrax odorata*, *Pteralyxia kauaiensis*, *Rauvolfia sandwicensis*, *Santalum freycinetianum* var. *pyrularium* (iliahi), *Streblus pendulinus* (aiai), *Syzygium sandwicensis*, *Tetraplasandra* spp., or *Xylosma* spp. (Bates 1999; HINHP Database 2000; Service 1998a; K. Wood, pers. comm., 2001).

Competition with and habitat degradation by invasive nonnative plant species, substrate loss from erosion, habitat degradation and browsing by feral goats and deer, and seed predation by rats are the major threats affecting the survival of *Kokia kauaiensis* (HINHP Database 2000; Service 1998a; Wood and Perlman 1993).

Labordia lydgatei (kamakahala)

Labordia lydgatei, a member of the logania family (Loganiaceae), is a much-branched perennial shrub or small tree with sparsely hairy, square stems. The small size of the flowers and capsules borne on sessile (attached to the base) inflorescences (a flower cluster) distinguish it from other members of the genus growing in the same area (Wagner *et al.* 1999).

Immature fruits were seen on two plants during surveys in 1991 and 1992 by botanists from NTBG, and remnants of old fruiting bodies were seen on another, suggesting that the plants are able to self-fertilize. It is also suspected that the fruits of this species are adapted for bird dispersal. Due to a lack of bird or other native pollinators, pollination may be inhibited. Microhabitat requirements for seed germination and growth may also be extremely specific. Virtually nothing is known about the life history or ecology of this species (Service 1994).

This species was originally known from the Wahiaua drainage, Waioli Stream Valley, and Makaleha Mountains on Kauai. *Labordia lydgatei* is currently known from six occurrences, consisting of 37 individual plants, located on State (Lihue-Koloa and Halelea Forest Reserves) and privately owned lands at Pali Eleele, Waioli Valley, Lelewi, Lumahai Valley, and Kapalaoa (GDSI

2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Labordia lydgatei is found on streambanks in *Metrosideros polymorpha-Dicranopteris linearis* lowland wet forest at elevations between 182 and 1,048 m (597 and 3,437 ft). Associated native plant species include *Antidesma platyphyllum* var. *hillebrandii* (hame), *Cyanea* spp., *Cyrtandra* spp., *Dubautia knudsenii*, *Hedyotis terminalis*, *Ilex anomala*, *Labordia hirtella* (kamakahala), *Psychotria* spp., or *Syzygium sandwicensis* (HINHP Database 2000; Service 1994; K. Wood, pers. comm., 2001).

Competition from nonnative plants poses the greatest threat to the survival of *Labordia lydgatei* (56 FR 47695). Additional threats include habitat degradation from feral pigs; rats, a potential seed predator; landslides and erosion; reduced germination; and a lack of dispersal or pollination agents (Service 1994).

Labordia tinifolia var. *wahiawaensis* (kamakahala)

Labordia tinifolia var. *wahiawaensis*, a member of the logania family (Loganiaceae), is a shrub or small tree with hairless, cylindrical young branches. This long-lived perennial species differs from others of the genus by having a long common flower cluster stalk, hairless young stems and leaf surfaces, transversely wrinkled capsule valves, and length of the corolla lobes. Three varieties of *Labordia tinifolia* are recognized: var. *lanaiensis* on Lanai and Molokai; var. *tinifolia* on Kauai, Oahu, Molokai, Maui, and Hawaii; and var. *wahiawaensis*, endemic to Kauai. The variety *wahiawaensis* is distinguished from the other two by its larger corolla (Wagner *et al.* 1999).

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

Labordia tinifolia var. *wahiawaensis* has only been known from one occurrence with a current total of approximately 20 to 30 individual plants on private land in the Wahiawa drainage in the Wahiawa Mountains (GDSI 2000; HINHP Database 2000).

Labordia tinifolia var. *wahiawaensis* grows along streambanks in lowland wet forests dominated by *Metrosideros polymorpha* at elevations between 458 and 1,006 m (1,502 and 3,301 ft), with *Antidesma platyphyllum*, *Athyrium microphyllum* (akolea), *Cheirodendron* spp., *Cyrtandra* spp., *Dicranopteris linearis*, *Hedyotis terminalis*, or

Psychotria spp. (HINHP Database 2000; K. Wood, pers. comm., 2001).

The primary threats to the remaining individuals of *Labordia tinifolia* var. *wahiawaensis* are competition with nonnative plants, habitat degradation by feral pigs, trampling by humans, and a risk of extinction from catastrophic random events or reduced reproductive vigor due to the small number of individuals in a single population (61 FR 53070).

Lipochaeta fauriei (nehe)

Lipochaeta fauriei, a member of the aster family (Asteraceae), is a perennial herb with somewhat woody, erect or climbing stems. This short-lived perennial species differs from other species on Kauai by having a greater number of disk and ray flowers per flower head, longer ray flowers, and longer leaves and leaf stalks (Gardner 1976, 1979; Service 1995; Wagner *et al.* 1985, 1990).

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

Historically and currently, *Lipochaeta fauriei* is known from Olokele Canyon on Kauai. This species is now found on State-owned land in Poopooiki Valley, Kuia Valley, Haelele Valley, and Kawaiiki Valley within Kuia NAR, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve. Currently there is a total of five occurrences with 82 individuals. An occurrence in Koaie Canyon previously thought to be *L. fauriei* was later identified as *Melanthera subcordata* (nehe) (Gardner 1979; GDSI 2000; HINHP Database 2000; Service 1995; K. Wood, *in litt.* 1999).

This species grows most often in moderate shade to full sun and is usually found on the sides of steep gulches in diverse lowland mesic forests at elevations between 436 and 947 m (1,432 and 3,108 ft). Associated native plant species include *Acacia koa*, *Carex meyenii*, *Carex wahuensis*, *Dicranopteris linearis*, *Diospyros* spp., *Dodonaea viscosa*, *Euphorbia haeleleana*, *Hibiscus waimeae*, *Kokia kauaiensis*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Pleomele aurea*, *Psychotria greenwelliae*, *Psychotria mariniana*, or *Sapindus oahuensis* (lonomea) (HINHP Database 2000; K. Wood, pers. comm., 2001).

Major threats to *Lipochaeta fauriei* are predation and habitat degradation by feral goats and pigs and competition with invasive nonnative plants. Fire is also a significant threat to *L. fauriei* due

to the invasion of *Melinis minutiflora*, a fire-adapted grass that creates unnaturally high fuel loads. The small total number of individuals makes the species susceptible to extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor (HINHP Database 2000; Service 1995; 59 FR 9304).

Lipochaeta micrantha (nehe)

Lipochaeta micrantha, a member of the aster family (Asteraceae), is a somewhat woody short-lived perennial herb. The small number of disk flowers separates this species from the other members of the genus on the island of Kauai. The two recognized varieties of this species, var. *exigua* and var. *micrantha*, are distinguished by differences in leaf length and width, degree of leaf dissection, and the length of the ray florets (Gardner 1976, 1979; Wagner *et al.* 1990).

Little is known about the life histories of *Lipochaeta micrantha* var. *exigua* and *L. m.* var. *micrantha*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995).

Historically, *Lipochaeta micrantha* var. *exigua* was only known from the Haupu Range on Kauai. Currently, five occurrences of *L. micrantha* var. *exigua*, with a total of 110 individuals, are known from privately owned land in the vicinity of Haupu Range and southwest of Hokunui summit. Historically, *L. micrantha* var. *micrantha* was known from Olokele Canyon, Hanapepe Valley, and the Koloa District on Kauai. Currently, this variety is only known from five occurrences totaling 121 individuals on State land within the Na Pali-Kona Forest Reserve in Koaie Canyon and Kawaiiki Valley (GDSI 2000; HINHP Database 2000).

Lipochaeta micrantha grows on cliffs, ridges, streambanks, or slopes in mesic to wet mixed communities at elevations between 35 and 1,362 m (115 and 4,468 ft). Associated species include *Acacia koa*, *Antidesma* spp., *Artemisia australis*, *Bidens sandwicensis*, *Bobea* spp., *Chamaesyce celastroides* var. *hanapepensis*, *Diospyros* spp., *Dodonaea viscosa*, *Eragrostis grandis*, *Eragrostis variabilis*, *Hibiscus kokio*, *Lepidium bidentatum* (anaunau), *Lobelia niihauensis*, *Melicope* spp., *Metrosideros polymorpha*, *Neraudia kauaiensis* (NCN), *Nototrichium* spp., *Pipturus* spp., *Plectranthus parviflorus* (ala ala wai nui), *Pleomele aurea*, *Psydrax odorata*, *Rumex albescens* (huahuako), *Sida fallax*, or *Xylosma*

hawaiiense (maua) (HINHP Database 2000; Service 1995; K. Wood, pers. comm., 2001).

The major threats to both varieties of *Lipochaeta micrantha* are habitat degradation by feral pigs and goats and competition with nonnative plant species such as *Erigeron karvinskianus*, *Lantana camara*, *Pluchea carolinensis*, or *Stachytarpheta australis*. The species is also threatened by extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of existing populations (HINHP Database 2000; Lorence and Flynn 1991; Service 1995).

Lipochaeta waimeaensis (nehe)

Lipochaeta waimeaensis, a member of the aster family (Asteraceae), is a low growing, somewhat woody, short-lived perennial herb. This species is distinguished from other *Lipochaeta* species on Kauai by leaf shape and the presence of shorter leaf stalks and ray florets (Gardner 1976, 1979; Wagner *et al.* 1990).

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

Lipochaeta waimeaensis has been known only from the original site of discovery along the rim of Kauai's Waimea Canyon on State-owned land. There are no more than 100 individuals (GDSI 2000; HINHP Database 2000).

This species grows on eroded soil on a precipitous, shrub-covered gulch in a diverse lowland forest at elevations between 44 and 460 m (145 and 1,509 ft) with *Artemisia australis*, *Chamaesyce celastroides*, *Dodonaea viscosa*, *Lipochaeta connata*, *Panicum* spp. (NCN), *Santalum freycinetianum*, or *Schiedea spergulina* (NCN) (HINHP Database 2000; Wagner *et al.* 1999; K. Wood, pers. comm., 2001).

The major threats to *Lipochaeta waimeaensis* are competition from nonnative plants and habitat destruction by feral goats, whose presence exacerbates the existing soil erosion problem at the site. The single occurrence, and thus the entire species, is threatened by extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of existing individuals (59 FR 9304).

Melicope haupuensis (alani)

Melicope haupuensis, a member of the rue family (Rutaceae), is a small

long-lived perennial tree. Unlike other species of this genus on Kauai, the exocarp (outermost layer of a fruit) and endocarp (innermost layer of a fruit) are hairless and the sepals are covered with dense hairs (Stone *et al.* 1999).

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

For 62 years, *Melicope haupuensis* was known only from the site of its original discovery on the north side of Haupu Ridge on Kauai. This occurrence is now gone. The species is now known from four occurrences with a total of 13 individuals on State-owned land within the Alakai Wilderness Preserve, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve in Kalahu, Awaawapuhi Valley, and Koaie Canyon (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Melicope haupuensis grows on moist talus slopes in *Metrosideros polymorpha*-dominated lowland mesic forests or *M. polymorpha*-*Acacia koa* montane mesic forest at elevations between 111 and 1,249 m (364 and 4,097 ft). Associated native plant species include *Antidesma platyphyllum* var. *hillebrandii*, *Bobea brevipes*, *Cheirodendron trigynum*, *Claoxylon sandwicense*, *Cryptocarya mannii* (holio), *Dianella sandwicensis* (ukiuki), *Diospyros hillebrandii*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Elaeocarpus bifidus*, *Hedyotis terminalis*, *Melicope anisata*, *M. barbiger* (uahiapele), *M. ovata* (alani), *Pleomele aurea*, *Pouteria sandwicensis*, *Pritchardia minor* (loulou), *Psychotria greenwelliae*, *Psychotria mariniana*, *Tetraplasandra waimeae* (ohetikooloa), or *Zanthoxylum dipetalum* (HINHP Database 2000; K. Wood, pers. comm., 2001).

Habitat degradation by feral goats and competition with invasive nonnative plant species are the major threats to *Melicope haupuensis*. In addition, this species may be susceptible to the black twig borer (*Xylosandrus compactus*). The existence of only 13 known trees constitutes an extreme threat of extinction from naturally occurring events, such as landslides or hurricanes, or reduced reproductive vigor (Hara and Beardsley 1979; HINHP Database 2000; Medeiros *et al.* 1986; 59 FR 9304).

Melicope quadrangularis (alani)

Melicope quadrangularis, a member of the rue family (Rutaceae), is a shrub or small tree. Young branches are generally covered with fine yellow fuzz

but become hairless with age. This species differs from others in the genus in having the following combination of characters: oppositely arranged leaves, only one or two flowers per cluster, cube-shaped capsules with fused lobes, and a deep central depression at the top of the fruit (Stone *et al.* 1999).

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

Melicope quadrangularis is known from the type locality in the Wahiawa Bog region of Kauai. One adult plant and two seedlings were discovered in 1991 by Ken Wood of NTBG on an east-facing slope of Wahiawa Ridge at 853 m (2,800 ft) on privately owned land. Subsequent exploration resulted in the location of a total of 13 individuals of this species. Although a survey after hurricane Iniki in 1992 did not relocate any individuals, it is hoped that there is a seed bank or that undiscovered individuals remain to be found (Stone *et al.* 1999).

Melicope quadrangularis grows in *Metrosideros polymorpha* diverse lowland wet forest that ranges from mesic to wet conditions at elevations between 608 and 1,593 m (1,995 and 5,228 ft). Associated native plant species include *Antidesma platyphyllum*, *Broussaisia arguta*, *Cheirodendron fauriei* (olapa), *Cibotium nealiae* (hapuu), *Cyrtandra pickeringii* (haiwale), *Dicranopteris linearis*, *Machaerina angustifolia*, *Machaerina mariscooides* (ahaniu), other *Melicope* spp., *Metrosideros waialealae* (NCN), *Psychotria hexandra*, *P. mariniana*, *P. wawrae* (kopiko), *Sadleria pallida*, *Scaevola gaudichaudiana* (naupaka kuahiwi), or *Syzygium sandwicensis* (K. Wood, pers. comm., 2001).

This species is threatened by nonnative plants and habitat disturbance by feral pigs; over-collecting for scientific purposes; extinction from naturally occurring events, such as landslides or hurricanes; and/or reduced reproductive vigor due to the dearth of individuals (Service 1994).

Munroidendron racemosum (NCN)

Munroidendron racemosum, a member of the ginseng family (Araliaceae), is a small tree with a straight gray trunk crowned with spreading branches. This long-lived perennial species is the only member of a genus endemic to Hawaii. The genus is distinguished from other closely related Hawaiian genera of the family by

its distinct flower clusters and corolla (Constance and Affolter 1999).

Reproduction occurs year-round, with flowers and fruits found throughout the year. Self-pollination is assumed to occur since viable seeds have been produced by isolated individuals. Pollinators have not been observed, but insect pollination is likely. Dispersal mechanisms are unknown (Service 1995).

Historically, *Munroidendron racemosum* was known from scattered locations throughout the island of Kauai. Occurrences are now known from Waiahuakua, Pohakua, the left and right branches of Kalalau Valley, Nakeikionaiwi Valley, Awaawapuhi Valley spring, Honopu Valley, Nualolo Valley, Poomau Valley, Kawaiiki Valley, Koaie Canyon, Nonou, Haupu, and Keopaweo. There are currently 17 known occurrences with approximately 59 to 99 individuals on State (Hono o Na Pali NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, Nonou Forest Reserve, and Puu Ka Pele Forest Reserve) and privately owned lands (GDSI 2000; HINHP Database 2000).

Munroidendron racemosum is typically found on steep exposed cliffs or on ridge slopes in coastal to lowland mesic forests at elevations between 6 and 979 m (19 and 3,213 ft). Associated plant species include *Bobeia brevipes*, *Brighamia insignis*, *Canavalia napaliensis* (awikiwiki), *Diospyros hillebrandii*, *Diospyros sandwicensis*, *Nestegis sandwicensis*, *Pisonia sandwicensis* (aulu), *Pisonia umbellifera* (papala kepau), *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria* spp., *Psychotria odorata*, *Rauvolfia sandwicensis*, *Schiedea* spp. (NCN), *Sida fallax*, or *Tetraplasandra* spp. (Gagne and Cuddihy 1999; HINHP Database 2000; 59 FR 9304; K. Wood, pers. comm., 2001).

The threats to *Munroidendron racemosum* are competition with nonnative plant species, such as *Aleurites moluccana*, *Lantana camara*, *Leucaena leucocephala* (koa haole), or *Psidium guajava*; habitat degradation by feral goats and fruit predation by rats; introduced insects of the long-horned beetle family (Cerambycidae); fire; extinction from naturally occurring events, such as landslides or hurricanes; and reduced reproductive vigor (HINHP Database 2000; Service 1995; 59 FR 9304).

Myrsine linearifolia (kolea)

Myrsine linearifolia, a member of the myrsine family (Myrsinaceae), is a branched shrub. This long-lived perennial species is distinguished from others of the genus by the shape, length,

and width of the leaves, length of the petals, and number of flowers per cluster (Wagner *et al.* 1999).

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

Historically, *Myrsine linearifolia* was found at scattered locations on Kauai: Olokele Valley, Kalualea, Kalalau Valley, Kahuamaa Flat, Limahuli-Hanakapiai Ridge, Koaie Stream, Pohakua, Namolokama summit plateau, and Haupu. There are currently 12 occurrences with approximately 490 to 564 individuals on State (Alakai Wilderness Preserve and Na Pali Coast State Park) and privately owned lands. The populations are found in Limahuli Valley, Alealau, the left branch of Kalalau Valley, Puu O Kila, Koaie Canyon, Namolokama, and Kapalaoa (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Myrsine linearifolia typically grows at elevations between 105 and 1,380 m (346 and 4,526 ft) in diverse mesic or wet lowland or montane *Metrosideros polymorpha* forest with *Cheirodendron* spp. or *Dicranopteris linearis* as co-dominant species. Plants growing in association with this species include *Bobeia brevipes*, *Cryptocarya mannii*, *Dubautia* spp., *Eurya sandwicensis* (anini), *Freycinetia arborea*, *Hedyotis terminalis*, *Lysimachia glutinosa*, *Machaerina angustifolia*, *Melicope* spp., *Myrsine* spp., *Nothoestrum* spp. (aiea), *Psychotria* spp., *Sadleria pallida*, or *Syzygium sandwicensis* (HINHP Database 2000; 61 FR 53070; K. Wood, pers. comm., 2001).

Competition with nonnative plants, such as *Erigeron karvinskianus*, *Kalanchoe pinnata* (air plant), *Lantana camara*, *Psidium cattleianum*, *Rubus argutus*, and *Rubus rosifolius* and habitat degradation by feral pigs and goats are the major threats to *Myrsine linearifolia* (61 FR 53070).

Nothoestrum peltatum (aiea)

Nothoestrum peltatum, a member of the nightshade family (Solanaceae), is a small tree with ash-brown bark and woolly stems. The usually peltate (leaf stem attached to the center) leaves and shorter leaf stalks separate this species from others in the genus (Symon 1999).

Although plants of this long-lived perennial species have been observed flowering, they rarely set fruit. This could be the result of a loss of pollinators, reduced genetic variability, or an inability to fertilize itself. Little else is known about the life history of

Nothoestrum peltatum. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (59 FR 9304).

Historically, *Nothoestrum peltatum* was known from Kauai at Kumuwela, Kaholuamanu, and the region of Nualolo. This species is now known from a total of 10 occurrences with 20 individuals, located at Kahuamaa Flats, Awaawapuhi Trail, Awaawapuhi Valley, Kawaiula Valley, and Makaha Valley on State-owned land within the Kokee State Park, Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

This species generally grows in rich soil on steep slopes in mesic or wet forest dominated by *Acacia koa* or a mixture of *A. koa* and *Metrosideros polymorpha*, at elevations between 581 and 1,290 m (1,906 and 4,232 ft). Associated native plants include *Alphitonia ponderosa*, *Antidesma* spp., *Bobeia brevipes*, *Broussaisia arguta*, *Cheirodendron trigynum*, *Claoxylon sandwicense*, *Coprosma* spp., *Cryptocarya mannii*, *Dianella sandwicensis*, *Dicranopteris linearis*, *Diplazium sandwichianum*, *Dodonaea viscosa*, *Elaeocarpus bifidus*, *Hedyotis terminalis*, *Ilex anomala*, *Melicope anisata*, *M. barbigeria*, *M. haupuensis*, *Perrottetia sandwicensis*, *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria greenwelliae*, *Psychotria mariniana*, *Tetraplasandra kavaiensis*, or *Xylosma* spp. (HINHP Database 2000; K. Wood, pers. comm., 2001).

Competition with nonnative plants (such as *Erigeron karvinskianus*, *Lantana camara*, *Passiflora tarminiana*, or *Rubus argutus*), and habitat degradation by feral pigs, deer, and red jungle fowl (*Gallus gallus*) constitute the major threats to *Nothoestrum peltatum*. This species is also threatened by fire, risk of extinction from naturally occurring events (*e.g.*, landslides or hurricanes), and reduced reproductive vigor due to the small number of existing individuals (HINHP Database 2000; 59 FR 9304).

Panicum niihauense (lau ehu)

Panicum niihauense, a member of the grass family (Poaceae), is a perennial bunchgrass with unbranched culms (aerial stems). This short-lived perennial species is distinguished from others in the genus by the erect inflorescence branches and the densely clustered spikelets (Davidse 1999).

Little is known about the life history of this species. Reproductive cycles,

longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Panicum niihauense was known historically from Niihau and one location on Kauai. Currently, this species is only known from one occurrence of 23 individuals at the Polihale State Park area of Kauai on State-owned land (GDSI 2000; HINHP Database 2000).

Panicum niihauense is found scattered in sand dunes in coastal shrubland at elevations between 0 and 103 m (0 and 337 ft). Associated native plant species include *Cassytha filiformis* (kaunaoa pehu), *Chamaesyce celastroides*, *Dodonaea viscosa*, *Nama sandwicensis* (hinahina kahakai), *Ophioglossum pendulum* ssp. *falcatum* (puapua moa), *Scaevola sericea* (naupaka kahakai), *Sida fallax*, *Sporobolus virginicus* (akiaki), or *Vitex rotundifolia* (kolokolo kahakai) (HINHP Database 2000; K. Wood, pers. comm., 2001).

Primary threats to *Panicum niihauense* are destruction by off-road vehicles, competition with nonnative plant species, and a risk of extinction from naturally occurring events (e.g., landslides or hurricanes) and reduced reproductive vigor due to the small number of individuals in the one remaining population (HINHP Database 2000; 61 FR 53108).

Phyllostegia knudsenii (NCN)

Phyllostegia knudsenii, a nonaromatic member of the mint family (Lamiaceae), is an erect herb or vine. This short-lived perennial species is distinguished from others in the genus by its specialized flower stalk; it differs from the closely related *P. floribunda* by often having four flowers per group (Wagner *et al.* 1999).

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

Until 1993, *Phyllostegia knudsenii* was only known from the site of its original discovery made in the 1800s from the woods of Waimea on Kauai. There is currently one known occurrence with a total of 4 to 13 individuals on State-owned land in Koaie Canyon within the Alakai Wilderness Preserve (GDSI 2000; HINHP Database 2000; Wagner *et al.* 1999; K. Wood, *in litt.* 1999).

Phyllostegia knudsenii is found in *Metrosideros polymorpha* lowland mesic or wet forest at elevations between 399 and 1,059 m (1,309 and

3,475 ft). Associated native plant species include *Bobea timonioides* (ahakea), *Claoxylon sandwicense*, *Cryptocarya mannii*, *Cyrtandra kauaiensis*, *Cyrtandra paludosa* (moa), *Diospyros sandwicensis*, *Elaeocarpus bifidus*, *Ilex anomala*, *Myrsine linearifolia*, *Perrottetia sandwicensis*, *Pittosporum kauaiense* (hoawa), *Pouteria sandwicensis*, *Pritchardia minor*, *Selaginella arbuscula* (lepelepe moa), *Tetraplasandra oahuensis* (ohe mauka), or *Zanthoxylum dipetalum* (61 FR 53070; K. Wood, pers. comm., 2001).

Major threats to *Phyllostegia knudsenii* include habitat degradation by feral pigs and goats, competition with nonnative plants, and a risk of extinction from naturally occurring events (e.g., landslides and hurricanes) and reduced reproductive vigor due to the small number of individuals in the only known population (61 FR 53070; Service 1998a).

Phyllostegia waimeae (NCN)

Phyllostegia waimeae, a nonaromatic member of the mint family (Lamiaceae), is a climbing perennial plant. Characteristics that distinguish this species from others in the genus are the nearly stalkless bracts that partially overlap and cover the flowers, and relatively fewer oil glands on the leaves (Wagner *et al.* 1999).

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

Historically, *Phyllostegia waimeae* was known from Kaholuamanu and Kaaha on Kauai. Currently, one occurrence with six individuals persists on State land in Kawaiiki Valley within the Na Pali-Kona Forest Reserve (K. Wood, *in litt.* 2001).

This species typically grows in *Acacia koa-Metrosideros polymorpha* dominated wet or mixed mesic forest with *Cheirodendron* spp. or *Dicranopteris linearis* as co-dominants at elevations between 655 and 1,224 m (2,149 and 4,016 ft). Associated native plant species include *Broussaisia arguta*, *Claoxylon sandwicense*, *Diplazium sandwichianum*, *Dubautia knudsenii*, *Elaphoglossum* spp., *Gunnera kauaiensis*, *Hedyotis* spp., *Myrsine lanaiensis*, *Pleomele aurea*, *Psychotria* spp., *Sadleria* spp., *Scaevola procera* (naupaka kuahiwi), *Syzygium sandwicensis*, or *Vaccinium* spp. (K. Wood, pers. comm., 2001).

Habitat destruction by feral goats, erosion, and competition with

introduced grasses are the major threats to *Phyllostegia waimeae*. The species is also threatened by over-collecting for scientific purposes; extinction from naturally occurring events, such as hurricanes; and/or reduced reproductive vigor due to the small number of existing individuals (Service 1995).

Phyllostegia wawrana (NCN)

Phyllostegia wawrana, a nonaromatic member of the mint family (Lamiaceae), is a perennial vine that is woody toward the base and has long, crinkly hairs along the stem. This short-lived perennial species can be distinguished from the related *P. floribunda* and *P. knudsenii* by its less specialized flower stalk (Wagner *et al.* 1999).

Seeds were observed in the wild in August 1993. No additional life history information for this species is currently known (Service 1998a).

Phyllostegia wawrana was reported to be found at Hanalei on Kauai in the 1800s and along Kokee Stream in 1926. Currently, four occurrences with approximately 34 to 54 individuals are reported from Koaie Canyon, Moaalele, Awaawapuhi Valley, and Makaleha on State-owned land within the Alakai Wilderness Preserve, Hono o Na Pali NAR, and Kokee State Park (GDSI 2000; HINHP Database 2000).

This species grows at elevations between 398 and 1,284 m (1,306 and 4,212 ft) in *Acacia koa-Metrosideros polymorpha-Cheirodendron* mixed mesic forest. Associated native plant species include *Alectryon macrococcus*, *Asplenium polyodon*, *Athyrium microphyllum*, *Carex* spp., *Claoxylon sandwicense*, *Cyanea fissa* (haha), *Delissea rivularis*, *Dianella sandwicensis*, *Diplazium sandwichianum*, *Dodonaea viscosa*, *Doodia kunthiana*, *Dryopteris wallichiana*, *Dubautia knudsenii*, *Dubautia laevigata*, *Hedyotis tryblum*, *Machaerina angustifolia*, *Panicum nephelophilum*, *Peperomia* spp., *Perrottetia sandwicensis*, *Pleomele aurea*, *Poa sandwicensis*, *Pteridium aquilinum* var. *decompositum*, *Sadleria pallida*, *Scaevola procera*, *Schiedea stellarioides*, *Syzygium sandwicensis*, *Touchardia latifolia*, or *Vaccinium dentatum* (HINHP Database 2000; 61 FR 53070; K. Wood, pers. comm., 2001).

Major threats to *Phyllostegia wawrana* include habitat degradation by feral pigs and competition with nonnative plant species, such as *Erechtites valerianifolia*, *Erigeron karvinskianus*, *Melastoma candidum*, *Passiflora tarminiana*, *Rubus argutus*, and *Rubus rosifolius* (61 FR 53070; Service 1998a).

Poa mannii (Mann's bluegrass)

Poa mannii, a member of the grass family (Poaceae), is a perennial grass with short rhizomes (underground stems) and erect, tufted culms. All three native species of *Poa* in the Hawaiian Islands are endemic to the island of Kauai. *Poa mannii* is distinguished from both *P. siphonoglossa* and *P. sandvicensis* by its fringed ligule (an appendage on the leaf sheath) and from *P. sandvicensis* by its shorter panicle (a flower cluster) branches (O'Connor 1999).

Little is known about the life history of *Poa mannii*. Flowering cycles, pollination vectors, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995).

Historically, this species was found in Olokele Gulch on Kauai. Currently, there is a total of six occurrences with approximately 268 individuals on State-owned land in the right and left branches of Kalalau Valley, Awaawapuhi Valley, Kuia Valley, and Kauhao Valley within the Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Waimea Canyon State Park (GDSI 2000; HINHP Database 2000; O'Connor 1999; K. Wood, *in litt.* 1999).

This species typically grows on cliffs or rock faces in lowland or montane mesic *Metrosideros polymorpha* or *Acacia koa*-*M. polymorpha* forest at elevations between 327 and 1,222 m (1,072 and 4,009 ft). Associated native plant species include *Antidesma platyphyllum*, *Artemisia australis*, *Bidens cosmoides*, *Bidens sandvicensis*, *Carex meyenii*, *Carex wahuensis*, *Chamaesyce celastroides* var. *hanapepensis*, *Cyperus phleoides* (NCN), *Diospyros sandwicensis*, *Dodonaea viscosa*, *Eragrostis variabilis*, *Hedyotis terminalis*, *Lobelia niihauensis*, *Lobelia yuccoides* (panaunau), *Luzula hawaiiensis* (wood rush), *Melicope anisata*, *M. barbiger*, *M. pallida*, *Nototrichium* spp., *Panicum lineale*, *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria greenwelliae*, *Psychotria mariniana*, *Schiedea* spp., or *Wilkesia gymnoxiphium* (HINHP Database 2000; 59 FR 56330; K. Wood, pers. comm., 2001).

Poa mannii survives only in very steep areas that are inaccessible to goats, suggesting that goat herbivory may have eliminated this species from more accessible locations, as is the case for other rare plants from northwestern Kauai. Threats to *P. mannii* include habitat damage, trampling, and browsing by feral goats, and competition with invasive nonnative plants. *Erigeron*

karvinskianus has invaded Kalalau, Koaie, and Waialae Valleys, three of the areas where *P. mannii* occurs. *Lantana camara* threatens all known populations, and *Rubus argutus* threatens the populations in Kalalau and Waialae Valleys. *Poa mannii* is also threatened by fire and reduced reproductive vigor and/or extinction from naturally occurring events, such as landslides or hurricanes, due to the small number of existing populations and individuals (59 FR 56330).

Poa sandvicensis (Hawaiian bluegrass)

Poa sandvicensis is a perennial grass (Poaceae) with densely tufted, mostly erect culms. It is distinguished from closely related species by its shorter rhizomes and culms which do not become rush-like with age, closed and fused sheaths, relatively even-edged ligules, and longer panicle branches (O'Connor 1999).

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

Historically, this species was known from the following areas on the island of Kauai: the rim of Kalalau Valley; Halemanu Ridge, Kumuwela Ridge, and Kauaikanana drainage; Awaawapuhi Trail; Kohua Ridge/Mohihi drainage; and Kaholuamanu. Hillebrand's (1888) reference to a Maui locality is most likely an error. Currently, there is a total of nine occurrences with 1,321 individuals on State-owned land. *Poa sandvicensis* is known to be extant at Alealau, Keanapuka, Awaawapuhi Trail, Kumuwela Ridge, Maile Flat Trail, Mohihi Stream, Mohihi-Waialae Trail, Kawaiiki Valley, and Waialae Valley in the Alakai Wilderness Preserve, Hono o Na Pali NAR, Kokee State Park, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000; 57 FR 20580; K. Wood, *in litt.* 1999).

Poa sandvicensis grows on wet, shaded, gentle to steep slopes, ridges, and rock ledges of streambanks in semi-open to closed, wet, diverse *Acacia koa*-*Metrosideros polymorpha* montane forest, at elevations between 473 and 1,290 m (1,553 and 4,232 ft). Associated native plant species include *Alyxia oliviformis*, *Bidens sandvicensis*, *Cheirodendron* spp., *Cloaxylon sandwicense*, *Coprosma* spp., *Dianella sandwicensis*, *Dicranopteris linearis*, *Dodonaea viscosa*, *Dubautia* spp., *Hedyotis* spp., *Melicope* spp., *Peperomia* spp., *Psychotria* spp., *Scaevola procera*, *Schiedea*

stellarioides, or *Syzygium sandwicensis* (HINHP Database 2000; 57 FR 20580; K. Wood, pers. comm., 2001).

The greatest immediate threats to the survival of *Poa sandvicensis* are competition from nonnative plants, such as *Erigeron karvinskianus*, *Hedyochium* spp., *Passiflora tarminiana*, or *Rubus argutus*; erosion caused by feral pigs and goats; and State Forest Reserve trail maintenance activities and human recreation. In addition, naturally occurring events, such as landslides and hurricanes, constitute a threat of extinction or reduced reproductive vigor due to the species' small population size (Service 1995; 57 FR 20580).

Poa siphonoglossa (NCN)

Poa siphonoglossa is a perennial grass (Poaceae) with extensive tufted and flattened culms that cascade from banks in masses. It differs from related species by its longer culms and lack of a prominent tooth on the ligule. In addition, its shorter panicle branches distinguish it from *P. sandvicensis*, and its short rhizomes and closed and fused sheaths separate it from *P. mannii* (O'Connor 1999).

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

Historically, *Poa siphonoglossa* was known from five sites on the island of Kauai: Kohua Ridge, near Kaholuamanu, Kaulaula Valley, Kuia Valley, and Kalalau. Currently, there are a total of five occurrences with a total of 50 individuals on State-owned land at Kahuamaa Flats, Mohihi-Waialae Trail, Kuia Valley, Makaha Ridge, and Kaulaula Valley in the Alakai Wilderness Preserve, Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Poa siphonoglossa typically grows on shady banks on steep slopes in mesic *Metrosideros polymorpha*-*Acacia koa* forests at elevations between about 480 and 1,296 m (1,573 and 4,251 ft). Associated native plant species include *Alphitonia ponderosa*, *Alyxia oliviformis*, *Bobea brevipes*, *Carex meyenii*, *Carex wahuensis*, *Coprosma waimeae*, *Dianella sandwicensis*, *Dodonaea viscosa*, *Dubautia* spp., *Hedyotis* spp., *Leptocophylla tameiameiae*, *Lobelia yuccoides*, *Melicope* spp., *Microlepia strigosa*, *Myrsine* spp., *Panicum nephelophilum*, *Poa sandvicensis*, *Psychotria* spp., *Scaevola procera*, *Tetraplasandra*

kavaiensis, *Vaccinium* spp., *Wilkesia gymnoxiphium*, *Xylosma* spp., or *Zanthoxylum dipetalum* (57 FR 20580; K. Wood, pers. comm., 2001).

The primary threat to the survival of *Poa siphonoglossa* is habitat degradation and/or herbivory by feral pigs and deer. The nonnative plant *Rubus argutus* invading Kohua Ridge constitutes a probable threat to that population. Small population size and the potential for one disturbance event to destroy the majority of known individuals are also serious threats to this species (HINHP Database 2000; Service 1995; 57 FR 20580).

Pritchardia aylmer-robinsonii (wahane)

Pritchardia aylmer-robinsonii, a member of the palm family (Arecaceae) is a fan-leaved tree about 7 to 15 m (23 to 50 ft) tall. This species is distinguished from others of the genus by the thin leaf texture and drooping leaf segments, tan woolly hairs on the underside of the petiole and the leaf blade base, stout hairless flower clusters that do not extend beyond the fan-shaped leaves, and the smaller spherical fruit (Read and Hodel 1999).

Little is known about the life history of *Pritchardia aylmer-robinsonii*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (61 FR 41020).

Historically, *Pritchardia aylmer-robinsonii* was found at three sites in the eastern and central portions of the island of Niihau. Trees were found on Kaali Cliff and in Mokouia and Haao Valleys at elevations between 70 and 270 m (230 and 885 ft) on privately owned land. The most recent observations indicate that two plants still remain on Kaali Cliff (GDSI 2000; HINHP Database 2000; Read and Hodel 1999).

Pritchardia aylmer-robinsonii typically grows on rocky talus in seepage areas within coastal dry forest at elevations between 91 to 259 m (300 to 850 ft). Associated native plant species include *Brighamia insignis*, *Cyperus trachysanthos*, *Lipochaeta lobata* var. *lobata* (nehe), or *Lobelia niihauensis*. Originally a component of the coastal dry forest, this species now occurs only in a rugged and steep area where it receives some protection from grazing ungulates (HINHP Database 2000; 61 FR 41020).

The species is threatened by habitat degradation and/or herbivory by cattle, feral pigs, and feral goats and seed predation by rats. Small population size, limited distribution, and reduced reproductive vigor makes this species

particularly vulnerable to extinction (61 FR 41020).

Pritchardia napaliensis (loulou)

Pritchardia napaliensis, a member of the palm family (Arecaceae), is a small tree with about 20 leaves and an open crown. This species is distinguished from others of the genus that grow on Kauai by having about 20 flat leaves with pale scales on the lower surface that fall off with age, inflorescences with hairless main axes, and globose round fruits less than 3 cm (1.2 in) long (Read and Hodel 1999).

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

Pritchardia napaliensis has only been known from five occurrences with 155 individuals on State-owned land in Pohakuao, Alealau, Waiahuakua, and Hoolulu Valley within the Hono o Na Pali NAR and Na Pali Coast State Park (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Pritchardia napaliensis typically grows in areas between elevations of 152 and 1,158 m (500 and 3,800 ft) in a wide variety of habitats ranging from lowland dry to diverse mesic forests dominated by *Diospyros* spp. or montane wet forests dominated by *Metrosideros polymorpha* and *Dicranopteris linearis*. Associated native plant species include *Alsinidendron lychnoides*, *Alyxia oliviformis*, *Boehmeria grandis*, *Cheirodendron trigynum*, *Cibotium* spp., *Dubautia knudsenii*, *Elaeocarpus bifidus*, *Hibiscus kokio* ssp. *saintjohnianus* (kokio), *Lipochaeta connata* var. *acris* (nehe), *Melicope peduncularis* (alani), *Nesoluma polynesianum* (keahi), *Ochrosia kauaiensis* (holei), *Phyllostegia electra* (NCN), *Pleomele aurea*, *Poa sandwicensis*, *Pouteria sandwicensis*, *Psychotria* spp., *Psydrax odorata*, *Pteralyxia kauaiensis*, *Rauvolfia sandwicensis*, *Santalum freycinetianum* var. *pyrularium*, *Stenogyne purpurea* (NCN), *Syzygium sandwicensis*, *Vaccinium dentatum*, *Wilkesia gymnoxiphium*, or *Xylosma hawaiiense* (HINHP Database 2000; Service 1998a; 61 FR 53070).

Major threats to *Pritchardia napaliensis* include habitat degradation and grazing by feral goats and pigs; seed predation by rats; and competition with nonnative plants such as *Erigeron karvinskianus*, *Kalanchoe pinnata*, *Lantana camara*, *Psidium guajava*, or possibly *Cordyline fruticosa*. The species is also threatened by vandalism

and over-collection. In 1993, near the Wailua River, the State Division of Forestry and Wildlife (DOFAW) constructed a fenced enclosure around 39 recently planted *P. napaliensis* individuals. Shortly after planting, the fence was vandalized and the 39 plants were removed. Also, because of the small number of remaining populations and individuals, this species is susceptible to a risk of extinction from naturally occurring events, such as landslides or hurricanes, and from reduced reproductive vigor (61 FR 53070; Craig Koga, DOFAW, *in litt.* 1999; A. Kyono, pers. comm., 2000).

Pritchardia viscosa (loulou)

Pritchardia viscosa, a member of the palm family (Arecaceae), is a small tree 3 to 8 m (10 to 26 ft) tall. This species differs from others of the genus that grow on Kauai by the degree of hairiness of the lower surface of the leaves and main axis of the flower cluster, and length of the flower cluster (Read and Hodel 1999).

Historically, *Pritchardia viscosa* was known only from a 1920 collection from Kalihiwai Valley. It was not seen again until 1987, when Robert Read observed it in the same general area as the type locality, off the Powerline Road at 512 m (1,680 ft) elevation (HINHP Database 2000). Currently, there is one occurrence with three individuals on State-owned land within the Halelea Forest Reserve (GDSI 2000; HINHP Database 2000; 61 FR 53070).

This species is found in *Metrosideros polymorpha-Dicranopteris linearis* lowland wet forest at elevations between 488 and 518 m (1,600 and 1,700 ft). Associated native species include *Antidesma* spp., *Bobea* spp., *Cibotium* spp., *Cyanea fissa*, *Cyrtandra kauaiensis*, *Cyrtandra longiflora*, *Dubautia knudsenii*, *Nothocestrum* spp., *Perrottetia sandwicensis*, *Psychotria* spp., *Sadleria pallida*, or *Syzygium sandwicensis* (Service 1998a; 61 FR 53070).

Pritchardia viscosa is threatened by *Psidium cattleianum*, nonnative grasses such as *Paspalum conjugatum*, and seed predation by rats. At least one of the remaining mature trees has been damaged by spiked boots used either by a botanist or seed collector to scale the tree. In mid-1996, a young plant and seeds from mature *Pritchardia viscosa* plants were removed from the only known location of this species. Because of this past activity, it is reasonable to assume that these plants are threatened by over-collection and vandalism. Also, because of the small numbers of individuals in the only known population, this species is susceptible to

extinction since a single naturally occurring event (e.g., a hurricane) could destroy all remaining plants (61 FR 53070; C. Koga, in litt. 1999; A. Kyono, pers. comm., 2000).

Pteralyxia kauaiensis (kaulu)

Pteralyxia kauaiensis, a member of the dogbane family (Apocynaceae), is a long-lived perennial tree 3 to 8 m (10 to 26 ft) tall. The leaves are dark green and shiny on the upper surfaces, but pale and dull on the lower surfaces. This species differs from the only other species of this endemic Hawaiian genus in having reduced lateral wings on the seed (Wagner *et al.* 1999).

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

Historically, *Pteralyxia kauaiensis* was known from the Wahiawa Mountains in the southern portion of Kauai. This species is now known from 39 occurrences, with a total of 1,124 to 1,161 individuals in the following scattered locations on State land: Limahuli Valley, the left and right branches of Kalalau Valley, Pohakuao, Makaha Valley, Kuia Valley, Haeleele Valley, Koaie Canyon, Kawaiiki Valley, Hipalau, Haupu, Blue Hole, Poomau Valley, and Kapalikea within the Lihue-Koloa Forest Reserve, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve. There is also an undocumented sighting of one individual at Makaleha, above the town of Kapaa (HINHP Database 2000; Wagner *et al.* 1999; 59 FR 9304; K. Wood, in litt. 1999).

This species is typically found in diverse mesic or *Diospyros sandwicensis* mixed mesic forests with *Pisonia* spp. between elevations of 127 and 1,563 m (418 and 5,128 ft). Associated native plant species include *Acacia koa*, *Alectryon macrococcus*, *Alphitonia ponderosa*, *Antidesma platyphyllum* var. *hillebrandii*, *Bohea brevipes*, *Carex* spp., *Charpentiera elliptica*, *Claoxylon sandwicense*, *Cyanea* spp., *Dianella sandwicensis*, *Diospyros* spp. (lama), *Diplazium sandwichianum*, *Dodonaea viscosa*, *Euphorbia haeleeleana*, *Freycinetia arborea*, *Gahnia* spp., *Gardenia remyi* (nanu), *Hedyotis terminalis*, *Hibiscus kokio*, *Kokia kauaiensis*, *Leptecophylla tameiameia*, *Metrosideros polymorpha*, *Myrsine lanaiensis*, *Neraudia* spp. (NCN), *Nesoluma polynesicum*, *Nestegis sandwicensis*, *Peperomia* spp., *Pipturus* spp., *Pisonia sandwicensis*, *Pleomele aurea*, *Poa sandwicensis*, *Pouteria*

sandwicensis, *Pritchardia* spp., *Psychotria* spp., *Psydrax odorata*, *Rauvolfia sandwicensis*, *Santalum freycinetianum* var. *pyrularium*, *Schiedea* spp., *Syzygium sandwicensis*, *Tetraplasandra* spp., *Xylosma hawaiiense*, or *Zanthoxylum dipetalum* (HINHP Database 2000; 59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to *Pteralyxia kauaiensis* are habitat destruction by feral animals and competition with introduced plants. Animals affecting the survival of this species include feral goats and pigs, and possibly rats, which may eat the fruit. Fire could threaten some populations. Introduced plants competing with this species include *Aleurites moluccana*, *Cordyline fruticosa*, *Erigeron karvinskianus*, *Lantana camara*, *Psidium cattleianum*, or *Psidium guajava* (HINHP Database 2000; Service 1995; 59 FR 9304).

Remya kauaiensis (NCN)

Remya kauaiensis, one of three species of a genus endemic to the Hawaiian Islands, is in the aster family (Asteraceae). *Remya kauaiensis* is a small short-lived perennial shrub, about 1 m (3 ft) tall, with many sprawling branches covered with a fine tan fuzz near their tips. The lower surface of the leaves is covered with fine white hairs. This species is distinguished from the other Kauai species in the genus by being hairy, having shorter flower head stalks, and having narrower tips on the floral bracts (Wagner *et al.* 1999).

Seedlings of this species have not been observed. Flowers have been observed in April, May, June, and August, and are probably insect-pollinated. Seeds are probably wind or water-dispersed. *Remya kauaiensis* may be self-incompatible (Herbst 1988; Service 1995; 56 FR 1450).

Historically, this species was found at Koaie, Mohihi, Kalalau, Makaha, Nualolo, Kawaiula, Kuia, Honopu, Awaawapuhi, Kopakaka, and Kauhao on Kauai. There are currently 17 known occurrences with a total of 106 to 114 individuals on State-owned land. They occur in Hipalau Valley, Awini Valley, Koaie Canyon, Mohihi Stream, the left branch of Kalalau Valley, Awaawapuhi and Nualolo Valleys, Kuia and Kawaiula Valleys, Makaha Valley, Kauhao Valley, and Kaulaula Valley within the Alakai Wilderness Preserve, Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, Puu Ka Pele Forest Reserve, and Waimea Canyon State Park (GDSI 2000; HINHP Database 2000; K. Wood, in litt. 1999).

Remya kauaiensis grows chiefly on steep, north or northeast-facing slopes at elevations between 560 and 1,247 m

(1,836 and 4,090 ft). It is found primarily in *Acacia koa*-*Metrosideros polymorpha* lowland mesic forest with *Chamaesyce* spp. (akoko), *Claoxylon sandwicense*, *Dianella sandwicensis*, *Diospyros* spp., *Dodonaea viscosa*, *Hedyotis terminalis*, *Melicope* spp., *Nestegis sandwicensis*, *Pouteria sandwicensis*, *Psychotria* spp., *Schiedea* spp., or *Tetraplasandra* spp. (HINHP Database 2000; Herbst 1988; 56 FR 1450; K. Wood, pers. comm., 2001).

The primary threats to *Remya kauaiensis* include herbivory and habitat degradation by feral goats, pigs, cattle, and deer, and competition from nonnative plant species. Other threats include erosion, fire, and risk of extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of remaining populations and individuals (Service 1995; 56 FR 1450).

Remya montgomeryi (NCN)

Remya montgomeryi in the aster family (Asteraceae) was discovered in 1985 by Steven Montgomery on the sheer, virtually inaccessible cliffs below the upper rim of Kalalau Valley, Kauai. It is a small short-lived perennial shrub, about 1 m (3 ft) tall, with many sprawling to weakly erect, smooth branches. The species is distinguished from *R. kauaiensis* by being hairless, with longer flower head stalks and broader floral bract tips (Wagner *et al.* 1999).

Seedlings of this species have not been observed. Flowers have been observed in April through August and are probably insect-pollinated. Seeds are probably wind or water-dispersed. *Remya montgomeryi* may be self-incompatible (Herbst 1988; 56 FR 1450).

Remya montgomeryi is known only from Kauai. Six occurrences with 143 individuals are reported on State-owned land in the left and right branches of Kalalau Valley, Koaie Canyon, and Kuia Valley within the Alakai Wilderness Preserve and Na Pali Coast State Park (GDSI 2000; HINHP Database 2000; Herbst 1988; K. Wood, in litt. 1999).

Remya montgomeryi grows at elevations between 336 and 1,344 m (1,102 and 4,411 ft), primarily on steep, north or northeast-facing slopes or cliffs in transitional wet or *Metrosideros polymorpha*-dominated mixed mesic forest. Associated native plant species include *Artemisia australis*, *Bohea* spp., *Boehmeria grandis*, *Cheirodendron* spp., *Claoxylon sandwicense*, *Cyrtandra* spp., *Dubautia* spp., *Ilex anomala*, *Lepidium serra*, *Lysimachia* spp. (kolokolo kuahiwi), *Myrsine linearifolia*, *Nototrichium* spp., *Pleomele aurea*, *Poa*

mannii, *Sadleria* spp., *Scaevola* spp., *Stenogyne campanulata*, *Tetraplasandra* spp., or *Zanthoxylum dipetalum* (HINHP Database 2000; K. Wood, pers. comm., 2001).

The primary threats to *Remya montgomeryi* are herbivory and habitat degradation by feral goats, pigs, cattle, and deer, and competition from nonnative plant species. Other threats include erosion, fire, and an increased risk of extinction from naturally occurring events (e.g., landslides or hurricanes) because of the small size of the populations and their limited distribution (Service 1995; 56 FR 1450).

Schiedea apokremnos (maolioli)

Schiedea apokremnos, a member of the pink family (Caryophyllaceae), is a low, branching short-lived perennial shrub 20 to 51 cm (8 to 20 in) tall with leaves that are somewhat fleshy. *Schiedea apokremnos* is distinguished from related species by shorter sepals, nectaries, and capsules (Wagner *et al.* 1999).

Some individuals of *Schiedea apokremnos* are functionally female and must be cross-pollinated to set seed. This reproductive strategy may be ineffective in populations with few individuals. Little is known about the life history of *Schiedea apokremnos*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995).

Schiedea apokremnos has been collected from Nualolo Kai, Kaaweiki Ridge, and along a 10.5 km (6.5 mi) long section of the Na Pali coast including Milolii Valley, Kalalau Beach, Kaaalahina and Manono Ridges, Haeleele Ridge, and as far north as Pohakuao Valley, all on the island of Kauai. There is currently a total of five occurrences containing 201 individuals on State-owned lands. The species is extant at Nakeikionaiwi, Pohakuao, Nualolo Valley, Haeleele Valley, and Kawaiiki Valley within the Na Pali Coast State Park and Puu Ka Pele Forest Reserve (GDSI 2000; HINHP Database 2000; 56 FR 49639).

Schiedea apokremnos grows in the crevices of near-vertical basalt coastal cliff faces, at elevations between 11 and 538 m (35 and 1,765 ft). The species grows in sparse dry coastal cliff shrub vegetation along with *Artemisia australis*, *Bidens* spp., *Carex meyenii*, *Chamaesyce celastroides*, *Eragrostis variabilis*, *Lepidium serra*, *Lipochaeta connata*, *Lobelia niihauensis*, *Myoporum sandwicense*, *Peperomia* spp., *Pleomele aurea*, *Psydrax odorata*, or *Wilkesia* spp. (HINHP Database 2000;

56 FR 49639; K. Wood, pers. comm., 2001).

The restriction of this species to inaccessible cliffs suggests that goat herbivory may have eliminated it from more accessible locations. The greatest current threat to the survival of *Schiedea apokremnos* is still herbivory and habitat degradation by feral goats, as well as competition from the nonnative plants *Leucaena leucocephala* and *Hyptis pectinata* (comb hyptis), and trampling by humans. Given the small size of most populations and restricted distribution, depressed reproductive vigor may be a serious threat to the species. In addition, a single environmental disturbance (such as a landslide or fire) could destroy a significant percentage of the extant individuals (Service 1995; 56 FR 49639).

Schiedea helleri (NCN)

Schiedea helleri, a member of the pink family (Caryophyllaceae), is a short-lived perennial vine. The stems are usually prostrate and at least 15 cm (6 in) long. This species is the only member of the genus on Kauai that grows as a vine (Wagner *et al.* 1999).

Three plants have been observed flowering in February. No additional life history information for this species is currently known (Service 1998a).

Schiedea helleri was originally found only at a single location at Kaholuamano over 100 years ago. There is currently a total of three occurrences with 50 to 60 individuals on State-owned land at Mohihi Stream, Nawaimaka Valley, and Mohihi-Waialae Trail within the Alakai Wilderness Preserve and Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Schiedea helleri is found on ridges and steep cliffs in closed *Metrosideros polymorpha*-*Dicranopteris linearis* montane wet forest, *M. polymorpha*-*Cheirodendron* spp. montane wet forest, or *Acacia koa*-*M. polymorpha* montane mesic forest at elevations between 664 and 1,361 m (2,178 and 4,464 ft). Other native plants growing in association with this species include *Broussaisia arguta*, *Cheirodendron* spp., *Cibotium* spp., *Cyanea* spp., *Dianella sandwicensis*, *Dubautia* spp., *Elaeocarpus bifidus*, *Hedyotis terminalis*, *Melicope* spp., *Myrsine* spp., *Poa sandwicensis*, *Scaevola procera*, *Syzygium sandwicense*, or *Viola wailenalanae* (pamakani) (HINHP Database 2000; K. Wood, pers. comm., 2001).

Competition with the nonnative plant *Rubus argutus*, a risk of extinction from naturally occurring events (e.g.,

landslides or hurricanes), and reduced reproductive vigor due to the small number of extant individuals are serious threats to *Schiedea helleri* (61 FR 53070).

Schiedea kauaiensis (NCN)

Schiedea kauaiensis, a member of the pink family (Caryophyllaceae), is an erect subshrub. This short-lived perennial species is distinguished from others in this endemic Hawaiian genus by its habit, larger leaves, the hairiness of the inflorescence, the number of flowers in each inflorescence, larger flowers, and larger seeds (Wagner *et al.* 1999).

Little is known about the life history of this taxon. Fruit and flowers have been observed in July through September. There is no evidence of regeneration from seed under field conditions. Reproductive cycles, longevity, specific environmental requirements and limiting factors are unknown (Service 1998a).

Historically, *Schiedea kauaiensis* was known from the northwestern side of Kauai, from Papaa to Mahanaloa. It was thought to be extinct until the five currently known occurrences in Mahanaloa and Kalalau Valleys, with a total of 22 individuals, were found. All occurrences are on State land within the Kuia NAR and Na Pali Coast State Park (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Schiedea kauaiensis typically grows in diverse mesic to wet *Acacia koa*-*Metrosideros polymorpha* forest on steep slopes at elevations between 117 and 1,290 m (385 and 4,232 ft). Associated native plant species include *Alphitonia ponderosa*, *Cryptocarya mannii*, *Diospyros* spp., *Dodonaea viscosa*, *Euphorbia haeleeleana*, *Exocarpos luteolus*, *Leptocophylla tameiameia*, *Microlepis strigosa*, *Nestegis sandwicensis*, *Pisonia* spp., *Peucedanum sandwicense* (makou), *Psychotria* spp., or *Psydrax odorata* (HINHP Database 2000; 61 FR 53108; K. Wood, pers. comm., 2001).

Threats to *Schiedea kauaiensis* include habitat degradation and/or destruction by feral goats, pigs, and cattle; competition from several nonnative plant species; predation by introduced slugs and snails; and a risk of extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the low number of individuals in only two known populations. *Schiedea kauaiensis* is also potentially threatened by fire (HINHP Database 2000; Service 1998a; 61 FR 53108).

Schiedea membranacea (NCN)

Schiedea membranacea, a member of the pink family (Caryophyllaceae), is a short-lived perennial herb. This species differs from other *Schiedea* species on Kauai by having five-to seven-veined leaves and an herbaceous habit (Wagner *et al.* 1999).

Research suggests that this species largely requires outcrossing for successful germination and survival to adulthood. Pollinators for *Schiedea membranacea* are unknown, since none have been seen during the daytime, and none were observed during one set of night observations. Little else is known about the life history of *S. membranacea*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998a).

Schiedea membranacea is currently known from the western side of the island of Kauai, on State and privately owned lands at Poopooiki Valley, Milolii Ridge, Kuia Valley, Awaawapuhi Valley, Nualolo Valley, Kahuamaa Flats, Waialae Falls, Koaie Canyon, and the right branch of Wainiha Valley. On State lands it occurs within the Alakai Wilderness Preserve, Halelea Forest Reserve, Kuia NAR, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve. There are currently 10 occurrences containing 344 to 348 individuals (GDSI 2000; HINHP Database 2000; Wood and Perlman 1993; 61 FR 53070; K. Wood, *in litt.* 1999;).

This species is typically found on cliffs and cliff bases in mesic or wet habitats in lowland or montane shrubland or forest communities dominated by *Acacia koa*, *Pipturus* spp. and *Metrosideros polymorpha* or Urticaceae shrubland on talus slopes at elevations between 422 and 1,259 m (1,386 and 4,131 ft). Associated native plant species include *Alphitonia ponderosa*, *Alyxia oliviformis*, *Asplenium* spp., *Athyrium sandwicense* (akolea), *Bobea brevipes*, *Boehmeria grandis*, *Cyrtandra* spp., *Diplazium sandwichianum*, *Dodonaea viscosa*, *Eragrostis variabilis*, *Hedyotis terminalis*, *Hibiscus waimeae*, *Joinvillea ascendens* ssp. *ascendens* (ohe), *Labordia helleri* (kamakahala), *Lepidium serra*, *Lysimachia kalalauensis* (NCN), *Machaerina angustifolia*, *Mariscus pennatifolius*, *Melicope* spp., *Myrsine* spp., *Perrottetia sandwicensis*, *Pisonia* spp., *Pleomele aurea*, *Poa mannii*, *Poa sandwicensis*, *Pouteria sandwicensis*, *Psychotria* spp., *Psydrax odorata*, *Remya kauaiensis*, *Sadleria cyatheoides* (amau), *Scaevola procera*, *Thelypteris*

cyatheoides (kikawaio), *Thelypteris sandwicensis* (palapalaia), or *Touchardia latifolia* (HINHP Database 2000; 61 FR 53070; K. Wood, pers. comm., 2001).

Habitat degradation by feral goats, pigs, and deer; competition with the nonnative plant species *Ageratina riparia* (Hamakua pamakani), *Erigeron karvinskianus*, *Lantana camara*, *Passiflora tarminiana*, *Psidium cattleianum*, *Rubus argutus*, or *R. rosifolius*; loss of pollinators; and landslides are the primary threats to *Schiedea membranacea*. Based on observations indicating that snails and slugs may consume seeds and seedlings, it is likely that introduced molluscs also represent a major threat to this species (Service 1998a; Wood and Perlman 1993; 61 FR 53070).

Schiedea spergulina var. *leiopoda* and *Schiedea spergulina* var. *spergulina* (NCN)

Schiedea spergulina, a member of the pink family (Caryophyllaceae), is a short-lived perennial subshrub. Of the 22 species in this endemic genus, only two other species have smooth seeds. *Schiedea spergulina* differs from those two in having very compact flower clusters. The two weakly defined varieties differ primarily in the degree of hairiness of the inflorescences, with *S. spergulina* var. *leiopoda* being the less hairy of the two (Wagner *et al.* 1999).

Little is known about the life histories of either *Schiedea spergulina* var. *leiopoda* or *S. spergulina* var. *spergulina*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995).

Historically, *Schiedea spergulina* var. *leiopoda* was found on a ridge on the east side of Hanapepe on Kauai. One occurrence with approximately 135 to 150 individuals is now known to grow in Lawai Valley on Kauai on privately owned land (GDSI 2000; HINHP Database 2000).

Schiedea spergulina var. *spergulina* was historically found in Olokele Canyon, but is now known only from the right branch of Kalalau Valley, Koaie Canyon, and Waimea Canyon. A total of three occurrences numbering approximately 208 individuals is reported on State-owned land within the Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and the Puu Ka Pele Forest Reserve. However, it has been estimated that this species may number in the thousands on Kauai (GDSI 2000; HINHP Database 2000; Service 1995).

Both varieties of *Schiedea spergulina* are usually found on bare rock outcrops or sparsely vegetated portions of rocky cliff faces or cliff bases in diverse lowland dry to mesic forests at elevations between 21 and 90 m (69 and 294 ft) for *S. spergulina* var. *leiopoda* and elevations between 144 and 828 m (474 and 2,718 ft) for *S. spergulina* var. *spergulina*. Associated native plant species include *Acacia koa*, *Artemisia australis*, *Bidens sandwicensis*, *Carex meyenii*, *Chamaesyce celastroides*, *Dianella sandwicensis*, *Doryopteris* spp. (kumuniu), *Eragrostis variabilis*, *Erythrina sandwicensis* (wiliwili), *Gahnia* spp., *Heliotropium* spp. (ahinahina), *Lepidium serra*, *Lipochaeta connata*, *Microlepia strigosa*, *Nestegis sandwicensis*, *Nototrichium sandwicense*, *Panicum lineale*, *Peucedanum sandwicense*, or *Wilkesia gymnoxiphium* (HINHP Database 2000; Lorence and Flynn 1991; Service 1995; 59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to *Schiedea spergulina* var. *leiopoda* are habitat destruction by feral goats and competition with nonnative plants such as *Furcraea foetida* (Mauritius hemp), *Lantana camara*, or *Leucaena leucocephala*. Individuals have also been damaged and destroyed by rock slides. This variety is potentially threatened by pesticide use in nearby sugarcane fields, as well as being at risk of extinction from naturally occurring events (e.g., hurricanes) and/or reduced reproductive vigor due to the small number of existing individuals (Lorence and Flynn 1991; Service 1995; 59 FR 9304).

Schiedea spergulina var. *spergulina* is threatened by competition with nonnative plant species, including *Erigeron karvinskianus*, *Lantana camara*, *Melia azedarach*, or *Triumfetta semitriloba* (Sacramento bur). The area in which this variety grows is used heavily by feral goats, and there is evidence that plants are being browsed and trampled (HINHP Database 2000; Lorence and Flynn 1991; 59 FR 9304).

Schiedea stellarioides (lauhilihi)

Schiedea stellarioides, a member of the pink family (Caryophyllaceae), is a slightly erect to prostrate subshrub with branched stems. The opposite leaves are very slender to oblong-elliptic, and one-veined. This short-lived perennial species is distinguished from other *Schiedea* species on Kauai by the number of veins in the leaves, shape of the leaves, presence of a leaf stalk, length of the flower cluster, and shape of the seeds (Wagner *et al.* 1999).

Plants have been observed flowering in February. Little else is known about the life history of *Schiedea stellarioides*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1995).

Historically, *Schiedea stellarioides* was found at the sea cliffs of Hanakapiai Beach, Kaholuamano-Opaewela region, the ridge between Waialae and Nawaimaka Valleys, and Haupū Range on the island of Kauai. Currently it is found in Kawaiiki Valley and Waialae Falls within the Na Pali-Kona Forest Reserve. There is a total of three occurrences with 1,500 individuals on State-owned land (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999).

Schiedea stellarioides is found on steep slopes in closed *Acacia koa*-*Metrosideros polymorpha* lowland to montane mesic forest or shrubland at elevations between 376 and 1,251 m (1,135 and 4,102 ft). Associated native plant species include *Alsinidendron viscosum*, *Artemisia australis*, *Bidens cosmoides*, *Chenopodium* spp. (aheahea), *Dianella sandwicensis*, *Dodonaea viscosa*, *Leptecophylla tameiameia*, *Mariscus* spp., *Melicope* spp., *Nototrichium sandwicense*, *Pipturus* spp., *Syzygium sandwicensis*, or *Zanthoxylum dipetalum* (HINHP Database 2000; 61 FR 53070; K. Wood, pers. comm., 2001).

The primary threats to this species include habitat degradation and herbivory by feral pigs and goats, competition with the nonnative plants *Melinis minutiflora* and *Rubus argutus*, and a risk of extinction of the two remaining populations from naturally occurring events, such as landslides or hurricanes (61 FR 53070).

Stenogyne campanulata (NCN)

Stenogyne campanulata, a member of the mint family (Lamiaceae), is a vine with four-angled, hairy stems. A short-lived perennial species, *Stenogyne campanulata* is distinguished from closely related species by its large and very broadly bell-shaped calyces that nearly enclose the relatively small, straight corollas, and by small calyx teeth that are half as long as wide (Weller and Sakai 1999).

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

Stenogyne campanulata is known from three occurrences with 66 individuals which were originally

discovered in the left branch of Kalalau Valley on State-owned land in the Na Pali Coast State Park (GDSI 2000; HINHP Database 2000).

Stenogyne campanulata grows on the rock face of a nearly vertical, north-facing cliff in diverse lowland or montane mesic forest at elevations between 335 and 1,290 m (1,100 and 4,232 ft). The associated native plant species include *Lepidium serra*, *Lobelia niihauensis*, *Lysimachia* spp., *Melicope pallida*, *Metrosideros polymorpha*, *Neraudia kauaiensis*, *Nototrichium divaricatum* (kului), *Poa mannii*, *Remya montgomeryi*, or *Wilkesia gymnoxiphium* (Weller and Sakai 1999; 57 FR 20580; K. Wood, pers. comm., 2001).

The restriction of this species to virtually inaccessible cliffs suggests that herbivory by feral goats may have eliminated it from more accessible locations. Goat herbivory and habitat degradation remain the primary threat. Feral pigs have disturbed vegetation in the vicinity of these plants. Erosion caused by feral goats or pigs exacerbates the potential threat of landslides. *Erigeron karvinskianus* and *Rubus argutus* are the primary nonnative plants threatening *Stenogyne campanulata*. The small number of individuals and its restricted distribution are serious potential threats to the species. The limited population size may depress reproductive vigor, or a single environmental disturbance, such as a landslide, could destroy all known extant individuals (57 FR 20580).

Viola helenae (NCN)

Viola helenae is a small, unbranched perennial subshrub with an erect stem in the violet family (Violaceae). It is distinguished from other Kauai species of *Viola* by the leaf shape and width, woody stems, and strictly chasmogamous (open at maturity for access by pollinators) flowers (Wagner *et al.* 1999).

Little is known about the life history of *Viola helenae*. Wagner *et al.* (1999) state that the flowers are all chasmogamous and not cleistogamous (remain closed and self-fertilize in the bud) as in certain other violet species. Therefore, it is likely that its flowers require pollination by insects for seed set. Mature flowering plants do produce seed; however, seed viability may be low and microhabitat requirements for germination and growth may be very specific. Seeds planted at NTBG on Kauai failed to germinate, although they may not have been sufficiently mature when collected and violet seeds are often very slow to germinate. The seeds

are jettisoned when the capsule splits open, as in most species of the genus (Service 1994).

Historically, *Viola helenae* was known from four populations, two along either branch of Wahiawa Stream on Kauai. Currently, there is one known occurrence with a total of 137 plants, on privately owned land within the Wahiawa drainage (GDSI 2000; HINHP Database 2000; Service 1994; 56 FR 47695).

This species is found in *Metrosideros polymorpha*-*Dicranopteris linearis* lowland wet forest or *M. polymorpha*-*Cheirodendron* wet forest growing on stream drainage banks or adjacent valley bottoms in light to moderate shade at elevations between 522 and 1,006 m (1,712 and 3,301 ft). Associated native plant species include *Antidesma platyphyllum* var. *hillebrandii*, *Broussaisia arguta*, *Dicranopteris linearis*, *Diplazium sandwichianum*, *Dubautia* spp., *Freycinetia arborea*, *Hesperomannia lydgatei*, *Melicope* spp., or *Pritchardia* spp. (HINHP Database 2000; Service 1994; K. Wood, pers. comm., 2001).

Threats to *Viola helenae* include competition from nonnative plant species, including *Elephantopus mollis*, *Erechtites valerianifolia*, *Melastoma candidum*, *Psidium cattleianum*, *Rubus rosifolius*, *Stachytarpheta australis*, various nonnative grasses, or potentially *Melaleuca quinquenervia*; trampling and browsing damage by feral pigs; landslides and erosion; and hurricanes (Service 1994; 56 FR 47695).

Viola kauaiensis var. *wahiawaensis* (nani waialeale)

Viola kauaiensis, a member of the violet family (Violaceae), is a short-lived perennial herb with upward curving or weakly rising, hairless, lateral stems. The species is distinguished from others of the genus by its non-woody habit, widely spaced kidney-shaped leaves, and by having two types of flowers: conspicuous, open flowers and smaller, unopened flowers. Two varieties of the species are recognized, both occurring on Kauai: var. *kauaiensis* and var. *wahiawaensis*. *Viola kauaiensis* var. *wahiawaensis* is distinguished by having broadly wedge-shaped leaf bases (Service 1998a; Wagner *et al.* 1999).

Viola kauaiensis var. *wahiawaensis* has been observed in flower in December. Little else is known about the life history of *V. kauaiensis* var. *wahiawaensis*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998a).

Viola kauaiensis var. *wahiawaensis* is known only from two occurrences in the Wahiawa Mountains of Kauai with a total of 13 individual plants, on privately owned land. This taxon is not known to have occurred beyond its current range (GDSI 2000; HINHP Database 2000).

Viola kauaiensis var. *wahiawaensis* is found in *Machaerina angustifolia*-*Rhynchospora rugosa* (kuolohia) lowland bog or mixed wet shrubland and adjacent *Metrosideros polymorpha* wet forest at elevations between 393 and 1,006 m (1,291 and 3,301 ft). Associated native plant species include *Antidesma platyphyllum* var. *hillebrandii*, *Bidens forbesii* (kookoolau), *Chamaesyce remyi* (akoko), *Chamaesyce sparsiflora* (akoko), *Coprosma* spp., *Cyanea fissa*, *Dicranopteris linearis*, *Diplopterygium pinnatum* (uluhe lau nui), *Dubautia imbricata* (naenae), *Dubautia raillardoides*, *Gahnia vitiensis* (NCN), *Leptechophylla tameiameiae*, *Lobelia kauaiensis* (NCN), *Machaerina angustifolia*, *Machaerina mariscoides*, *Melicope* spp., *Psychotria wawrae*, *Sadleria pallida*, *Scaevola gaudichaudii*, *Sphenomeris chinensis*, *Syzygium sandwicensis*, *Tetraplasandra oahuensis*, or *Vaccinium dentatum* (HINHP Database 2000; Lorence and Flynn 1991; Service 1998a; 61 FR 53070; K. Wood, pers. comm., 2001).

The primary threats to *Viola kauaiensis* var. *wahiawaensis* are a risk of extinction from naturally occurring events, such as landslides or hurricanes, and reduced reproductive vigor due to the small number of existing populations and individuals; habitat degradation through the rooting activities of feral pigs; and competition with nonnative plants, such as *Juncus planifolius* (NCN) or *Pterolepis glomerata* (NCN) (HINHP Database 2000; Lorence and Flynn 1991; Service 1994; 61 FR 53070).

Wilkesia hobdyi (dwarf iliau)

Wilkesia hobdyi, a member of an endemic Hawaiian genus in the aster family (Asteraceae), is a short-lived perennial shrub which branches from the base. The tip of each branch bears a tuft of narrow leaves growing in whorls joined together into a short sheathing section at their bases. The cream-colored flower heads grow in clusters. It is distinguished from the other species of *Wilkesia* by having shorter branched stems and fewer shorter leaves per whorl (Carr 1982a, 1999b).

This species is probably pollinated through outcrossing and is probably self-incompatible. Insects are the most likely pollinators. In 1982, Carr reported

that reproduction and seedling establishment were occurring and appeared sufficient to sustain the populations. Flowering has been observed most often in the winter months, but also during June. Fruits may be dispersed when they stick to the feathers of birds. Densities reach one plant per sq m (approximately one sq yard) in localized areas, and hybridization with *Wilkesia gymnoxiphium* may be occurring (Carr 1982a).

First collected in 1968 on Polihale Ridge, Kauai, this species was not formally described until 1971 (St. John 1971). Currently, there are nine occurrences with a total of 406 to 471 individuals. This species occurs on State-owned lands within the Hono o Na Pali NAR, Na Pali Coast State Park, and Puu Ka Pele Forest Reserve and on land under Federal jurisdiction within the Pacific Missile Range Facility (PMRF) at Makaha Ridge. The plants occur in Milolii Valley, Makaha Ridge, Haelele Ridge, Kaaweiki Ridge, Polihale Spring, Pohakumano, and Pohakuao (GDSI 2000; HINHP Database 2000).

Wilkesia hobdyi grows on coastal dry cliffs or very dry ridges at elevations between 12 and 685 m (40 and 2,246 ft). The associated native plant species include *Artemisia australis*, *Dodonaea viscosa*, *Eragrostis variabilis*, *Hibiscus kokio* ssp. *saint johnianus*, *Lipochaeta connata*, *Lobelia niihauensis*, *Myoporum sandwicense*, *Peperomia blanda* (ala ala wai nui), *Peperomia tetraphylla* (ala ala wai nui), *Peperomia* spp., *Peucedanum sandwicense*, *Psydrax odorata*, *Sida fallax*, *Waltheria indica* (uhaloa), or *Wilkesia gymnoxiphium* (Service 1995; Wagner *et al.* 1999; 57 FR 27859; K. Wood, pers. comm., 2001).

The greatest immediate threats to the survival of this species are habitat disturbance and browsing by feral goats. Although the low number of individuals and their restricted habitat could be considered a potential threat to the survival to the species, the plant appears to have vigorous reproduction and may survive indefinitely if goats were eliminated from its habitat. Fire and extinction through naturally occurring events, such as landslides or hurricanes, could also be threats to the survival of the species (Service 1995; 57 FR 27859).

Xylosma crenatum (NCN)

Xylosma crenatum is a dioecious (plant bears only male or female flowers, and must cross-pollinate with another plant to produce viable seed) long-lived perennial tree in the

flacourtiaceae family (Flacourtiaceae). The tree grows up to 14 m (45 ft) tall and has dark gray bark. More coarsely toothed leaf edges and hairy undersides of the leaves distinguish *X. crenatum* from the other Hawaiian member of this genus (Wagner *et al.* 1999).

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

Historically, *Xylosma crenatum* was known from three occurrences on Kauai: along upper Nualolo Trail and along Mohihi Road between Waiakoali and Mohihi drainages. Currently, this species is extant on State-owned land in Kainamanu, Nualolo Trail, and Mohihi Valley within Kokee State Park, Kuia NAR, and Na Pali-Kona Forest Reserve. There are three occurrences with a total of 16 individual plants (GDSI 2000; HINHP Database 2000; Service 1995; 57 FR 20580).

Xylosma crenatum is known from diverse *Acacia koa*-*Metrosideros polymorpha* montane mesic or wet forest, or *M. polymorpha*-*Dicranopteris linearis* montane wet forest, at elevations between 936 and 1,284 m (3,070 and 4,212 ft). Associated native plant species include *Athyrium sandwicense*, *Cheirodendron* spp., *Claoxylon sandwicense*, *Coprosma* spp., *Cyanea* spp. (haha), *Diplazium sandwicense*, *Dubautia knudsenii*, *Hedyotis* spp., *Ilex anomala*, *Lobelia yuccoides*, *Myrsine* spp., *Nestegis sandwicensis*, *Perrottetia sandwicensis*, *Pleomele aurea*, *Poa sandwicensis*, *Pouteria sandwicensis*, *Psychotria* spp., *Scaevola procera*, *Streblus pendulinus*, *Tetraplasandra* spp., *Touchardia latifolia*, or *Zanthoxylum dipetalum* (HINHP Database 2000; Service 1995; 57 FR 20580; K. Wood, pers. comm., 2001).

The small number of individuals and scattered distribution make this species vulnerable to human or natural environmental disturbance. *Xylosma crenatum* is also threatened by competition from nonnative plants, particularly *Psidium guajava*. In addition, feral pigs may threaten this species (HINHP Database 2000; Service 1995; 57 FR 20580).

Multi-Island Species

Acaena exigua (liliwai)

Acaena exigua is a small perennial rosette herb in the rose family (Rosaceae) with narrow, fern-like, divided leaves. It is distinguished from the other Hawaiian rose family members by its lack of petals and by its urn-

shaped, constricted receptacle (top of flower stem where floral parts are attached) that encloses the carpels (ovule-bearing floral part) (Wagner *et al.* 1999).

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

Historically, *Acaena exigua* was known from Puu Kukui on West Maui and from Mount Waialeale on Kauai. On Kauai, *A. exigua* was last collected between 1869 and 1870, and has not been seen in the wild since (Wagner *et al.* 1999).

Acaena exigua is known only from sites with extensive cloud cover and moderate to strong winds in wet montane shrub bog or bog margins characterized by a thick peat substrate overlying an impervious clay substrate, with hummocks of sedges and grasses, stunted trees, and shrubs and elevations between 666 and 1,598 m (2,185 and 5,244 ft). Associated native plant species include *Deschampsia nubigena* (hair grass), *Dichantherium cynodon* (NCN), *Dichantherium hillebrandianum* (NCN), *Dichantherium isachnoides* (NCN), *Dubautia* spp., *Melicope* spp., *Metrosideros polymorpha*, *Oreobolus furcatus* (NCN), or *Vaccinium* spp. (K. Wood, pers. comm., 2001).

The reason for the disappearance of this species is not known. Although impacts from herbivory and rooting by pigs are assumed and often cited, feral pigs have become established at Waialeale (Kauai) only within the past two decades. The main current threats to *Acaena exigua*, if it exists, are believed to include small population size; human impacts (collecting and site degradation); potentially consumption of vegetative or floral parts of this species by nonnative slugs and/or rats; predation and habitat disturbance by feral pigs; and nonnative plant species, especially *Juncus planifolius* (57 FR 20772).

Achyranthes mutica (NCN)

Achyranthes mutica, a member of the amaranth family (Amaranthaceae) and a short-lived perennial, is a many-branched shrub with egg-shaped leaves and stalkless flowers. This species is distinguished from others in the genus by the shape and size of the sepals and by characteristics of the spike, which is short and congested (Wagner *et al.* 1999).

Historically, *Achyranthes mutica* was known from three collections from opposite ends of the main archipelago:

Kauai and Hawaii. Currently, this species is known only from Hawaii Island, from Kilohana Gulch on private land. It was last observed on Kauai in the 1850s (GDSI 2000; HINHP Database 2000; 61 FR 53108).

Nothing is known of the preferred habitat of or native plant species associated with *Achyranthes mutica* on the island of Kauai.

Nothing is known of the threats to *Achyranthes mutica* on the island of Kauai.

Adenophorus periens (pendent kihi fern)

Adenophorus periens, a member of the grammitis family (Grammitidaceae), 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 (a leaflet) margins, by the pinnae being at right angles to the midrib axis, by the placement of the sori on the pinnae, and 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, 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 known (Linney 1989).

Historically, *Adenophorus periens* was reported from Kauai, Oahu, Lanai, Maui, and the island of Hawaii. Currently, it is known from several locations on Kauai, Molokai, and Hawaii (HINHP Database 2000). On Kauai, there is a total of seven occurrences on private and State-owned lands (Halelea Forest Reserve, Hono o Na Pali NAR, and Kealia Forest Reserve), with approximately 59 individuals, that occur at Pihea, Pali Elele, Waioli Valley, Mount Namahana, Lumahai Valley, Wainiha Valley, and Kapalaoa (GDSI 2000; HINHP Database 2000; 59 FR 56333;).

This epiphytic species usually growing on *Metrosideros polymorpha* trunks, is found in riparian banks of stream systems in well-developed, closed canopy that provides deep shade or high humidity in *M. polymorpha*-

Cibotium glaucum lowland wet forests, open *M. polymorpha* montane wet forest, or *M. polymorpha-Dicranopteris linearis* lowland wet forest at elevations between 107 and 1,593 m (351 and 5,228 ft). Associated native plant species include *Antidesma platyphyllum*, *Athyrium sandwicianum*, *Broussaisia arguta*, *Cheirodendron trigynum*, *Cyanea* spp., *Cyrtandra* spp., *Dicranopteris linearis*, *Freycinetia arborea*, *Hedyotis terminalis*, *Labordia hirtella*, *Machaerina angustifolia*, *Psychotria hexandra*, *Psychotria* spp., *Syzygium sandwicensis*, or *Tetraplasandra oahuensis* (Linney 1989; 59 FR 56333; K. Wood, pers. comm., 2001).

The threats to this species on Kauai include habitat degradation by feral pigs and goats and competition with the nonnative plant *Psidium cattleianum* (HINHP Database 2000; 59 FR 56333).

Alectryon macrococcus var. *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. The underside of the leaf has dense brown hairs, persistent in *A. macrococcus* var. *auwahiensis*, but only on leaves of young *A. macrococcus* var. *macrococcus* plants. 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 2.3 cm (0.9 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 *Alectryon macrococcus*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, and specific environmental requirements are unknown (Service 1997).

Alectryon macrococcus var. *macrococcus* historically and currently occurs on Kauai, Oahu, Molokai and Maui. On Kauai, *A. macrococcus* var. *macrococcus* occurs on State-owned land in the Alakai Wilderness Preserve, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve. A total of 18 occurrences of 159 to 174 individuals is known from Kalalau Valley, Kipalau Valley, Haelele Valley, Waimea Canyon, Hipalau Valley, and Kawaiiki Falls (GDSI 2000; K. Wood, *in litt.* 1999). *Alectryon macrococcus* var. *auwahiensis* is found

only on leeward east Maui (HINHP Database 2000; Medeiros *et al.* 1986).

The habitat of *Alectryon macrococcus* var. *macrococcus* on Kauai is *Diospyros* spp.-*Metrosideros polymorpha* lowland mesic forest, *M. polymorpha* mixed mesic forest, or *Diospyros* spp. mixed mesic forest on dry slopes or in gulches, at elevations between 341 and 954 m (1,120 and 3,129 ft). Associated native plant species include *Acacia koa*, *Alyxia oliviformis*, *Antidesma* spp., *Bobea timonioides*, *Caesalpinia kavaiense* (uhiuhi), *Canavalia* spp. (awikiwiki), *Carex meyenii*, *Carex wahuensis*, *Doodia kunthiana*, *Hibiscus waimeae*, *Kokia kauaiensis*, *Melicope knudsenii* (alani), *Microlepia strigosa*, *Munroidendron racemosum*, *Myrsine lanaiensis*, *Nesoluma polynesicum*, *Nestegis sandwicensis*, *Pisonia* spp., *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria* spp., *Psydrax odorata*, *Pteralyxia kauaiensis*, *Rauvolfia sandwicensis*, *Streblus pendulinus*, *Tetraplasandra* spp., *Xylosma* spp., or *Zanthoxylum* spp. (HINHP Database 2000; 57 FR 20772; K. Wood, pers. comm., 2001).

Alectryon macrococcus var. *macrococcus* on Kauai is threatened by feral goats and pigs; the nonnative plant species *Melinis minutiflora*, *Psidium cattleianum*, or *Schinus terebinthifolius* (Christmasberry); damage from the black twig borer; seed predation by rats and mice; fire; depressed reproductive vigor; seed predation by insects (probably the endemic microlepidopteran *Prays* cf. *fulvocanella*); loss of pollinators; and, due to the small remaining number of individuals and their limited distribution, natural or human-caused environmental disturbances that could easily be catastrophic (57 FR 20772).

Bonamia menziesii (NCN)

Bonamia menziesii, a member of the morning-glory family (Convolvulaceae), 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*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Bonamia menziesii* was known from the following general areas: scattered locations on Kauai, the Waianae Mountains of Oahu, scattered locations on Molokai, one location on

West Maui, and eastern Hawaii.

Currently, it is known from Kauai, Oahu, Lanai, Maui, and Hawaii. On Kauai, there are nine occurrences with 36 individuals on State (Alakai Wilderness Preserve, Hono o Na Pali NAR, Lihue-Koloa Forest Reserve, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve) and privately owned lands in Waiahuakua, Kalalau Valley, Awaawapuhi Valley, Paaiki Valley, Kipalau Valley, Hulua, Wahiwawa Falls, and Laauhihaihai (GDSI 2000; HINHP Database 2000; Service 1999; K. Wood, *in litt.* 1999).

Bonamia menziesii is found in dry, mesic, or wet *Metrosideros polymorpha*-*Cheirodendron-Dicranopteris* forest at elevations between 351 and 1,415 m (1,151 and 4,644 ft). Associated native plant species include *Acacia koa*, *Alphitonia ponderosa*, *Antidesma platyphyllum*, *Cyanea* spp., *Cyrtandra limahuliensis*, *Cyrtandra pickeringii*, *Dianella sandwicensis*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Dubautia knudsenii*, *Hedyotis terminalis*, *Isodendron longifolium*, *Labordia hirtella*, *Melicope anisata*, *Melicope barbiger* (uahiapele), *Myoporum sandwicense*, *Nestegis sandwicensis*, *Pisonia* spp., *Pittosporum* spp., *Pouteria sandwicensis*, *Psychotria hexandra*, *Psychotria mariniana*, *Psydrax odorata*, *Sapindus oahuensis*, *Scaevola procera*, or *Syzygium sandwicensis* (HINHP Database 2000; Service 1999; K. Wood, pers. comm., 2001).

The primary threats to this species on Kauai include habitat degradation and possible predation by feral pigs and goats, deer, and cattle; competition with a variety of nonnative plants; and fire (59 FR 56333).

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. It is possible that heavy rainfall induces flowering. Populations are found in dry areas, and plants are more likely to be found following heavy rains. Little else is known about the life history of *C. sebaeoides*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically and currently, *Centaurium sebaeoides* is known from scattered localities on the islands of Kauai, Oahu, Molokai, Lanai, and Maui. Currently on Kauai, there are a total of three occurrences with approximately 22 to 52 individuals on State-owned land. This species is found at Puanaiea Point, the caves at Nakeikionaiwi, and Pohakuao within the Na Pali Coast State Park (GDSI 2000; HINHP Database 2000).

Centaurium sebaeoides typically grows in volcanic or clay soils or on cliffs in arid coastal areas at elevations between 0 and 147 m (0 and 483 ft). Associated native plant species include *Artemisia* spp. (hinahina), *Bidens* spp., *Chamaesyce celastroides*, *Cyperus phleoides*, *Dodonaea viscosa*, *Fimbristylis cymosa* (mauu akiaki), *Heteropogon contortus*, *Jacquemontia ovalifolia* (pauohiika), *Lipochaeta* spp., *Lycium sandwicense*, *Lysimachia mauritiana* (kolokolo kuahiwi), *Melanthera integrifolia* (nehe), *Panicum fauriei* (NCN), *P. torridum* (kakonakona), *Scaevola sericea*, *Sida fallax*, or *Wikstroemia uva-ursi* (akia) (56 FR 55770; K. Wood, pers. comm., 2001).

The major threats to this species on Kauai include habitat degradation by feral goats and cattle; competition from the nonnative plant species *Casuarina equisetifolia* (ironwood), *Casuarina glauca* (saltmarsh), *Leucaena leucocephala*, *Prosopis pallida* (kiawe), *Schinus terebinthifolius*, *Syzygium cumini* (Java plum), and *Tournefortia argentea* (tree heliotrope); trampling by humans on or near trails; and fire (Medeiros *et al.* 1999; Service 1999; 56 FR 55770).

Ctenitis squamigera (pauoa)

Ctenitis squamigera is a short-lived perennial fern of the spleenwort family (Aspleniaceae). *Ctenitis squamigera* 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 is known about the life history of *Ctenitis squamigera*. Its reproduction cycles, dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998c).

Historically, *Ctenitis squamigera* was recorded from the islands of Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii. It is currently found on Oahu, Lanai, Molokai, and Maui. It was last seen on Kauai in 1896 (HINHP Database 2000).

This species is found on rock faces in gulches in the forest understory at

elevations between 538 and 1,069 m (1,765 and 3,507 ft), in *Metrosideros polymorpha-Diospyros* spp. mesic forest and diverse mesic forest. Associated native plant species include *Myrsine* spp., *Psychotria* spp., and *Xylosma* spp. (HINHP Database 2000; Service 1998a; K. Wood, pers. comm., 2001).

The primary threats to *Ctenitis squamigera* are habitat degradation by feral pigs and goats, competition with nonnative plant species, especially *Psidium cattleianum* or *Schinus terebinthifolius*; fire; and extinction from naturally occurring events due to the small number of existing populations and individuals (Service 1998a).

Cyperus trachysanthos (puukaa)

Cyperus trachysanthos, a member of the sedge family (Cyperaceae), is a perennial grass-like plant with a short rhizome. The culms 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 (bract below each flower), and the length of the culms (Koyama 1999).

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

Historically, *Cyperus trachysanthos* was known on Niihau, Kauai, and scattered locations on Oahu, Molokai, and Lanai. It was last observed on Molokai in 1912 and on Lanai in 1919. Currently, this species is reported from Nualolo Valley on Kauai on State-owned land and west of Mokouia Valley on the privately owned island of Niihau. There is one known occurrence with about 300 individuals on the island of Kauai and an unknown number of individuals on Niihau (GDSI 2000; HINHP Database 2000).

Cyperus trachysanthos is usually found in wet sites (mud flats, wet clay soil, or wet cliff seeps) on seepy flats or talus slopes at elevations between 0 and 235 m (0 and 771 ft). *Talipariti tiliaceum* (hau) is often found in association with this species (Koyama 1999; 61 FR 53108; K. Wood, pers. comm., 2001).

On Kauai, the threats to this species are the loss of wetlands and a risk of extinction from naturally occurring events, such as landslides or hurricanes, due to the small number of populations. The threats on Niihau are unknown (Service 1999; 61 FR 53108).

Delissea undulata (NCN)

Delissea undulata, a member of the bellflower family (Campanulaceae), is an unbranched, palm-like, woody-stemmed perennial tree, with a dense cluster of leaves at the tip of the stem. One or two knob-like structures often occur on the back of the flower tube. The three recognized subspecies are distinguishable on the basis of leaf shape and margin characters: in *D. undulata* ssp. *kauaiensis*, the leaf blades are oval and have a flat margin with sharp teeth; in *D. undulata* ssp. *niihauensis*, the leaf blades are heart-shaped and have a flat margin with shallow, rounded teeth; and in *D. undulata* ssp. *undulata*, the leaf blades are elliptic to lance-shaped and have a wavy margin with small, sharply pointed teeth. This species is separated from the other closely related members of the genus by its large flowers and berries and broad leaf bases (Lammers 1990).

On the island of Hawaii, *Delissea undulata* ssp. *undulata* has been observed in flower and fruit (immature) in August and outplanted individuals have been observed in flower in July. Little else is known about the life history of *Delissea undulata*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1996; 61 FR 53124).

Historically and currently, *Delissea undulata* ssp. *kauaiensis* is known only from Kauai. Currently, there is one known occurrence of three individuals on State-owned land in Kuia Valley within the Kuia NAR. *Delissea undulata* ssp. *niihauensis* was known only from Niihau, but has not been seen since 1865. *Delissea undulata* ssp. *undulata* was known from southwestern Maui and western Hawaii. Currently, this variety occurs only on the island of Hawaii (GDSI 2000; HINHP Database 2000; Lammers 1999; 61 FR 53124; K. Wood, *in litt.* 1999).

Delissea undulata ssp. *kauaiensis* occurs in dry or open *Acacia koa*-*Metrosideros polymorpha* mesic forests or *Alphitonia ponderosa* montane forest at elevations between 139 and 1,006 m (456 and 3,299 ft). Associated native species include *Diospyros sandwicensis*, *Dodonaea viscosa*, *Doodia kunthiana*, *Eragrostis variabilis*, *Euphorbia haeleeleana*, *Kokia kauaiensis*, *Microlepia strigosa*, *Panicum* spp., *Pleomele aurea*, *Psychotria greenwelliae*, *Psychotria mariniana*, and *Santalum freycinetianum* (K. Wood, pers. comm., 2001).

The threats to this subspecies on Kauai are feral goats, pigs, and cattle; small population size; competition with the nonnative plants *Delairea odorata* (German ivy) and *Passiflora tarminiana*; fire; introduced slugs; seed predation by rats and introduced game birds; and a risk of extinction due to random naturally occurring events, such as landslides or hurricanes (Service 1996).

Diellia erecta (asplenium-leaved diellia)

Diellia erecta, a short-lived perennial fern in the spleenwort family (Aspleniaceae), grows in tufts of three to nine lance-shaped fronds emerging from a rhizome covered with brown to dark gray scales. This species differs from other members of the genus in having large 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*. Its reproduction cycles, dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Diellia erecta* was known on Kauai, Oahu, Molokai, Lanai, scattered locations on Maui, and various locations on the island of Hawaii. Currently, it is known from Molokai, Maui, and Hawaii and has recently been rediscovered on Kauai. On Kauai there is one known occurrence with 30 individuals in Kawaiiki Valley on State-owned land within the Na Pali-Kona Forest Reserve (Service 1999; HINHP Database 2000).

This species is found in brown granular soil with leaf litter and occasional terrestrial moss on north-facing slopes in deep shade on steep slopes or gulch bottoms in *Metrosideros polymorpha-Dicranopteris linearis* wet forest or *M. polymorpha* mixed mesic forest with *Acacia koa* and *Acacia koaia* as co-dominants, at elevations between 655 and 1,224 m (2,149 and 4,016 ft). Associated native plant species include *Asplenium aethiopicum* (NCN), *Asplenium contiguum* (NCN), *Asplenium macraei* (NCN), *Coprosma* spp., *Dodonaea viscosa*, *Dryopteris fusco-atra* (ii), *Dryopteris unidentata*, *Hedyotis terminalis*, *Leptecophylla tameiameia*, *Melicope* spp., *Microlepia strigosa*, *Myrsine* spp., *Nestegis sandwicensis*, *Psychotria* spp., *Syzygium sandwicensis*, or *Wikstroemia* spp. (HINHP Database 2000; Service 1999; K. Wood, pers. comm., 2001).

The major threats to *Diellia erecta* on Kauai are habitat degradation by pigs and goats; competition with nonnative

plant species, including *Blechnum occidentale*, *Cyperus meyenianus* (NCN), *Grevillea robusta* (silk oak), *Lantana camara*, *Morrellia faya*, *Passiflora tarminiana*, *Rubus argutus*, or *Setaria palmifolia* (palm grass); and random naturally occurring events that could cause extinction and/or reduced reproductive vigor due to the small number of existing individuals (Service 1996; 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).

Little is known about the life history of *Diplazium molokaiense*. Its reproductive cycles, dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998c).

Historically, *Diplazium molokaiense* was found on Kauai, Oahu, Molokai, Lanai, and Maui. Currently, this species is only known from Maui. It was last seen on Kauai in 1909 (HINHP Database 2000).

This species occurs in brown soil with basalt outcrops near waterfalls in lowland or montane mesic *Metrosideros polymorpha*-*Acacia koa* forest at elevations between 476 and 1,284 m (1,562 and 4,212 ft) (HINHP Database 2000; Service 1998a; K. Wood, pers. comm., 2001).

The primary threats on Kauai are habitat degradation by feral goats and pigs and competition with nonnative plant species (HINHP Database 2000; Service 1998a; 59 FR 49025).

Euphorbia haeleleana (akoko)

Euphorbia haeleleana, a member of the spurge family (Euphorbiaceae), is a dioecious tree with alternate papery leaves. This short-lived perennial 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 haeleleana* bear only male or female flowers, and must be cross-pollinated from a different tree to produce viable seed. *Euphorbia haeleleana* sets fruit between August and October. Little else is known about the life history of this species. Reproductive cycles, longevity,

specific environmental requirements, and limiting factors are unknown (Service 1999; Wagner *et al.* 1999).

Euphorbia haeleleana is known historically and currently from northwestern Kauai and the Waianae Mountains of Oahu. On Kauai, there is a total of 23 occurrences with 597 individuals occurring on State-owned land. It is found at Pohakuao, Kalalau Valley, Hipalau Valley, Koaie Canyon, Mahanaloa Valley, Kuia Valley, Poopooiki Valley, Nualolo Trail, Makaha Valley, and Haelele Valley within the Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve (HINHP Database 2000; Service 1999; 61 FR 53108; K. Wood, *in litt.* 1999;).

Euphorbia haeleleana is usually found in lowland mixed mesic or dry *Diospyros* forest that is often codominated by *Metrosideros polymorpha* and *Alphitonia ponderosa*. This plant is typically found at elevations between 284 and 1,178 m (931 and 3,866 ft). Associated native plant species include *Acacia koa*, *Antidesma platyphyllum*, *Carex meyenii*, *Carex wahuensis*, *Claoxylon sandwicense*, *Diplazium sandwichianum*, *Dodonaea viscosa*, *Erythrina sandwicensis*, *Kokia kauaiensis*, *Pisonia sandwicensis*, *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria greenwelliae*, *Psychotria mariniana*, *Pteralyxia kauaiensis*, *Rauvolfia sandwicensis*, *Sapindus oahuensis*, *Tetraplasandra kavaiensis*, or *Xylosma* spp. (61 FR 53108; K. Wood, pers. comm., 2001).

Threats to this species on Kauai include habitat degradation and destruction by deer, feral goats, and pigs; seed predation by rats; fire; and competition with nonnative plants (Service 1999; 61 FR 53108).

Flueggea neowawraea (mehamehame)

Flueggea neowawraea, a member of the spurge family (Euphorbiaceae), is a large dioecious tree with white oblong pores covering its scaly, pale brown bark. This long-lived perennial 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; Linney 1982; Neal 1965; 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 the life history of this species. Reproductive cycles, longevity, specific environmental requirements, and

limiting factors are unknown (Hayden 1999).

Historically, *Flueggea neowawraea* was known from Kauai, Oahu, Maui, Molokai, and the island of Hawaii. Currently, it is known from Kauai, Oahu, east Maui, and Hawaii. On Kauai, this species is reported from Limahuli Valley, Pohakuao, the left branch of Kalalau Valley, Kuia and Paaiki Valleys, Kipalau Valley, Koaie Falls, Kawaiiki Valley, and Waimea Canyon. There are 10 occurrences with 62 known individuals occurring on State (Alakai Wilderness Preserve, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve) and privately owned lands. However, it has been estimated that the total number of individuals may be slightly over 100 (GDSI 2000; HINHP Database 2000; Hayden 1999; Service 1999; K. Wood, *in litt.* 1999).

Flueggea neowawraea occurs in dry or mesic forests at elevations between 210 and 1,178 m (689 and 3,865 ft). Associated native plant species include *Alectryon macrococcus*, *Antidesma platyphyllum*, *Bidens sandwicensis*, *Bohea timonioides*, *Caesalpinia kavaiensis*, *Charpentiera* spp., *Diospyros* spp., *Diplazium sandwichianum*, *Freycinetia arborea*, *Hibiscus* spp., *Isodendron laurifolium*, *Kokia kauaiensis*, *Melicope* spp., *Metrosideros polymorpha*, *Munroidendron racemosum*, *Myrsine lanaiensis*, *Nesoluma polynesianum*, *Nestegis sandwicensis*, *Tetraplasandra* spp., *Pittosporum* spp., *Pouteria sandwicensis*, *Pritchardia minor*, *Psychotria* spp., *Psydrax odorata*, *Pteralyxia kauaiensis*, *Rauvolfia sandwicensis*, *Streblus pendulinus*, *Xylosma crenatum*, or *Xylosma hawaiiense* (HINHP Database 2000; Service 1999; 59 FR 56333; K. Wood, pers. comm., 2001).

The threats to this species on Kauai include the black twig borer; habitat degradation by feral pigs, goats, deer, and cattle; competition with nonnative plant species; fire; small population size; depressed reproductive vigor; and a potential threat of fruit predation by rats (HINHP Database 2000; Service 1999; 59 FR 56333).

Gouania meyenii (NCN)

Gouania meyenii, a member of the buckthorn family (Rhamnaceae), is a shrub with papery leaves with smooth margins. This short-lived perennial species is distinguished from the two other Hawaiian species of *Gouania* by its lack of tendrils on the flowering branches, the absence of teeth on the leaves, and the lack or small amount of hair on the fruit (Wagner *et al.* 1999).

Gouania meyenii flowers from March to May. Seed capsules develop in about 6 to 8 weeks. Plants appear to live about 10 to 18 years in the wild. Little else is known about the life history of *Gouania meyenii*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998b).

Historically, *Gouania meyenii* was known only from Oahu. It was discovered on Kauai in 1993. Currently, this species is found on Oahu and on Kauai on State-owned land within the Na Pali Coast State Park and the Na Pali-Kona Forest Reserve. There is a total of three occurrences on Kauai with nine individuals found in Kalalau and Hipalau valleys (GDSI 2000; HINHP Database 2000; Wagner *et al.* 1999; 56 FR 55770).

This species typically grows on rocky ledges, cliff faces, and ridge tops in dry shrubland or *Metrosideros polymorpha* lowland diverse mesic forest at elevations between 375 and 1,179 m (1,231 and 3,867 ft). Associated native plant species include *Bidens* spp., *Carex meyenii*, *Chamaesyce* spp., *Diospyros* spp., *Dodonaea viscosa*, *Eragrostis variabilis*, *Euphorbia haelealeana*, *Hedyotis* spp., *Hibiscadelphus* spp., *Lysimachia* spp., *Melicope pallida*, *Neraudia kauaiensis*, *Nestegis sandwicensis*, *Nototrichium divaricatum*, *Panicum lineale*, *Poa mannii*, *Psychotria* spp., *Senna gaudichaudii* (kolomona), or *Wilkesia gymnoxiphium* (HINHP Database 2000; 56 FR 55770; K. Wood, pers. comm., 2001).

Threats to *Gouania meyenii* on Kauai include competition from the nonnative plants *Melinis minutiflora*, *Psidium cattleianum*, or *Schinus terebinthifolius*; fire; habitat degradation by feral pigs and goats; and the small number of extant populations and individuals (Service 1998b; 56 FR 55770).

Hedyotis cookiana (awiwi)

Hedyotis cookiana, a member of the coffee family (Rubiaceae), is a small shrub with many branches and papery-textured leaves which are fused at the base to form a sheath around the stem. This short-lived perennial species is distinguished from other species in the genus that grow on Kauai by being entirely hairless (Wagner *et al.* 1999).

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

Historically, *Hedyotis cookiana* was known from the islands of Hawaii, Kauai, Molokai, and Oahu. Currently, it is only known from one occurrence of 60 to 80 individuals on State-owned land within Hono O Na Pali NAR in Waiahuakua Valley on Kauai (GDSI 2000; HINHP Database 2000).

This species generally grows in streambeds or on steep cliffs close to water sources in relict *Metrosideros polymorpha* lowland mesic and lowland wet forest communities at elevations between 119 and 553 m (392 and 1,814 ft). Associated native plant species include *Boehmeria grandis*, *Chamaesyce celastroides* var. *hanapepensis*, *Hibiscus kokio* ssp. *saintjohnianus*, *Machaerina angustifolia*, *Nototrichium sandwicense*, *Pipturus kauaiensis* (mamaki), *Pleomele aurea*, *Pouteria sandwicensis*, *Psydrax odorata*, or *Rauvolfia sandwicensis* (Wagner *et al.* 1999; K. Wood, pers. comm., 2001).

The threats to this species on Kauai are risk of extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of individuals in the only known population; flooding; competition with nonnative plants; and habitat modification by feral pigs and goats (HINHP Database 2000; Service 1995; 59 FR 9304).

Hibiscus brackenridgei (mao hau hele)

Hibiscus brackenridgei, a short-lived perennial and a 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. Two subspecies are currently recognized, *Hibiscus brackenridgei* ssp. *brackenridgei* and *H. brackenridgei* ssp. *mokuleianus* (Bates 1990).

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 tied to day length. Little else is known about the life history of this plant. Pollination biology, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Hibiscus brackenridgei* was known from the islands of Kauai, Oahu, Lanai, Maui, Molokai, Hawaii, and possibly Kahoolawe. Currently, *Hibiscus brackenridgei* ssp.

mokuleianus is only known from Oahu. *Hibiscus brackenridgei* ssp. *brackenridgei* is currently known from Lanai, Maui, and the island of Hawaii (Bates 1990; HINHP Database 2000; Service 1999).

Nothing is known of the preferred habitat of or native plant species associated with *Hibiscus brackenridgei* on the island of Kauai.

Nothing is known of the threats to *Hibiscus brackenridgei* on the island of Kauai.

Ischaemum byrone (Hilo ischaemum)

Ischaemum byrone, a short-lived perennial member of the grass family (Poaceae), has creeping underground and erect stems. *Ischaemum byrone* can be distinguished from other Hawaiian grasses by its tough outer flower bracts, dissimilar basic flower units, which are awned and two-flowered, and a two-or three-tiered inflorescence (O'Connor 1999).

Additional information on the life history of this plant, its reproductive cycles, longevity, specific environmental requirements, and limiting factors is generally unknown (Service 1996).

Historically, *Ischaemum byrone* was reported from Oahu, Molokai, East Maui, Kauai and the island of Hawaii. Currently, this species is found on Molokai, Hawaii, Maui, and recently rediscovered on the north shore of Kauai. On Kauai, there are two occurrences with at least two individuals at Kaweonui Point and Kauapea Beach on privately owned land (HINHP Database 2000; 59 FR 10305).

The habitat of *Ischaemum byrone* is coastal shrubland, near the ocean among rocks and seepy cliffs at elevations between 0 and 297 m (0 and 975 ft). Associated native plant species include *Bidens* spp., *Chamaesyce celastroides*, *Fimbristylis cymosa*, *Lipochaeta succulenta*, *Lysimachia mauritiana*, or *Scaevola sericea* (HINHP Database 2000; K. Wood, pers. comm., 2001).

Threats to *Ischaemum byrone* include the invasion of nonnative plants, fire, grazing and browsing by feral goats and pigs. Disturbance incurred from these ungulates further promotes the introduction and establishment of nonnative weeds. Some populations are also threatened from residential development (HINHP Database 2000; Service 1996; 59 FR 10305).

Isodendron laurifolium (aupaka)

Isodendron laurifolium, a member of the violet family (Violaceae), is a slender, erect shrub with few branches. The short-lived perennial species is distinguished from others in the genus

by its leathery, oblong-elliptic or narrowly elliptic, lance-shaped leaves (Wagner *et al.* 1999).

Little is known about the life history of *Isodendron laurifolium*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Isodendron laurifolium* is known from scattered locations on Kauai and Oahu. Currently, on Kauai, this species is found on State-owned land within the Alakai Wilderness Preserve, Kuia NAR, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve in the following locations: Paaiki, Poopooiki, Kawaiula Valley, Mahanaloa Valley, Makaha Valley, Haeleele Valley, Kipalau Valley, Kawaiiki Valley and Kaluahaulu Ridge. There are a total of 13 occurrences with 142 to 154 individuals (GDSI 2000; HINHP Database 2000; Service 1999).

Isodendron laurifolium is usually found at elevations between 376 and 1,163 m (1,233 and 3,817 ft) in diverse mesic forest dominated by *Metrosideros polymorpha*, *Acacia koa* or *Diospyros* spp. Associated native species include *Alphitonia ponderosa*, *Antidesma* spp., *Claoxylon sandwicense*, *Dodonaea viscosa*, *Dubautia* spp., *Elaeocarpus bifidus*, *Euphorbia haeleeleana*, *Hedyotis terminalis*, *Kokia kauaiensis*, *Melicope anisata*, *Melicope barbiger*, *Melicope ovata* (alani), *Melicope peduncularis*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Pisonia* spp., *Pittosporum glabrum* (hoawa), *Pleomele aurea*, *Pouteria sandwicensis*, *Psychrax odorata*, *Streblus pendulinus*, or *Xylosma hawaiiense* (HINHP Database 2000; K. Wood, pers. comm., 2001).

The primary threats to *Isodendron laurifolium* on Kauai are habitat degradation by feral goats, pigs and deer and competition with nonnative plants (HINHP Database 2000; Service 1999; 61 FR 53108).

Isodendron longifolium (aupaka)

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

Little is known about the life history of *Isodendron longifolium*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically and currently, *Isodendron longifolium* is known from scattered locations on Kauai and Oahu.

On Kauai, this species is reported from Limahuli Valley, Hanakapiai, Pohakea, Waioli Valley, the left branch of Kalalau Valley, Honopu Valley, Kawaiula Valley, and Haupu. There is a total of 15 occurrences on Kauai containing approximately 804 to 854 individual plants on State (Halelea Forest Reserve, Hono o Na Pali NAR, Kokee State Park, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve) and privately owned lands (GDSI 2000; HINHP Database 2000; Lorence and Flynn 1991, 1993; Service 1999; 61 FR 53108).

Isodendron longifolium is found on steep slopes, gulches, or streambanks and some flats in certain undisturbed areas in mesic or wet *Metrosideros polymorpha*-*Acacia koa* forests, usually at elevations between 38 and 1,541 m (125 and 5,057 ft). Associated native plant species include *Antidesma* spp., *Bidens* spp., *Bobea brevipes*, *Cheirodendron* spp., *Cibotium* spp., *Cyanea hardyi*, *Cyrtandra* spp., *Dicranopteris linearis*, *Diospyros* spp., *Eugenia reinwardtiana*, *Hedyotis* spp., *Ilex anomala*, *Melicope* spp., *Nestegis sandwicensis*, *Peperomia* spp., *Perrottetia sandwicensis*, *Pipturus* spp., *Pittosporum* spp., *Pritchardia* spp., *Psychotria* spp., *Psychrax odorata*, or *Syzygium sandwicensis* (HINHP Database 2000; Service 1999; 61 FR 53108; K. Wood, pers. comm., 2001).

The major threats to *Isodendron longifolium* on Kauai are habitat degradation or destruction by feral goats and pigs, and competition with various nonnative plants (HINHP Database 2000; Lorence and Flynn 1993; Service 1999; 61 FR 53108).

Isodendron pyrifolium (wahine noho kula)

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

During periods of drought, this species drops all but the newest leaves. After sufficient rain, the plants produce flowers with seeds ripening one to two months later. No other life history information is currently known for this species (Service 1996).

Isodendron pyrifolium is known historically from Niihau, Oahu, Molokai, Lanai, Maui, and Hawaii. It is currently found only on the island of Hawaii. It was last seen on Niihau in the 1850s (GDSI 2000; HINHP Database 2000; Service 1996; 59 FR 10305; Marie Bruegmann, U.S. Fish and Wildlife Service, pers. comm., 2000).

Information on the physical and biological features that are essential to the conservation of *Isodendron pyrifolium* on the island of Niihau is not known.

Information on the threats of *Isodendron pyrifolium* on the island of Niihau is not known.

Lobelia niihauensis (NCN)

Lobelia niihauensis, a member of the bellflower family (Campanulaceae), is a small, branched shrub. This short-lived perennial species is distinguished from others in the genus by lacking or nearly lacking leaf stalks, the width of the leaf, and length of the magenta-colored flowers (Lammers 1999).

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 the life history of *Lobelia niihauensis*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998b).

Historically, *Lobelia niihauensis* was known from Oahu, Niihau, and Kauai. It is now known to be extant only on Kauai and Oahu. On Kauai, 13 occurrences containing 284 to 2,134 individuals are found on State (Hono o Na Pali NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve) and privately owned lands in Limahuli Valley, Hoolulu Valley, Hanakoa Valley, Pohakua, the left and right branches of Kalalau Valley, Koaie Canyon, Kipalau Valley, Polihale Spring, Kaaweiki Valley, and Keopaweo (GDSI 2000; HINHP Database 2000; Service 1998b).

Lobelia niihauensis typically grows on exposed, mesic mixed shrubland or coastal dry cliffs at elevations between 11 and 887 m (37 and 2,911 ft). Associated native plant species include *Artemisia australis*, *Bidens sandwicensis*, *Chamaesyce celastroides*, *Charpentiera* spp., *Eragrostis variabilis*, *Hibiscus kokio* ssp. *saint-johnianus*, *Lipochaeta connata* var. *acris*, *Lythrum* spp. (pukamole), *Nototrichium* spp., *Plectranthus parviflorus*, *Schiedea apokremnos*, or *Wilkesia hobdyi* (HINHP Database 2000; Lammers 1999; Service 1998b; K. Wood, pers. comm., 2001).

On Kauai, the major threats to this species are habitat degradation and browsing by feral goats and competition from nonnative plants (56 FR 55770).

Lysimachia filifolia (NCN)

Lysimachia filifolia, a member of the primrose family (Primulaceae), is a

small shrub. This short-lived perennial species is distinguished from other species of the genus by its leaf shape and width, calyx lobe shape, and corolla length (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 1995).

Historically, *Lysimachia filifolia* was known only from the upper portion of Olokele Valley on Kauai. This species is now also known from Oahu, and the "Blue Hole" area of Waialeale, Kauai. There is currently one occurrence containing a total of 20 to 75 individuals on State-owned land on Kauai within the Lihue-Koloa Forest Reserve (GDSI 2000; HINHP Database 2000; Service 1995).

This species 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 between 177 and 1,308 m (581 and 4,290 ft). Associated native plant species include *Antidesma platyphyllum*, *Bidens valida* (kookoolau), *Bobea elatior* (ahakea lau nui), *Chamaesyce remyi* var *kauaiensis* (akoko), *Cyanea asarifolia*, *Dubautia plantaginea* ssp. *magnifolia* (naenae), *Eragrostis variabilis*, *Machaerina angustifolia*, *Melicope* spp., *Metrosideros polymorpha*, or *Panicum lineale* (HINHP Database 2000; Service 1995; Wagner *et al.* 1999; 59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to *Lysimachia filifolia* on Kauai include competition with nonnative plant species; habitat degradation by feral pigs; and the risk of extinction on Kauai from naturally occurring events (e.g., landslides and hurricanes), due to the small number of individuals in the only known population (HINHP Database 2000; 59 FR 9304).

Mariscus pennatiformis (NCN)

Mariscus pennatiformis, a short-lived member of the sedge family (Cyperaceae), is a perennial plant with a woody root system covered with brown scales. *Mariscus pennatiformis* is divided into two subspecies, ssp. *bryanii* and ssp. *pennatiformis*, which are distinguished by the length and width of the spikelets; color, length, and width of the glume; and by the shape and length of the fruit. 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 (Koyama 1990).

Mariscus pennatiformis is known to flower from November to December after heavy rainfall. Additional information on the life history of this plant, reproductive cycles, longevity, specific environmental requirements, and limiting factors is generally unknown (Service 1999).

Historically, *Mariscus pennatiformis* was known from Kauai, Oahu, East Maui, the island of Hawaii, and from Laysan Island in the Northwestern Hawaiian Islands). *Mariscus pennatiformis* ssp. *bryanii* is only known from Laysan Island. *Mariscus pennatiformis* ssp. *pennatiformis* is currently found only on East Maui. It was last seen on Kauai in 1927 (GDSI 2000; HINHP Database 2000; K. Wood, *in litt.* 1999;).

Mariscus pennatiformis is found at elevations between 544 and 1,104 m (1,785 and 3,621 ft) in open sites in *Metrosideros polymorpha*-*Acacia koa* mixed mesic forest. Associated native plant species include *Alsinidendron viscosum*, *Antidesma platyphyllum* var. *hillebrandii*, *Carex alligata* (NCN), *Cyperus laevigatus* (makalao), *Dianella sandwicensis*, *Diospyros hillebrandii*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Leptecophylla tameiameia*, *Myrsine linearifolia*, *Nestegis sandwicensis*, *Panicum nephelophilum*, *Poa sandwicensis*, *Psydrax odorata*, *Schiedea stellarioides*, or endemic ferns (HINHP Database 2000; Koyama 1990; K. Wood, pers. comm., 2001).

Threats to *Mariscus pennatiformis* on Kauai include grazing and habitat destruction caused by ungulates; competition from nonnative plant species; and extinction from random naturally occurring events (e.g., landslides or hurricanes) (Service 1999; 59 FR 56333).

Melicope knudsenii (alani)

Melicope knudsenii, a member of the rue family (Rutaceae), is a tree with smooth gray bark and yellowish brown to olive-brown hairs on the tips of the branches. This long-lived perennial species is distinguished from *M. haupuensis* and other members of the genus by the distinct carpels present in the fruit, a hairless endocarp, a larger number of flowers per cluster, and the distribution of hairs on the underside of the leaves (Stone *et al.* 1999).

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

Historically and currently, *Melicope knudsenii* is known from Maui and

Kauai. On Kauai, this species is known from 10 occurrences on State-owned land, with a total of 10 individuals, in Poopooiki Valley, Kuia Valley, Mahanaloa Valley, Makaha Ridge, Koaie Canyon, Koaie Falls, and Kawaiiki Valley within Kuia NAR and Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000; Service 1995; 59 FR 9304; K. Wood, pers. comm., 2001).

Melicope knudsenii grows on forested flats with brown granular soil in lowland dry to montane mesic forests at elevations between 111 and 1,141 m (364 and 3,745 ft) with *Alectryon macrococcus*, *Antidesma platyphylla*, *Bobea brevipes*, *Carex meyenii*, *Cryptocarya mannii*, *Diospyros sandwicensis*, *Diplazium sandwichianum*, *Dodonaea viscosa*, *Euphorbia haeleeleana*, *Gahnia becheyi* (NCN), *Hedyotis* spp., *Hibiscus waimeae*, *Isodendron laurifolium*, *Leptecophylla tameiameia*, *Melicope* spp., *Metrosideros polymorpha*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Panicum nephelophilum*, *Peucedanum sandwicense*, *Pisonia sandwicensis*, *Pittosporum kauaiensis*, *Pleomele aurea*, *Pouteria sandwicensis*, *Pritchardia minor*, *Psychotria hobdyi*, *Psydrax odorata*, *Rauvolfia sandwicensis*, *Remya kauaiensis*, *Scaevola procera*, or *Xylosma hawaiiense* (HINHP Database 2000; Service 1995; K. Wood, pers. comm., 2001).

The major threats to *Melicope knudsenii* on Kauai include competition with the nonnative plant *Lantana camara*; habitat degradation by feral goats and pigs; fire; black twig borer; and the risk of extinction on Kauai from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of existing individuals and populations (Service 1995; 59 FR 9304).

Melicope pallida (alani)

Melicope pallida, a member of the rue family (Rutaceae), is a tree with grayish white hairs and black, resinous new growth. The long-lived perennial species differs from *M. haupuensis*, *M. knudsenii*, and other members of the genus by the presence of resinous new growth, leaves folded 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 1995).

Historically and currently, *Melicope pallida* is known from Oahu and Kauai. On Kauai, the species is currently known from the following locations: Pohakuao, the left branch of Kalalau Valley, Honopu Trail, Awaawapuhi Valley, and Koaie Canyon. There is a total of six occurrences with 181 individuals on State-owned land within the Alakai Wilderness Preserve, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000; D.W. Mathias, U.S. Navy (Navy), *in litt.* 1999; K. Wood, *in litt.* 1999).

Melicope pallida usually grows on steep rock faces in lowland to montane mesic to wet forests or shrubland at elevations between 359 and 1,081 m (1,179 and 3,546 ft). Associated native plant species include *Alyxia oliviformis*, *Artemisia australis*, *Boehmeria grandis*, *Carex meyenii*, *Chamaesyce celastroides* var. *hanapepensis*, *Coprosma kauensis* (koi), *Coprosma waimeae*, *Dodonaea viscosa*, *Dryopteris* spp., *Hedyotis terminalis*, *Lepidium serra*, *Melicope* spp., *Metrosideros polymorpha*, *Nototrichium* spp., *Pipturus albidus* (mamaki), *Pleomele aurea*, *Poa mannii*, *Pritchardia minor*, *Psychotria mariniana*, *Sapindus oahuensis*, *Schiedea membranacea*, *Tetraplasandra waialealae*, or *Xylosma hawaiiense* (HINHP Database 2000; K. Wood, pers. comm., 2001).

The major threats to *Melicope pallida* are habitat destruction by feral goats and pigs; the black twig borer; fire; susceptibility to extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of existing populations; and competition with nonnative plant species (Hara and Beardsley 1979; HINHP Database 2000; Medeiros *et al.* 1986; Service 1995; 59 FR 9304).

Peucedanum sandwicense (makou)

Peucedanum sandwicense, a member of the parsley family (Apiaceae), is a parsley-scented, sprawling herb. Hollow stems arise from a short, vertical stem with several fleshy roots. This short-lived perennial species is the only member of the genus in the Hawaiian Islands, one of three genera of the family with species endemic to the island of Kauai. This species differs from the other Kauai members of the parsley family in having larger fruit and pinnately compound leaves with broad leaflets (Constance and Affolter 1999).

Little is known about the life history of *Peucedanum sandwicense*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and

limiting factors are unknown (Service 1995).

Historically and currently, *Peucedanum sandwicense* is known from Molokai, Maui, and Kauai. In 1990, it was discovered on Oahu. On Kauai, there are 15 occurrences on State (Haena State Park, Hono o Na Pali and Kuia NARs, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve) and privately owned lands, containing approximately 156 to 256 individuals, in Maunahou Valley, Limahuli Valley, Hoolulu, Hanakoa, Pohakuao, Kanakou, the left branch of Kalalau Valley, Nualolo Valley, Kuia Valley, Mahanaloa Valley, Koaie Canyon, and Haupu (GDSI 2000; HINHP Database 2000; Service 1995; 59 FR 9304; K. Wood, *in litt.* 1999).

This species grows on cliff habitats in mixed shrub coastal dry cliff communities or diverse mesic forest at elevations between 0 and 1,232 m (0 and 4,041 ft). Associated native plant species include *Acacia koa*, *Artemisia australis*, *Bidens* spp., *Brighamia insignis*, *Carex meyenii*, *Chamaesyce celastroides*, *Diospyros* spp., *Dodonaea viscosa*, *Eragrostis variabilis*, *Hibiscus kokio*, *Lobelia niihauensis*, *Metrosideros polymorpha*, *Panicum lineale*, *Psychotria* spp., *Psydrax odorata*, or *Wilkesia* spp. (Constance and Affolter 1999; HINHP Database 2000; 59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to *Peucedanum sandwicense* on Kauai include competition with introduced plants; habitat degradation and browsing by feral goats and deer; and trampling and trail clearing (Hanakapiai population) (HINHP Database 2000; Service 1995; 59 FR 9304).

Phlegmariurus mannii (wawaeiole)

Phlegmariurus mannii, a member of the clubmoss family (Lycopodiaceae) and a short-lived perennial, is a pendent epiphyte with clustered, delicate red stems and forked reproductive spikes. These traits distinguish it from others in the genus in Hawaii (Holub 1991).

Little is known about the life history of *Phlegmariurus mannii*. Reproductive cycles, dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1997).

Historically, *Phlegmariurus mannii* was known from Kauai, West Maui, and Hawaii island. Currently, this species is extant on Maui and Hawaii island. It was last observed on Kauai in 1900 (HINHP Database 2000).

Nothing is known of the preferred habitat of or native plant species associated with *Phlegmariurus mannii* on the island of Kauai.

Nothing is known of the threats to *Phlegmariurus mannii* on the island of Kauai.

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 (Wagner and Wagner 1987).

Phlegmariurus nutans has been observed fertile, with spores, in May and December. Little else is known about the life history of *Phlegmariurus nutans*. Its reproductive cycles, dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1998b).

Historically, *Phlegmariurus nutans* was known from the island of Kauai and from scattered locations in the Koolau Mountains of Oahu. It is currently only known from Oahu. It was last observed on Kauai in 1900 (HINHP Database 2000; Service 1998b).

Phlegmariurus nutans grows on tree trunks, usually on open ridges and slopes in *Metrosideros polymorpha-Dicranopteris linearis* wet forests and occasionally mesic forests at elevations between 601 and 1,594 m (1,971 and 5,228 ft). The vegetation in those areas typically includes *Antidesma platyphyllum*, *Broussaisia arguta*, *Cheirodendron fauriei*, *Cibotium* spp., *Diplopterygium pinnatum*, *Hedyotis terminalis*, *Hibiscus kokio* ssp. *kokio*, *Melicope waialealae* (alani wai), *Scaevola gaudichaudii*, *Syzygium sandwicensis*, *Perrottetia sandwicensis*, *Psychotria hexandra*, *Psychotria mariniana*, or *Psychotria wawrae* (K. Wood, pers. comm., 2001).

The primary threat to *Phlegmariurus nutans* is extinction due to naturally occurring events and/or reduced reproductive vigor because of the small number of remaining individuals and limited distribution. Additional threats to this species are feral pigs and the nonnative plants *Clidemia hirta* or *Psidium cattleianum* (Service 1998b).

Plantago princeps (laukahi kuahiwi)

Plantago princeps, a member of the plantain family (Plantaginaceae), is a small shrub or robust perennial herb. This short-lived perennial 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).

Little is known about the life history of this plant. Reproductive cycles, longevity, specific environmental requirements, and limiting factors are generally unknown. However, individuals have been observed in fruit from April through September (Service 1999).

Historically, *Plantago princeps* was found on the islands of Hawaii, Kauai, Maui, Molokai, and Oahu. It no longer occurs on the island of Hawaii. Two varieties of the species, totaling seven occurrences, with 542 to 670 individuals, are extant on the island of Kauai, on both State (Halelea Forest Reserve, Lihue-Koloa Forest Reserve, and Na Pali Coast State Park) and privately owned lands. Historically on Kauai, *Plantago princeps* var. *anomala* was reported from a ridge west of Hanapepe River. Currently, this variety is found in the left branch of Kalalau Valley and Puu Ki. *Plantago princeps* var. *longibracteata* was historically known from Hanalei, the Wahiawa Mountains, and Hanapepe Falls. Currently, five occurrences are known from Waioli Valley, Alakai Swamp, the left branch of Wainiha Valley, and Blue Hole (GDSI 2000; HINHP Database 2000; Service 1999; 59 FR 56333).

Plantago princeps var. *longibracteata* is found in windswept areas near waterfalls in *Metrosideros polymorpha-Cheirodendron* montane wet forest with riparian vegetation at elevations between 347 and 1,598 m (1,139 and 5,244 ft). Associated native plant species include *Antidesma platyphyllum* var. *hillebrandii*, *Bidens forbesii*, *Bobea elatior*, *Boehmeria grandis*, *Cyrtandra* spp., *Diplazium sandwichianum*, *Freycinetia arborea*, *Gunnera kauaiensis*, *Hedyotis centranthoides*, *Hedyotis elatior*, *Huperzia* spp., *Isachne pallens* (NCN), *Machaerina angustifolia*, *Perrottetia sandwicensis*, *Pilea peploides* (NCN), *Pipturus* spp., *Sadleria cyatheoides* (amau), or *Tetraplasandra* spp. (K. Wood, pers. comm., 2001).

Plantago princeps var. *anomala* is found in *Metrosideros polymorpha* lowland to montane transitional wet forest on cliffs and ridges, growing on basalt rocky outcrops. Associated native plant species include *Bidens sandwicensis*, *Carex meyenii*, *Carex wahuensis*, *Charpentiera elliptica*, *Hedyotis* spp., *Lipochaeta connata*, *Lysimachia glutinosa*, *Lysimachia kalalauensis*, *Melicope* spp., *Myrsine*

linearifolia, *Poa mannii*, or *Wilkesia gymnoxiphium* (K. Wood, pers. comm., 2001).

The primary threats to both species of *Plantago princeps* on Kauai are herbivory and habitat degradation by feral pigs and goats and competition with various nonnative plant species. Ungulate herbivory is especially severe, with numerous observations of *P. princeps* individuals exhibiting browse damage (Service 1999; 61 FR 53108).

Platanthera holochila (NCN)

Platanthera holochila, a 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 short-lived perennial is the only species of this genus that occurs in the Hawaiian Islands. It is distinguished from other Hawaiian orchids by its underground tubers that lack roots at the nodes or pseudobulbs, and the shape and length of its dorsal sepal (Wagner *et al.* 1999).

Little is known about the life history of *Platanthera holochila*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Platanthera holochila* was known from the Alakai Swamp, Kaholuamano area, and the Wahiawa Mountains on Kauai, and scattered locations on Oahu, Molokai, and Maui. Currently, *P. holochila* is extant on Kauai, Molokai, and Maui. On Kauai, there are two occurrences with 24 to 34 individuals reported on State-owned lands (Alakai Wilderness Preserve) at Kilohana and the Alakai Swamp (GDSI 2000; HINHP Database 2000).

Platanthera holochila is found in montane *Metrosideros polymorpha-Dicranopteris linearis* wet forest or *M. polymorpha* mixed bog at elevations between 803 and 1,563 m (2,635 and 5,128 ft). Associated native plant species include grammitid ferns, *Carex montis-eeka* (NCN), *Cibotium* spp., *Clermontia fauriei* (oha wai), *Coprosma elliptica* (pilo), *Dichantheium* spp., *Leptecophylla tameiameia*, *Lobelia kauaiensis*, *Machaerina angustifolia*, *Myrsine denticulata* (kolea), *Oreobolus furcatus*, *Rhynchospora* spp. (kuolohia), *Vaccinium* spp., or *Viola kauaiensis* (Service 1999; 61 FR 53108; K. Wood, pers. comm., 2001).

The primary threats to *Platanthera holochila* on Kauai are habitat degradation and destruction by pigs; competition with nonnative plants; and a risk of extinction on Kauai from

naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor, due to the small number of remaining populations and individuals. Predation by introduced slugs may also be a potential threat to this species (Service 1999; 61 FR 53108).

Schiedea nuttallii (NCN)

Schiedea nuttallii, a member of the pink family (Caryophyllaceae), is a generally hairless, erect subshrub. This long-lived perennial 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).

Little is known about the life history of *Schiedea nuttallii*. Based on field and greenhouse observations, it is hermaphroditic (flowers contain both male and female sexual parts). Plants on Oahu have been under observation for 10 years, and they appear to be long-lived. *Schiedea nuttallii* appears to be an outcrossing species. Under greenhouse conditions, plants fail to set seed unless hand-pollinated, suggesting that this species requires insects for pollination. Fruits and flowers are abundant in the wet season but can be found throughout the year (Service 1999).

Historically, *Schiedea nuttallii* was known from Kauai and Oahu and was reported from Maui. Currently, it is found on Kauai, Oahu, and Molokai. On Kauai, one occurrence with 10 to 50 individuals is found on Haupu Peak on privately owned land. The status of individuals previously found in Limahuli Valley is currently unknown (GDSI 2000; HINHP Database 2000; Service 1999; 1 FR 53108).

Schiedea nuttallii typically grows on cliffs in lowland diverse mesic forest dominated by *Metrosideros polymorpha* at elevations between 37 and 702 m (120 and 2,303 ft). Associated native plant species include *Antidesma platyphyllum* var. *hillebrandii*, *Bidens valida*, *Chamaesyce celastroides*, *Eragrostis variabilis*, *Hedyotis acuminata*, *Hedyotis fluviatililis* (kamapuaa), *Heteropogon contortus*, *Lepidium* spp. (anaunau), *Lobelia niihauensis*, *Perrottetia sandwicensis*, *Pisonia* spp., or *Psychotria* spp. (Service 1999; K. Wood, pers. comm., 2001).

Schiedea nuttallii is threatened on Kauai by habitat degradation and/or destruction by feral pigs, goats, and possibly deer; competition with several nonnative plants; landslides; predation by the black twig borer; and a risk of extinction from naturally occurring

events (e.g., landslides or hurricanes) and/or reduced reproductive vigor, due to the small number of individuals in the only known population. Based on observations that indicate that introduced snails and slugs may consume seeds and seedlings, it is likely that introduced molluscs also represent a major threat to this species (Service 1999; 61 FR 53108).

Sesbania tomentosa (ohai)

Sesbania tomentosa, a member of the pea family (Fabaceae), is typically a sprawling short-lived perennial shrub, but may also be a small tree. Each compound leaf consists of 18 to 38 oblong to elliptic leaflets which are usually sparsely to densely covered with silky hairs. The flowers are salmon colored, tinged with yellow, orange-red, scarlet or, rarely, pure yellow coloration. *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 populations 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 islands). Although once found on Niihau and Lanai, it is no longer extant on those islands. On Kauai, *S. tomentosa* is known from one occurrence, with 11 individuals, on State-owned land at Polihale State Park (GDSI 2000; HINHP Database 2000; 59 FR 56333).

Sesbania tomentosa is found on sandy beaches, dunes, or pond margins at elevations between 0 and 212 m (0 and 694 ft). It commonly occurs in coastal dry shrublands or mixed coastal dry cliffs with the associated native plant species *Chamaesyce celastroides*, *Cuscuta sandwichiana* (kaunaoa), *Dodonaea viscosa*, *Heteropogon contortus*, *Myoporum sandwicense*, *Nama sandwicensis*, *Scaevola sericea*, *Sida fallax*, *Sporobolus virginicus*, *Vitex rotundifolia*, or *Waltheria indica*

(HINHP Database 2000; Service 1999; K. Wood, pers. comm., 2001).

The primary threats to *Sesbania tomentosa* on Kauai are habitat degradation caused by competition with various nonnative plant species; lack of adequate pollination; seed predation by rats, mice, and, potentially, nonnative insects; fire; and destruction by off-road vehicles and other human disturbances (Service 1999; 59 FR 56333).

Silene lanceolata (NCN)

Silene lanceolata, a member of the pink family (Caryophyllaceae), is an upright, short-lived perennial plant with stems 15 to 51 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 *Silene* species by its erect stem, terminal inflorescence, and the length of the calyx, clawed petals, and carpophore (ovary structure) (Wagner *et al.* 1999).

Little is known about the life history of *Silene lanceolata*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1996; 57 FR 46325).

The historical range of *Silene lanceolata* includes five Hawaiian Islands: Kauai, Oahu, Molokai, Lanai, and Hawaii. *Silene lanceolata* is presently extant on the islands of Molokai, Oahu, and Hawaii. It was last observed on Kauai in the 1850s (GDSI 2000; Service 1996; 57 FR 46325).

Nothing is known of the preferred habitat of or native plant species associated with *Silene lanceolata* on the island of Kauai.

Nothing is known of the threats to *Silene lanceolata* on the island of Kauai.

Solanum incompletum (popolo ku mai)

Solanum incompletum, a short-lived perennial member of the nightshade family (Solanaceae), is a woody shrub. Its stems and lower leaf surfaces are covered with prominent reddish prickles or sometimes with yellow fuzzy hairs on young plant parts and lower leaf surfaces. This species differs from other native members of the genus by being generally prickly and having loosely clustered white flowers, curved anthers about 2 mm (0.08 in) long, and berries 1 to 2 cm (0.4 to 0.8 in) in diameter (Symon 1999).

Little is known about the life history of *Solanum incompletum*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (59 FR 56333).

Historically, *Solanum incompletum* was known from Lanai, Maui, and the island of Hawaii. According to David Symon (1999), the known distribution of *S. incompletum* also extended to the islands of Kauai and Molokai. Currently, the species is only known from the island of Hawaii. The reported presence on Kauai may be erroneous (HINHP Database 2000; Christopher Puttock, Bernice P. Bishop Museum, pers. comm., 2001).

Nothing is known of the preferred habitat of or native plant species associated with *Solanum incompletum* on the island of Kauai.

Nothing is known of the threats to *Solanum incompletum* on the island of Kauai.

Solanum sandwicense (aiakeakua, popolo)

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 4 lobes along the margins. This short-lived perennial species differs from others of the genus in 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 1995).

Historically, *Solanum sandwicense* was known from both Oahu and Kauai. Currently, this species is only known from Kauai. On Kauai, this species was historically reported from locations in the Kokee region bounded by Kalalau Valley, Milolii Ridge, and extending to the Hanapepe River. Currently, *S. sandwicense* is only known from eight occurrences of 14 individual plants on private and State lands (Kokee State Park, Kuia NAR, and Na Pali-Kona Forest Reserve) at Kahuamaa Flats, Awaawapuhi Valley, Kumuwela Ridge, Waialae Valley, and Mokuone Stream (GDSI 2000; HINHP Database 2000; Service 1995; 59 FR 9304; K. Wood, *in litt.* 1999; Joan Yoshioka, The Nature Conservancy of Hawaii (TNCH), pers. comm., 2000).

This species is typically found under forest canopies at elevations between 445 and 1,290 m (1,460 and 4,232 ft) in diverse lowland or montane *Acacia koa* or *A. koa-Metrosideros polymorpha* mesic forests or occasionally in wet forests. Associated native plant species include *Alphitonia ponderosa*, *Athyrium sandwicensis*, *Bidens* spp.,

Carex meyenii, *Coprosma* spp., *Cryptocarya mannii*, *Dianella sandwicensis*, *Dicranopteris linearis*, *Dubautia* spp., *Hedyotis* spp., *Ilex anomala*, *Melicope* spp., *Poa* spp., *Pouteria sandwicensis*, *Psychotria* spp., *Syzygium sandwicensis*, or *Xylosma hawaiiense* (HINHP Database 2000; Service 1995; 59 FR 9304; K. Wood, pers. comm., 2001).

The major threats to populations of *Solanum sandwicense* on Kauai are habitat degradation by feral pigs, and competition with nonnative plant species (*Hedychium gardnerianum* (kahili ginger), *Lonicera japonica*, *Passiflora tarminiana*, *Psidium cattleianum*, or *Rubus argutus*); fire; human disturbance and development; and a risk of extinction from naturally occurring events (e.g., landslides or hurricanes) and/or reduced reproductive vigor due to the small number of existing individuals (HINHP Database 2000; Service 1995; 59 FR 9304).

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 non-succulent annual with an umbrella-shaped inflorescence (Constance and Affolter 1999).

Little is known about the life history of *Spermolepis hawaiiensis*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Spermolepis hawaiiensis* was known from Kauai, Oahu, Lanai, and the island of Hawaii. Currently, it is found on Kauai, Oahu, Molokai, Lanai, West Maui, and Hawaii. On Kauai, this species is known from State-owned land at Koaie Canyon, the rim of Waimea Canyon, and Kapahili Gulch within the Na Pali-Kona Forest Reserve. There are two known occurrences with five individuals total on Kauai (GDSI 2000; HINHP Database 2000; Service 1999; 59 FR 56333).

Spermolepis hawaiiensis is known from *Metrosideros polymorpha* forest and *Dodonaea viscosa* lowland dry shrubland, at elevations between 56 and 725 m (184 and 2,377 ft). Associated native plant species include *Bidens sandwicensis*, *Doryopteris* spp., *Eragrostis variabilis*, *Erythrina sandwicensis*, *Lipochaeta* spp., *Schiedea spergulina*, or *Sida fallax* (HINHP Database 2000; Service 1999; K. Wood, pers. comm., 2001).

The primary threats to *Spermolepis hawaiiensis* on Kauai are habitat degradation by feral goats; competition with various nonnative plants; and erosion, landslides, and rock slides due to natural weathering, which result in the death of individual plants as well as habitat destruction (Service 1999; 59 FR 56333).

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 which 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, which may or may not be slightly inflated (Geesink *et al.* 1999).

Little is known about the life history of *Vigna o-wahuensis*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1999).

Historically, *Vigna o-wahuensis* was known from Niihau, Oahu, Molokai, Lanai, Kahoolawe, Maui, and the island of Hawaii. Currently, *Vigna o-wahuensis* is known from Molokai, Lanai, Kahoolawe, Maui, and the island of Hawaii. It was last observed on Niihau in 1912 (GDSI 2000; HINHP Database 2000; 59 FR 56333).

Nothing is known of the preferred habitat of or native plant species associated with *Vigna o-wahuensis* on the island of Niihau.

Nothing is known of the threats to *Vigna o-wahuensis* on the island of Niihau.

Zanthoxylum hawaiiense (ae)

Zanthoxylum hawaiiense is a medium-sized tree with pale to dark

gray bark and lemon-scented leaves in the rue family (Rutaceae). A long-lived perennial tree, *Z. hawaiiense* is distinguished from other Hawaiian members of the genus by several characteristics: three leaflets all of similar size, one joint on the lateral leaf stalk, and sickle-shaped fruits with a rounded tip (Stone *et al.* 1999).

Little is known about the life history of *Zanthoxylum hawaiiense*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (Service 1996).

Historically, *Zanthoxylum hawaiiense* was known from five islands: Kauai, Molokai, Lanai, Maui, and Hawaii. Currently, *Zanthoxylum hawaiiense* is found on Kauai, Molokai, Maui, and Hawaii. On Kauai, this species is only known from three occurrences with three individuals on State-owned land in Kawaiiki and Kipalau Valleys within the Alakai Wilderness Preserve and Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000).

Zanthoxylum hawaiiense is reported from lowland dry or mesic forests, at elevations between 332 and 1,151 m (1,089 and 3,774 ft). This species is typically found in forests dominated by *Metrosideros polymorpha* or *Diospyros sandwicensis* with associated native plant species including *Alectryon macrococcus*, *Antidesma platyphyllum*, *Charpentiera elliptica*, *Dodonaea viscosa*, *Melicope* spp., *Myrsine lanaiensis*, *Pisonia* spp., *Pleomele aurea*, *Streblus pendulinus*, or *Zanthoxylum dipetalum* (HINHP Database 2000; K. Wood, pers. comm., 2001).

The threats to *Zanthoxylum hawaiiense* on Kauai include competition with the nonnative plant species *Lantana camara* and *Melia azedarach*; fire; human disturbance; and risk of extinction from naturally occurring events, such as landslides or hurricanes, and/or reduced reproductive vigor due to the small number of existing individuals (Service 1996; 59 FR 10305).

A summary of occurrences and landownership for the 95 plant species reported from the islands of Kauai and Niihau is given in Table 2.

TABLE 2.—SUMMARY OF EXISTING OCCURRENCES ON KAUAI AND NIIHAU, AND LANDOWNERSHIP FOR 95 SPECIES REPORTED FROM KAUAI

Species	Number of current occurrences	Landownership		
		Federal	State	Private
<i>Acaena exigua</i>	0

TABLE 2.—SUMMARY OF EXISTING OCCURRENCES ON KAUAI AND NIIHAU, AND LANDOWNERSHIP FOR 95 SPECIES REPORTED FROM KAUAI—Continued

Species	Number of current occurrences	Landownership		
		Federal	State	Private
<i>Achyranthes mutica</i>	0			
<i>Adenophorus periens</i>	7		X	X
<i>Alectryon macrococcus</i>	18		X	
<i>Alsinidendron lychnoides</i>	4		X	
<i>Alsinidendron viscosum</i>	7		X	
<i>Bonamia menziesii</i>	9		X	X
<i>Brighamia insignis</i>	4		X	X
<i>Centaurium sebaeoides</i>	3		X	
<i>Chamaesyce halemanui</i>	9		X	
<i>Ctenitis squamigera</i>	0			
<i>Cyanea asarifolia</i>	2		X	
<i>Cyanea recta</i>	8		X	X
<i>Cyanea remyi</i>	7		X	X
<i>Cyanea undulata</i>	1			X
<i>Cyperus trachysanthos</i>	1			X
<i>Cyrtandra cyaneoides</i>	5		X	X
<i>Cyrtandra limahuliensis</i>	13		X	X
<i>Delissea rhytidosperma</i>	3		X	X
<i>Delissea rivularis</i>	2		X	
<i>Delissea undulata</i>	1		X	
<i>Diellia erecta</i>	1		X	
<i>Diellia pallida</i>	6		X	
<i>Diplazium molokaiense</i>	0			
<i>Dubautia latifolia</i>	26		X	
<i>Dubautia pauciflorula</i>	4		X	X
<i>Euphorbia haeleeeleana</i>	23		X	
<i>Exocarpos luteolus</i>	9		X	X
<i>Flueggea neowawraea</i>	10		X	X
<i>Gouania meyenii</i>	3		X	
<i>Hedyotis cookiana</i>	1		X	
<i>Hedyotis st.-johnii</i>	11		X	
<i>Hesperomannia lydgatei</i>	4		X	X
<i>Hibiscadelphus woodii</i>	2		X	
<i>Hibiscus brackenridgei</i>	0			
<i>Hibiscus clayi</i>	1		X	
<i>Hibiscus waimeae</i> ssp. <i>hannerae</i>	2		X	X
<i>Ischaemum byrone</i>	2			X
<i>Isodendron laurifolium</i>	13		X	
<i>Isodendron longifolium</i>	15		X	X
<i>Isodendron pyrifolium</i>	0			
<i>Kokia kauaiensis</i>	21		X	
<i>Labordia lydgatei</i>	6		X	X
<i>Labordia tinifolia</i> var. <i>wahiawaensis</i>	1			X
<i>Lipochaeta fauriei</i>	5		X	
<i>Lipochaeta micrantha</i>	5		X	X
<i>Lipochaeta waimeaensis</i>	1		X	
<i>Lobelia niihauensis</i>	13		X	X
<i>Lysimachia filifolia</i>	1		X	
<i>Mariscus pennatifolius</i>	0			
<i>Melicope haupuensis</i>	4		X	
<i>Melicope knudsenii</i>	10		X	
<i>Melicope pallida</i>	6		X	
<i>Melicope quadrangularis</i>	0			
<i>Munroidendron racemosum</i>	17		X	X
<i>Myrsine linearifolia</i>	12		X	X
<i>Nothoestrum peltatum</i>	10		X	
<i>Panicum niihauense</i>	1		X	
<i>Peucedanum sandwicense</i>	15		X	X
<i>Phlegmariurus mannii</i>	0			
<i>Phlegmariurus nutans</i>	0			
<i>Phyllostegia knudsenii</i>	3		X	
<i>Phyllostegia waimeae</i>	1		X	
<i>Phyllostegia wawrana</i>	4		X	X
<i>Plantago princeps</i>	7		X	X
<i>Platanthera holochila</i>	2		X	
<i>Poa mannii</i>	6		X	
<i>Poa sandwicensis</i>	9		X	
<i>Poa siphonoglossa</i>	5		X	
<i>Pritchardia aylmer-robinsonii</i>	1			X

TABLE 2.—SUMMARY OF EXISTING OCCURRENCES ON KAUAI AND NIIHAU, AND LANDOWNERSHIP FOR 95 SPECIES REPORTED FROM KAUAI—Continued

Species	Number of current occurrences	Landownership		
		Federal	State	Private
<i>Pritchardia napaliensis</i>	5		X	
<i>Pritchardia viscosa</i>	1		X	
<i>Pteralyxia kauaiensis</i>	39		X	
<i>Remya kauaiensis</i>	17		X	
<i>Remya montgomeryi</i>	6		X	
<i>Schiedea apokremnos</i>	5		X	
<i>Schiedea helleri</i>	3		X	
<i>Schiedea kauaiensis</i>	5		X	
<i>Schiedea membranacea</i>	10		X	X
<i>Schiedea nuttallii</i>	1			X
<i>Schiedea spergulina</i> var. <i>leiopoda</i>	1			X
<i>Schiedea spergulina</i> var. <i>spergulina</i>	3		X	
<i>Schiedea stellarioides</i>	3		X	
<i>Sesbania tomentosa</i>	1		X	
<i>Silene lanceolata</i>	0			
<i>Solanum incompletum</i>	0			
<i>Solanum sandwicense</i>	8		X	X
<i>Spermolepis hawaiiensis</i>	2		X	
<i>Stenogyne campanulata</i>	3		X	
<i>Vigna o-wahuensis</i>	0			
<i>Viola helenae</i>	1			X
<i>Viola kauaiensis</i> var. <i>wahiawaensis</i>	2			X
<i>Wilkesia hobdyi</i>	9	X*	X	
<i>Xylosma crenatum</i>	3		X	
<i>Zanthoxylum hawaiiense</i>	3		X	

* Pacific Missile Range Facility at Makaha Ridge.

Previous Federal Action

Federal action on these plants began as a result of section 12 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*), which directed the Secretary of the Smithsonian Institution to prepare a report on plants considered to be endangered, threatened, or extinct in the United States. This report, designated as House Document No. 94-51, was presented to Congress on January 9, 1975. In that document, *Adenophorus periens*, *Alectryon macrococcum* (as *A. macrococcum* var. *macrococcum* and *A. mahoe*), *Bonamia menziesii*, *Brighamia insignis* (as *B. citrina* var. *napaliensis* and *B. insignis*), *Chamaesyce halemanui* (as *Euphorbia halemanui*), *Delissea rhytidosperma*, *Dubautia latifolia* (as *D. latifolia* var. *latifolia*), *Exocarpos luteolus*, *Flueggea neowawraea* (as *Drypetes phyllanthoides*), *Hedyotis st-johnii*, *Hesperomannia lydgatei*, *Hibiscus clayi* (as *H. clayi* and *H. newhousei*), *H. waimeae* ssp. *hannerae* (as *H. waimeae*), *Kokia kauaiensis*, *Lipochaeta fauriei*, *L. micrantha* (as *L. exigua*), *Lobelia niihauensis*, *Melicope haupuensis* (as *Pelea haupuensis*), *M. knudsenii* (as *P. multiflora*), *M. pallida* (as *P. leveillei* and *P. pallida*), *Melicope quadrangularis* (*Pelea quadrangularis*), *Myrsine linearifolia* (as *M. linearifolia* var. *linearifolia*), *Nothoecstrum*

peltatum, *Peucedanum sandwicense* (as *P. kauaiense*), *Phyllostegia knudsenii*, *Plantago princeps* (as *P. princeps* var. *elata*, *P. var. laxifolia*, and *P. var. princeps*), *Poa sandwicensis*, *Pritchardia aylmer-robinsonii*, *Sesbania tomentosa* (as *S. hobdyi* and *S. tomentosa* var. *tomentosa*), *Solanum sandwicense* (as *S. hillebrandii* and *S. kauaiense*), *Viola helenae*, *V. kauaiensis* var. *wahiawaensis*, *Wilkesia hobdyi*, *Xylosma crenatum* (as *Antidesma crenatum*), and *Zanthoxylum hawaiiense* (as *Z. hawaiiense* var. *citiodora*), were considered to be endangered; *Delissea rivularis*, *Diellia pallida* (as *Diellia laciniata*), *Labordia lydgatei*, *Lipochaeta micrantha*, *L. waimeaeensis*, *Lysimachia filifolia*, *Schiedea membranacea*, and *Zanthoxylum hawaiiense* (as *Z. hawaiiense* var. *hawaiiense* and *Z. hawaiiense* var. *velutinosum*) were considered to be threatened; and *Delissea undulata* (as *D. undulata* var. *argutidentata* and *D. undulata* var. *undulata*), *Gouania meyenii*, *Hedyotis cookiana*, *Melicope knudsenii* (as *Pelea knudsenii* and *P. tomentosa*), *Munroidendron racemosum* (as *M. racemosum* var. *macdanielsii*), *Plantago princeps* (as *P. princeps* var. *acaulis*, *P. princeps* var. *denticulata*, and *P. princeps* var. *queleniana*), and *Remya kauaiensis* were considered to be extinct. On July 1, 1975, we published

a notice in the **Federal Register** (40 FR 27823) of our acceptance of the Smithsonian report as a petition within the context of section 4(c)(2) (now section 4(b)(3)) of the Act, and gave notice of our intention to review the status of the plant taxa named therein. As a result of that review, on June 16, 1976, we published a proposed rule in the **Federal Register** (41 FR 24523) to determine endangered status pursuant to section 4 of the Act for approximately 1,700 vascular plant taxa, including all of the above taxa except for *Diellia pallida*. The list of 1,700 plant taxa was assembled on the basis of comments and data received by the Smithsonian Institution and the Service in response to House Document No. 94-51 and the July 1, 1975, **Federal Register** publication (40 FR 27823).

General comments received in response to the 1976 proposal were summarized in an April 26, 1978, **Federal Register** publication (43 FR 17909). In 1978, amendments to the Act required that all proposals over 2 years old be withdrawn. A 1-year grace period was given to proposals already over 2 years old. On December 10, 1979, we published a notice in the **Federal Register** (44 FR 70796) withdrawing the portion of the June 16, 1976, proposal that had not been made final, along with four other proposals that had expired. We published updated Notices of

Review for plants on December 15, 1980 (45 FR 82479), September 27, 1985 (50 FR 39525), February 21, 1990 (55 FR 6183), and September 30, 1993 (58 FR

51144). We listed the 95 species as endangered or threatened between 1991 and 1996. A summary of the listing actions can be found in Table 3(a). A

summary of the critical habitat actions can be found in Table 3(b).

TABLE 3(a).—SUMMARY OF LISTING ACTIONS FOR 95 PLANT SPECIES FROM KAUAI AND NIIHAU

Species	Federal status	Proposed listing rule		Final listing rule	
		Date	Federal Register	Date	Federal Register
<i>Acaena exigua</i>	E	5/24/1991	56 FR 23842	5/15/1992	57 FR 20772
<i>Achyranthes mutica</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Adenophorus periens</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Alectryon macrococcus</i>	E	5/24/1991	56 FR 23842	5/15/1992	57 FR 20772
<i>Alsinidendron lychnoides</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Alsinidendron viscosum</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Bonamia menziesii</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Brighamia insignis</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Centaurium sebaeoides</i>	E	9/28/1990	55 FR 39664	10/29/1991	56 FR 55770
<i>Chamaesyce halemanui</i>	E	9/21/1990	55 FR 39301	5/13/1992	57 FR 20580
<i>Ctenitis squamigera</i>	E	6/24/1993	58 FR 34231	9/9/1994	59 FR 49025
<i>Cyanea asarifolia</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Cyanea recta</i>	T	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Cyanea remyi</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Cyanea undulata</i>	E	9/17/1990	55 FR 38242	9/20/1991	56 FR 47695
<i>Cyperus trachysanthos</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Cyrtandra cyaneoides</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Cyrtandra limahuliensis</i>	T	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Delissea rhytidosperra</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Delissea rivularis</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Delissea undulata</i>	E	6/27/1994	59 FR 32946	10/10/1996	61 FR 53124
<i>Diellia erecta</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Diellia pallida</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Diplazium molokaiense</i>	E	6/24/1993	58 FR 34231	9/9/1994	59 FR 49025
<i>Dubautia latifolia</i>	E	9/21/1990	55 FR 39301	5/13/1992	57 FR 20580
<i>Dubautia pauciflorula</i>	E	9/17/1990	55 FR 38242	9/20/1991	56 FR 47695
<i>Euphorbia haeleeleana</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Exocarpos luteolus</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Flueggea neowawraea</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Gouania meyenii</i>	E	9/28/1990	55 FR 39664	10/29/1991	56 FR 55770
<i>Hedyotis cookiana</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Hedyotis st-johnii</i>	E	8/3/1990	55 FR 31612	9/30/1991	56 FR 49639
<i>Hesperomannia lydgatei</i>	E	9/17/1990	55 FR 38242	9/20/1991	56 FR 47695
<i>Hibiscadelphus woodii</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Hibiscus brackenridgei</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Hibiscus clayi</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Hibiscus waimeae</i> ssp.	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Ischaemum byrone</i>	E	12/17/1992	57 FR 59951	3/4/1994	59 FR 10305
<i>Isodendrion laurifolium</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Isodendrion longifolium</i>	T	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Isodendrion pyriformis</i>	E	12/17/1992	57 FR 59941	3/4/1994	59 FR 10305
<i>Kokia kauaiensis</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Labordia lydgatei</i>	E	9/17/1990	55 FR 38242	9/20/1991	56 FR 47695
<i>Labordia tinifolia</i> var.	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Lipochaeta fauriei</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Lipochaeta micrantha</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Lipochaeta waimeaensis</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Lobelia niihauensis</i>	E	9/28/1990	55 FR 39664	10/29/1991	56 FR 55770
<i>Lysimachia filifolia</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Mariscus pennatifolius</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Melicope haupuensis</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Melicope knudsenii</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Melicope pallida</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Melicope quadrangularis</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Munroidendron racemosum</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Myrsine linearifolia</i>	T	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Nothoctrum peltatum</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Panicum niihauense</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Peucedanum sandwicense</i>	T	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Phlegmariurus mannii</i>	E	5/24/1991	56 FR 23842	5/15/1992	57 FR 20772
<i>Phlegmariurus nutans</i>	E	9/28/1990	55 FR 39664	10/29/1991	56 FR 55770
<i>Phyllostegia knudsenii</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Phyllostegia waimeae</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Phyllostegia wawrana</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070

TABLE 3(a).—SUMMARY OF LISTING ACTIONS FOR 95 PLANT SPECIES FROM KAUAI AND NIIHAU—Continued

Species	Federal status	Proposed listing rule		Final listing rule	
		Date	Federal Register	Date	Federal Register
<i>Plantago princeps</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Platanthera holochila</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Poa mannii</i>	E	4/7/1993	58 FR 18073	11/10/1994	59 FR 56330
<i>Poa sandvicensis</i>	E	9/21/1990	55 FR 39301	5/13/1992	57 FR 20580
<i>Poa siphonoglossa</i>	E	9/21/1990	55 FR 39301	5/13/1992	57 FR 20580
<i>Pritchardia aylmer-robinsonii</i>	E	12/17/1992	57 FR 59970	8/7/1996	61 FR 41020
<i>Pritchardia napaliensis</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Pritchardia viscosa</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Pteralyxia kauaiensis</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Remya kauaiensis</i>	E	10/2/1989	54 FR 40447	1/14/1991	56 FR 1450
<i>Remya montgomeryi</i>	E	10/2/1989	54 FR 40447	1/14/1991	56 FR 1450
<i>Schiedea apokremnos</i>	E	8/3/1990	55 FR 31612	9/30/1991	56 FR 49639
<i>Schiedea helleri</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Schiedea kauaiensis</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Schiedea membranacea</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Schiedea nuttallii</i>	E	10/2/1995	60 FR 51417	10/10/1996	61 FR 53108
<i>Schiedea spergulina</i> var. <i>leiopoda</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Schiedea spergulina</i> var. <i>spergulina</i>	T	10/30/1991	56 FR 55862	2/25/1994	59 FR 9304
<i>Schiedea stellarioides</i>	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Sesbania tomentosa</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Silene lanceolata</i>	E	9/20/1991	56 FR 47718	10/8/1992	57 FR 46325
<i>Solanum incompletum</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Solanum sandwicense</i>	E	10/30/1991	56 FR 55862	2/25/1994	59 FR 09304
<i>Spermolepis hawaiiensis</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Stenogyne campanulata</i>	E	9/21/1990	55 FR 39301	5/13/1992	57 FR 20580
<i>Vigna o-wahuensis</i>	E	9/14/1993	58 FR 48012	11/10/1994	59 FR 56333
<i>Viola helenae</i>	E	9/17/1990	55 FR 38242	9/20/1991	56 FR 47695
<i>Viola kauaiensis</i> var.	E	9/25/1995	60 FR 49359	10/10/1996	61 FR 53070
<i>Wilkesia hobdyi</i>	E	10/2/1989	54 FR 40444	6/22/1992	57 FR 27859
<i>Xylosma crenatum</i>	E	9/21/1990	55 FR 39301	5/13/1992	57 FR 20580
<i>Zanthoxylum hawaiiense</i>	E	12/17/1992	57 FR 59951	3/4/1994	59 FR 10305

Key: E = Endangered T = Threatened

TABLE 3(b).—SUMMARY OF CRITICAL HABITAT ACTIONS FOR 95 PLANT SPECIES FROM KAUAI AND NIIHAU

Species	Proposed critical habitat designation or nondesignation		Final critical habitat	
	Date(s)	Federal Register	Date(s)	Federal Register
<i>Acaena exigua</i>	12/18/2000	65 FR 79192	NA	NA
<i>Achyranthes mutica</i>	5/28/2002	67 FR 36968	NA	NA
<i>Adenophorus periens</i>	11/7/2000	65 FR 66808	NA	NA
	12/29/2000	65 FR 83157		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
<i>Alectryon macrococcus</i>	11/7/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		
	12/29/2000	65 FR 83157		
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 37108		
<i>Alsinidendron lychnoides</i>	11/7/2000	65 FR 66808	NA	NA
<i>Alsinidendron viscosum</i>	11/7/2000	65 FR 66808	NA	NA
<i>Bonamia menziesii</i>	11/7/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		
	12/27/2000	65 FR 82086		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 36968		
	4/3/2002	67 FR 15856		
	5/28/2002	67 FR 9806		
	5/28/2002	67 FR 37108		
<i>Brighamia insignis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Centaurium sebaeoides</i>	11/7/2000	65 FR 66808	NA	NA

TABLE 3(b).—SUMMARY OF CRITICAL HABITAT ACTIONS FOR 95 PLANT SPECIES FROM KAUAI AND NIIHAU—Continued

Species	Proposed critical habitat designation or nondesignation		Final critical habitat	
	Date(s)	Federal Register	Date(s)	Federal Register
	12/18/2000	65 FR 79192		
	12/27/2000	65 FR 82086		
	12/29/2000	65 FR 83157		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 37108		
<i>Chamaesyce halemanui</i>	11/7/2000	65 FR 66808	NA	NA
<i>Ctenitis squamigera</i>	12/18/2000	65 FR 79192	NA	NA
	12/27/2000	65 FR 79192		
	12/29/2000	65 FR 83157		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
<i>Cyanea asarifolia</i>	11/07/2000	65 FR 66808	NA	NA
<i>Cyanea recta</i>	11/07/2000	65 FR 66808	NA	NA
<i>Cyanea remyi</i>	11/7/2000	65 FR 66808	NA	NA
<i>Cyanea undulata</i>	11/7/2000	65 FR 66808	NA	NA
<i>Cyperus trachysanthos</i>	11/7/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	5/28/2002	67 FR 37108		
<i>Cyrtandra cyaneoides</i>	11/7/2000	65 FR 66808	NA	NA
<i>Cyrtandra limahuliensis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Delissea rhytidosperma</i>	11/7/2000	65 FR 66808	NA	NA
<i>Delissea rivularis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Delissea undulata</i>	11/7/2000	65 FR 66808	NA	NA
<i>Diellia erecta</i>	12/18/2000	65 FR 79192	NA	NA
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
<i>Diellia pallida</i>	11/7/2000	65 FR 66808	NA	NA
<i>Diplazium molokaiense</i>	12/18/2000	65 FR 79192	NA	NA
	01/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	3/4/2002	67 FR 9806		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 37108		
<i>Dubautia latifolia</i>	11/07/2000	65 FR 66808	NA	NA
<i>Dubautia pauciflora</i>	11/07/2000	65 FR 66808	NA	NA
<i>Euphorbia haeleeleana</i>	11/07/2000	65 FR 66808	NA	NA
	01/28/2002	67 FR 3940		
	05/28/2002			
<i>Exocarpos luteolus</i>	11/07/2000	65 FR 66808	NA	NA
<i>Flueggea neowawraea</i>	11/07/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	04/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
<i>Gouania meyenii</i>	11/07/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
<i>Hedyotis cookiana</i>	11/07/2000	65 FR 66808	NA	NA
<i>Hedyotis st.-johnii</i>	11/7/2000	65 FR 66808	NA	NA
<i>Hesperomannia lydgatei</i>	11/07/2000	65 FR 66808	NA	NA
<i>Hibiscadelphus woodii</i>	11/7/2000	65 FR 66808	NA	NA
<i>Hibiscus brackenridgei</i>	12/18/2000	65 FR 79192	NA	NA
	12/27/2000	65 FR 82086		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		

TABLE 3(b).—SUMMARY OF CRITICAL HABITAT ACTIONS FOR 95 PLANT SPECIES FROM KAUAI AND NIIHAU—Continued

Species	Proposed critical habitat designation or nondesignation		Final critical habitat	
	Date(s)	Federal Register	Date(s)	Federal Register
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
<i>Hibiscus clayi</i>	11/07/2000	65 FR 66808	NA	NA
<i>Hibiscus waimeae</i> ssp. <i>hannerae</i>	11/07/2000	65 FR 66808	NA	NA
<i>Ischaemum byrone</i>	12/18/2000	65 FR 79192	NA	NA
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
<i>Isodendron laurifolium</i>	11/07/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
	5/28/2002	67 FR 37108		
<i>Isodendron longifolium</i>	11/07/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
	5/28/2002	67 FR 37108		
<i>Isodendron pyrifolium</i>	3/4/2002	67 FR 9806	NA	NA
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
<i>Kokia kauaiensis</i>	11/07/2000	65 FR 66808	NA	NA
<i>Labordia lydgatei</i>	11/07/2000	65 FR 66808	NA	NA
<i>Labordia tinifolia</i> var. <i>wahiawaensis</i>	11/07/2000	65 FR 66808	NA	NA
<i>Lipochaeta fauriei</i>	11/07/2000	65 FR 66808	NA	NA
<i>Lipochaeta micrantha</i>	11/07/2000	65 FR 66808	NA	NA
<i>Lipochaeta waimeaensis</i>	11/07/2000	65 FR 66808	NA	NA
<i>Lobelia niihauensis</i>	11/07/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
	5/28/2002	67 FR 37108		
<i>Lysimachia filifolia</i>	11/07/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
	5/28/2002	67 FR 37108		
<i>Mariscus pennatifolius</i>	12/18/2000	65 FR 79192	NA	NA
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	5/14/2002	67 FR 34522		
	5/28/2002	67 FR 37108		
<i>Melicope haupuensis</i>	11/07/2000	65 FR 66808	NA	NA
<i>Melicope knudsenii</i>	11/07/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
<i>Melicope pallida</i>	11/07/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
	5/28/2002	67 FR 37108		
<i>Melicope quadrangularis</i>	11/07/2000	65 FR 66808	NA	NA
<i>Munroidendron racemosum</i>	11/07/2000	65 FR 66808	NA	NA
<i>Myrsine linearifolia</i>	11/07/2000	65 FR 66808	NA	NA
<i>Nothoctrum peltatum</i>	11/7/2000	65 FR 66808	NA	NA
<i>Panicum niihauense</i>	11/7/2000	65 FR 66808	NA	NA
<i>Peucedanum sandwicense</i>	11/7/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		
	12/29/2000	65 FR 83157		
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 37108		
<i>Phlegmariurus mannii</i>	12/18/2000	65 FR 79192	NA	NA
	4/3/2002	67 FR 15856		
<i>Phlegmariurus nutans</i>	1/28/2002	67 FR 3940	NA	NA
	5/28/2002	67 FR 37108		
<i>Phyllostegia knudsenii</i>	11/7/2000	65 FR 66808	NA	NA
<i>Phyllostegia waimeae</i>	11/7/2000	65 FR 66808	NA	NA
<i>Phyllostegia wawrana</i>	11/7/2000	65 FR 66808	NA	NA
<i>Plantago princeps</i>	11/7/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		

TABLE 3(b).—SUMMARY OF CRITICAL HABITAT ACTIONS FOR 95 PLANT SPECIES FROM KAUAI AND NIIHAU—Continued

Species	Proposed critical habitat designation or nondesignation		Final critical habitat	
	Date(s)	Federal Register	Date(s)	Federal Register
<i>Platanthera holochila</i>	12/29/2000	65 FR 83158	NA	NA
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	11/07/2000	65 FR 66808		
	12/18/2000	65 FR 79192		
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
<i>Poa mannii</i>	5/28/2002	67 FR 37108	NA	NA
	11/7/2000	65 FR 66808		
<i>Poa sandvicensis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Poa siphonoglossa</i>	11/7/2000	65 FR 66808	NA	NA
<i>Pritchardia aylmer-robinsonii</i>	11/7/2000	65 FR 66808	NA	NA
<i>Pritchardia napaliensis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Pritchardia viscosa</i>	11/7/2000	65 FR 66808	NA	NA
<i>Pteralyxia kauaiensis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Remya kauaiensis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Remya montgomeryi</i>	11/7/2000	65 FR 66808	NA	NA
<i>Schiedea apokremnos</i>	11/7/2000	65 FR 66808	NA	NA
<i>Schiedea helleri</i>	11/7/2000	65 FR 66808	NA	NA
<i>Schiedea kauaiensis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Schiedea membranacea</i>	11/7/2000	65 FR 66808	NA	NA
<i>Schiedea nuttallii</i>	11/7/2000	65 FR 66808	NA	NA
<i>Schiedea spergulina</i> var. <i>leiopoda</i>	12/29/2000	65 FR 83158	NA	NA
	1/28/2002	67 FR 3940		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 37108		
	11/7/2000	65 FR 66808		
	11/7/2000	65 FR 66808		
	11/7/2000	65 FR 66808		
	11/7/2000	65 FR 66808		
	12/18/2000	65 FR 79192		
	12/29/2000	65 FR 83158		
<i>Schiedea spergulina</i> var. <i>spergulina</i>	1/28/2002	67 FR 3940	NA	NA
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/14/2002	67 FR 34522		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
<i>Schiedea stellarioides</i>	4/3/2002	67 FR 15856	NA	NA
	4/5/2002	67 FR 16492		
	5/14/2002	67 FR 34522		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
<i>Sesbania tomentosa</i>	5/28/2002	67 FR 36968	NA	NA
	5/28/2002	67 FR 37108		
	11/7/2000	65 FR 66808		
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
<i>Silene lanceolata</i>	11/7/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		
	12/29/2000	65 FR 83158		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
<i>Solanum incompletum</i>	4/4/2002	67 FR 9806	NA	NA
	5/28/2002	67 FR 36968		
<i>Solanum sandwicense</i>	11/7/2000	65 FR 66808	NA	NA
	1/28/2002	67 FR 3940		
<i>Spermolepis hawaiiensis</i>	5/28/2002	67 FR 37108	NA	NA
	11/7/2000	65 FR 66808		
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
	11/7/2000	65 FR 66808		
<i>Stenogyne campanulata</i>	12/18/2000	65 FR 79192	NA	NA
	12/27/2000	65 FR 82086		
	12/29/2000	65 FR 83158		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		
	11/7/2000	65 FR 66808		
	12/18/2000	65 FR 79192		
<i>Vigna o-wahuensis</i>	12/27/2000	65 FR 82086	NA	NA
	12/29/2000	65 FR 83158		
	3/4/2002	67 FR 9806		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		
	5/28/2002	67 FR 37108		

TABLE 3(b).—SUMMARY OF CRITICAL HABITAT ACTIONS FOR 95 PLANT SPECIES FROM KAUAI AND NIIHAU—Continued

Species	Proposed critical habitat designation or nondesignation		Final critical habitat	
	Date(s)	Federal Register	Date(s)	Federal Register
<i>Viola helenae</i>	11/7/2000	65 FR 66808	NA	NA
<i>Viola kauaiensis</i> var. <i>wahiawaensis</i>	11/7/2000	65 FR 66808	NA	NA
<i>Wilkesia hobdyi</i>	11/7/2000	65 FR 66808	NA	NA
<i>Xylosma crenatum</i>	11/7/2000	65 FR 66808	NA	NA
<i>Zanthoxylum hawaiiense</i>	11/7/2000	65 FR 66808	NA	NA
	12/18/2000	65 FR 79192		
	12/29/2000	65 FR 83158		
	1/28/2002	67 FR 3940		
	4/3/2002	67 FR 15856		
	4/5/2002	67 FR 16492		
	5/28/2002	67 FR 36968		

At the time each of the 95 plants was listed, we determined that designation of critical habitat was not prudent because it would not benefit the plant or would increase the degree of threat to the species. The “not prudent” determinations for these species, along with others, were challenged in *Conservation Council for Hawaii v. Babbitt*, 2 F. Supp. 2d 1280 (D. Haw. 1998). On March 9, 1998, the United States District Court for the District of Hawaii directed us to review the prudency determinations for 245 listed plant species in Hawaii, including the 95 species reported from Kauai. Among other things, the court held that in most cases we did not sufficiently demonstrate that the species are threatened by human activity or that such threats would increase with the designation of critical habitat. The court also held that we failed to balance any risks of designating critical habitat against any benefits (*id.* at 1283–85).

On August 10, 1998, the court ordered us to publish proposed critical habitat designations or nondesignations for at least 100 species by November 30, 2000, and to publish proposed designations or nondesignations for the remaining 145 species by April 30, 2002 (*Conservation Council for Hawaii v. Babbitt*, 24 F. Supp. 2d 1074 (D. Haw. 1998)).

On November 30, 1998, we published a notice in the **Federal Register** requesting public comments on our reevaluation of whether designation of critical habitat is prudent for the 245 Hawaiian plants at issue (63 FR 65805). The comment period closed on March 1, 1999, and was reopened from March 24, 1999, to May 24, 1999 (64 FR 14209). We received more than 100 responses from individuals, non-profit organizations, the DOFAW, county governments, and Federal agencies (U.S. Department of Defense-Army, Navy, Air Force). Only a few responses offered

information on the status of individual plant species or on current management actions for one or more of the 245 Hawaiian plants. While some of the respondents expressed support for the designation of critical habitat for 245 Hawaiian plants, more than 80 percent opposed the designation of critical habitat for these plants. In general, these respondents opposed designation because they believed it would cause economic hardship, discourage cooperative projects, polarize relationships with hunters, or potentially increase trespass or vandalism on private lands. In addition, commenters also cited a lack of information on the biological and ecological needs of these plants which, they suggested, may lead to designation based on guesswork. The respondents who supported the designation of critical habitat cited that designation would provide a uniform protection plan for the Hawaiian Islands, promote funding for management of these plants, educate the public and State government, and protect partnerships with landowners and build trust.

On October 5, 1999, we contacted landowners on the islands of Kauai and Niihau, notifying them of our requirement to designate critical habitat for 95 plant species. We included a copy of the November 30, 1998, **Federal Register** notice, a map showing the general locations of the species that may be on his/her property, and a handout containing general information on critical habitat. We held three open houses on the island of Kauai, at the Waimea Community Center, the Kauai War Memorial Convention Hall in Lihue, and the Kilauea Neighborhood Center, on October 19, 20, and 21, 1999, respectively, to meet one-on-one with local landowners and other interested members of the public. In addition, we met with Kauai County DOFAW staff

and Kauai State Parks staff to discuss their management activities on Kauai.

On November 7, 2000, we published the first of the court-ordered proposed critical habitat designations or nondesignations for 76 Kauai and Niihau plants (65 FR 66808). The proposed critical habitat designations for Maui and Kahoolawe plants were published on December 18, 2000 (65 FR 79192), for Lanai plants on December 27, 2000 (65 FR 82086), and for Molokai plants on December 29, 2000 (65 FR 83158). All of these proposed rules had been sent to the **Federal Register** by or on November 30, 2000, as required by the court's order. In those proposals, we proposed that critical habitat was prudent for 85 species (*Adenophorus periens*, *Alectryon macrococcus*, *Alsinidendron lychnoides*, *Alsinidendron viscosum*, *Bonamia menziesii*, *Brighamia insignis*, *Centaurium sebaeoides*, *Chamaesyce halemanui*, *Ctenitis squamigera*, *Cyanea asarifolia*, *Cyanea recta*, *Cyanea remyi*, *Cyanea undulata*, *Cyperus trachysanthos*, *Cyrtandra cyaneoides*, *Cyrtandra limahuliensis*, *Delissea rhytidosperra*, *Delissea rivularis*, *Delissea undulata*, *Diellia erecta*, *Diellia pallida*, *Diplazium molokaiense*, *Dubautia latifolia*, *Dubautia pauciflorula*, *Euphorbia haelealeana*, *Exocarpos luteolus*, *Flueggea neowawraea*, *Gouania meyenii*, *Hedyotis cookiana*, *Hedyotis st.-johnii*, *Hesperomannia lydgatei*, *Hibiscadelphus woodii*, *Hibiscus brackenridgei*, *Hibiscus clayi*, *Hibiscus waimeae* ssp. *hannerae*, *Ischaemum byrone*, *Isodendron laurifolium*, *Isodendron longifolium*, *Kokia kauaiensis*, *Labordia lydgatei*, *Labordia tinifolia* var. *wahiawaensis*, *Lipochaeta fauriei*, *Lipochaeta micrantha*, *Lipochaeta waimeaensis*, *Lobelia niihauensis*, *Lysimachia filifolia*, *Mariscus pennatifolius*, *Melicope*

haupuensis, *Melicope knudsenii*, *Melicope pallida*, *Munroidendron racemosum*, *Myrsine linearifolia*, *Nothoecstrum peltatum*, *Panicum niuhauense*, *Peucedanum sandwicense*, *Phlegmariurus mannii*, *Phyllostegia knudsenii*, *Phyllostegia wawrana*, *Plantago princeps*, *Platanthera holochila*, *Poa mannii*, *Poa sandvicensis*, *Poa siphonoglossa*, *Pteralyxia kauaiensis*, *Remya kauaiensis*, *Remya montgomeryi*, *Schiedea apokremnos*, *Schiedea helleri*, *Schiedea kauaiensis*, *Schiedea membranacea*, *Schiedea nuttallii*, *Schiedea spergulina* var. *leiopoda*, *Schiedea spergulina* var. *spergulina*, *Schiedea stellarioides*, *Sesbania tomentosa*, *Silene lanceolata*, *Solanum sandwicense*, *Spermolepis hawaiiensis*, *Stenogyne campanulata*, *Vigna o-wahuensis*, *Viola helenae*, *Viola kauaiensis* var. *wahiawaensis*, *Wilkesia hobdyi*, *Xylosma crenatum*, and *Zanthoxylum hawaiiense*) that are reported from Kauai and/or Niihau as well as on Maui, Kahoolawe, Lanai, and Molokai. We proposed that critical habitat was not prudent for two species, *Phyllostegia waimeae* and *Melicope quadrangularis*, because they had not been seen recently in the wild, and no genetic material of these species was known to exist. We also proposed that critical habitat was not prudent for three species, *Pritchardia aylmer-robinsonii*, *Pritchardia napaliensis*, and *Pritchardia viscosa*, because it would increase the threat of vandalism to these species.

In the November 7, 2000 proposed rule, we proposed designation of critical habitat on approximately 24,539 ha (60,636 ac) of land on the islands of Kauai and Niihau. The publication of the proposed rule opened a 60-day public comment period, which closed on January 7, 2001. On January 18, 2001, we published a notice (66 FR 4782) announcing the reopening of the comment period until February 19, 2001, on the proposed rule and a notice of a public hearing. On February 6, 2001, we held a public hearing at the Radisson Kauai Beach Resort in Lihue, Kauai. On March 7, 2001, we published a notice (66 FR 13691) announcing the reopening of the comment period and the availability of the draft economic analysis for the proposed rule. This third public comment period was open until April 6, 2001.

On October 3, 2001, we submitted a joint stipulation with Earthjustice to the U.S. District Court requesting extension of the court order for the final rules to designate critical habitat for plants from Kauai and Niihau (July 30, 2002), Maui and Kahoolawe (August 23, 2002), Lanai (September 16, 2002), and Molokai

(October 16, 2002), citing the need to revise the proposals to incorporate or address new information and comments received during the comment periods. The joint stipulation was approved and ordered by the court on October 5, 2001.

On January 28, 2002, in the revised proposed rule, we published proposed prudency determinations for 95 plant species from Kauai and Niihau (67 FR 3940). Many of these proposed prudency determinations were incorporated from previous proposals. We also proposed that critical habitat is prudent for four species (*Achyranthes mutica*, *Isodendron pyriformium*, *Phlegmariurus nutans*, and *Solanum incompletum*) for which a prudency determination had not been made previously and that no longer occur on Kauai or Niihau but are reported from one or more of the other islands.

In addition, critical habitat for 83 (*Adenophorus periens*, *Alectryon macrococcus*, *Alsinidendron lychnoides*, *Alsinidendron viscosum*, *Bonania menziesii*, *Brighamia insignis*, *Centaurium sebaeoides*, *Chamaesyce halemanui*, *Ctenitis squamigera*, *Cyanea asarifolia*, *Cyanea recta*, *Cyanea remyi*, *Cyanea undulata*, *Cyperus trachysanthos*, *Cyrtandra cyaneoides*, *Cyrtandra limahuliensis*, *Delissea rhytidosperra*, *Delissea rivularis*, *Delissea undulata*, *Diellia erecta*, *Diellia pallida*, *Diplazium molokaiense*, *Dubautia latifolia*, *Dubautia pauciflora*, *Euphorbia haeleleana*, *Exocarpos luteolus*, *Flueggea neowawraea*, *Gouania meyenii*, *Hedyotis cookiana*, *Hedyotis st.-johnii*, *Hesperomannia lydgatei*, *Hibiscadelphus woodii*, *Hibiscus clayi*, *Hibiscus waimeae* ssp. *hannerae*, *Ischaemum byrone*, *Isodendron laurifolium*, *Isodendron longifolium*, *Kokia kauaiensis*, *Labordia lydgatei*, *Labordia tinifolia* var. *wahiawaensis*, *Lipochaeta fauriei*, *Lipochaeta micrantha*, *Lipochaeta waimeae*, *Lobelia niuhauensis*, *Lysimachia filifolia*, *Mariscus pennatifolius*, *Melicope haupuensis*, *Melicope knudsenii*, *Melicope pallida*, *Munroidendron racemosum*, *Myrsine linearifolia*, *Nothoecstrum peltatum*, *Panicum niuhauense*, *Peucedanum sandwicense*, *Phlegmariurus nutans*, *Phyllostegia knudsenii*, *Phyllostegia waimeae*, *Phyllostegia wawrana*, *Plantago princeps*, *Platanthera holochila*, *Poa mannii*, *Poa sandvicensis*, *Poa siphonoglossa*, *Pteralyxia kauaiensis*, *Remya kauaiensis*, *Remya montgomeryi*, *Schiedea apokremnos*, *Schiedea helleri*, *Schiedea kauaiensis*, *Schiedea membranacea*, *Schiedea nuttallii*, *Schiedea spergulina* var. *leiopoda*,

Schiedea spergulina var. *spergulina*, *Schiedea stellarioides*, *Sesbania tomentosa*, *Solanum sandwicense*, *Spermolepis hawaiiensis*, *Stenogyne campanulata*, *Viola helenae*, *Viola kauaiensis* var. *wahiawaensis*, *Wilkesia hobdyi*, *Xylosma crenatum*, and *Zanthoxylum hawaiiense*) of the 95 plant species was proposed on approximately 40,147 ha (99,206 ac) of land on Kauai and 282 ha (697ac) of land on Niihau (67 FR 3940). Critical habitat was not proposed for *Achyranthes mutica*, *Hibiscus brackenridgei*, *Phlegmariurus mannii*, *Silene lanceolata*, and *Solanum incompletum* on the island of Kauai and for *Isodendron pyriformium* and *Vigna o-wahuensis* on the island of Niihau because these plants no longer occur on Kauai or Niihau, and we were unable to identify habitat essential to their conservation on these two islands.

Because *Phyllostegia waimeae* had been rediscovered, we revised an earlier proposal to suggest that critical habitat would be prudent and propose critical habitat for this species in the revised proposed rule.

The publication of the revised proposed rule opened a 60-day public comment period, which closed on March 29, 2002. On February 11, 2002, we published a correction notice (67 FR 6214) correcting information contained in the January 28, 2002, revised proposal pertaining to the notice of a public hearing. On February 13, 2002, we held a public hearing at the Radisson Kauai Beach Resort in Lihue, Kauai. On May 28, 2002, we published a notice (67 FR 36851) announcing the availability of the draft economic analysis for the designation of critical habitat for 83 Kauai plants and reopening the public comment period until June 27, 2002. On August 26, 2002, we published a notice (67 FR 54766) reopening the public comment period until September 30, 2002. On July 11, 2002, we submitted joint stipulations with Earthjustice to the U.S. District Court 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 to conduct a series of public workshops on the proposals. The joint stipulations were approved and ordered by the court on July 12, 2002. On September 3 and 4,

2002, we held public meetings at the Waimea Community Center, Waimea, Kauai, and the War Memorial Convention Center, Lihue, Kauai, respectively.

On January 9, 2003, we determined that critical habitat was prudent for the following 15 species: *Adenophorus periens*, *Bonamia menziesii*, *Centaurium sebaeoides*, *Ctenitis squamigera*, *Cyperus trachysanthos*, *Diellia erecta*, *Diplazium molokaiense*, *Hibiscus brackenridgei*, *Isodendron pyriformium*, *Sesbania tomentosa*, *Silene lanceolata*, *Solanum incompletum*, *Spermolepis hawaiiensis*, *Vigna o-wahuensis* and *Zanthoxylum hawaiiense* (68 FR 1220), which also occur on Kauai or Niihau.

Summary of Comments and Recommendations

We received a total of 20 oral and 2,740 written comments during the three comment periods. These included responses from 7 State offices, 5 public officials, and 70 private organizations or individuals. Of the written comments, we received approximately 680 letters by facsimile and 1,998 electronic letters by e-mail, which stated general support for the proposed critical habitat designations, but that did not provide substantive comments. Of the other 82 comments, nine supported the designation, 60 were opposed to it, and 13 provided information but did not state a position on the designation. We reviewed all comments received for substantive issues and new information regarding critical habitat and the Kauai and Niihau plants. Similar comments were grouped into nine 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 23 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 incorporated into the final rule.

Issue 1: Biological Justification and Methodology

(1) *Comment:* One peer reviewer commented that there is no easy way to assess the match between the Service's proposed boundaries and the summation of habitat requirements of the individual taxa in each unit. Specifically, the intermediate step of indicating the species models for each of the listed taxa that is combined into the aggregate polygons that form the basis for the unit boundaries is not well documented. This leaves the reviewer with little basis to assess the match between habitat of the listed taxa and inclusion of such habitat in the critical habitat units. Species should be addressed individually, but the designation of conservation areas (or critical habitat) can and should consider the use of common areas to provide for multiple species. Another commenter stated that the Service's analysis has not demonstrated that inclusion of controversial areas has been minimized. There is no way to tell whether all of a given unit is necessary for that subset of taxa, which absolutely require the habitat found in that unit. The discussion of how each critical habitat unit provides for individual species helps one understand the reason for proposing the unit. However, additional information is needed in some instances (e.g., units J and N). The Service must justify every acre of land proposed for critical habitat designation, identify the specific species scheduled for recovery on that land, and explain why specific acreages are needed to do so.

Our Response: In response to these concerns, we have included the critical habitat maps and unit justifications for each species in the final rule, as well as descriptions of primary constituent elements and a composite map showing the overlap of the areas for all of the species combined.

(2) *Comment:* The majority of our peer reviewers agreed that the methodology is appropriate, scientifically well-grounded and conceptually sound. The approach of mapping the elevation, moisture, and habitat type for the listed taxa to the landscape is a sound approach to designating critical habitat. It seems that there is a good match of habitat identified long-term conservation of multiple populations of the listed species. The methodology uses information on species elevation range, vegetation type, associated species, physical location, and community type. It will allow the Service to revise or update habitat units as new information becomes available. This is more likely to provide habitat for

the recovery of these species. The proposed rulemaking represents the best scientific information available and is a scientifically appropriate technique for determining critical habitat on Kauai. On the other hand, some commenters felt that the proposed rule was an overly broad approach to designating critical habitat not based on scientific principles and knowledge of the needs of these plant species unique to the island State of Hawaii, but on litigation and the threat of future litigation. Additional consultation with academic and professional experts was recommended. 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 needs to allow peer review by a panel of unbiased scientists. Other commenters felt the data on which the proposed critical habitat is based is 30 years-old and may need updating. The proposed critical habitat covers too much acreage and was put together too quickly, using obsolete data, sloppy science, and lots of guess work.

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 designation methodology of critical habitat of Kauai 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 the peer reviewers support our methodology. All data and information on species status received in preparation of this rule was equally weighted and considered to come from reliable sources. Where

discrepancies existed between different data sources, the most current data were used. Changes in this final rule that decrease the boundaries of many units are based on additional information received during the public comment period and in meetings with additional species experts and land managers who were not available for comment during the preparation of the proposals. The changes in boundaries reflected in this final rule are based on additional information about areas lacking primary constituent elements or those that are too degraded to be restored. While we agree that additional time would be beneficial for the preparation of these final rules, we are required under the court-approved stipulation to finalize this designation by January 31, 2003. If provided with new information, we may revise the critical habitat designation in the future.

(3) *Comment:* One peer reviewer asked if the Service considered modeling the potential distribution based on known habitat correlates, as in Elith and Burgman (2002). Another peer reviewer stated that the Service should use spatial modeling of estimated values of selected habitat parameters for each species (such as elevation, median annual rainfall, vegetation units) as a first step in the process, rather than screen-digitizing. Some of the data on primary constituent elements (e.g., breeding system, dispersal mechanisms) can be inferred from similar species, but other pieces of critical information may not be currently available and should be the subject of further research. After the preliminary habitat polygons are identified, historic range can be determined either objectively or subjectively based on the known location points for a particular species. The steps going from narrative descriptions of habitat elements to geographical units are not well documented. The Service should elaborate on its methodology for defining the primary constituent elements for each species and the subsequent critical habitat.

Our Response: We agree that modeling of potential distribution within historic range is important, and have used this type of modeling, based on the limited available information. We did not feel that valid habitat parameters for each species could be developed without first digitizing known current and historic range and using that information, along with available digitized information on elevation, rainfall, and vegetation units, to determine potential habitat. Using the information from existing and historically known plant locations, we

used available digitized information on elevation, rainfall, and vegetation units, as well as advice from species experts, to model the potentially suitable habitat for each species. The critical habitat designated is the subset of suitable habitat that was determined to be essential to the conservation of each species (see the "Methods" section for more detail).

(4) *Comment:* Some reviewers commented that deletion of significant portions of any of the proposed critical 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 can't be maintained. The new proposal indicates that a wide range of habitats are covered in the areas proposed by the Service as critical habitat units. Units have been expanded to provide contiguous blocks of habitat that will reduce fragmentation and edge effects and are large enough to offer a variety of microsites. This will also improve the ability of listed species to maintain gene flow, reestablish populations following population declines or catastrophes, and to colonize new areas. However, the amount of dry and mesic forest included in proposed critical habitat is still very limited. Protecting critical habitat is essential not only for the recovery of threatened and endangered plant species, but also to protect the ecosystems on which these species rely for their long-term survival and recovery. Management actions for critical habitat need to allow for the expansion of populations and include the ecological matrix in which critical habitat is embedded. It is important that the adjacent noncritical habitat areas be managed for control or elimination of nonnative species, if recovery is to be achieved for the areas of less than 1,000 acres. On the other hand, some commenters felt that the increase in acreage from the first to the second proposal was the Service's attempt to get the community to be willing to go back to the original proposal. One commenter asked what the Service would do if newly obtained, good quality, scientific information proves the current best scientific knowledge is totally inaccurate.

Our Response: The Act requires us to use the best available scientific and commercial information 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 many areas were not essential for the conservation of the Kauai plant species, based on newly available information

concerning status of the species in specific areas and level 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. We determined them to be non-essential due to their lacking primary constituent elements, or having primary constituent elements but 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 Revised Proposed Rule" section for the justification for each unit's changes.

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 for each species. We concur on 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 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 critical habitat, and making them larger would add areas that lack the primary constituent elements. All of the changes in critical habitat from the first proposal, through the second, to this final, are based on the best available information received during comment periods, and are based on biological issues, not political or social issues. If new information becomes available indicating the existing critical habitat designations are not essential for the conservation of the species and/or that other areas are, we may propose revised designations for those species at that time.

(5) *Comment:* Critical habitat designation should be primarily directed toward areas that are currently being intensively managed or may be the subject of conservation agreements in the future for those species that are known to naturally occur in these habitats. A suggested method is that once realistic management units have been identified based on the management factors to address limiting factors (e.g. fence lines, fire control), the

next step is to see how many distinct populations of each plant species exists or can be established within those units to meet the species overall habitat needs to support eight to ten populations. Only after this analysis has been made and found to be lacking, would you start looking outside these management units for other lands needed. The commenter believes that this approach not only meets the legal requirements for critical habitat designation, but provides the best approach for recovery of the species.

Our Response: We agree that managed areas containing current or historic populations are vitally important to the conservation of the species, and have included managed areas on Kauai with appropriate primary constituent elements in critical habitat. Managed lands are not included only if management is sufficient to demonstrate that special management considerations or protection are not required, pursuant to 16 U.S.C. 1532(5)(A)(i). See "Managed Lands." However, these areas alone or in conjunction with other areas that may be managed in the future do not include all of the habitat essential for the Kauai and Niihau species. Therefore, we have designated these managed areas along with additional areas outside of managed units as critical habitat. In our final analysis, for each species, we ranked areas of the proposed critical habitat by the quality of the primary constituent elements, potential as a recovery area, and current or expected management of known threats. Areas that contain high quality primary constituent elements, are zoned for conservation, and have on-going or expected threat abatement actions were given high ranks. Of these highly-ranked areas, we selected adequate area for 8 to 10 populations distributed among the islands of each species' historical range. Of the proposed critical habitat for a species, areas that were not highly ranked and that may provide habitat for populations above the recovery goal of 8 to 10, were determined not essential for the conservation of the species and were excluded from the final designation (see "Criteria Used to Identify Critical Habitat").

(6) *Comment:* Designate critical habitat for Federal lands only.

Our Response: Federal lands on the island of Kauai include the Navy's Pacific Missile Range Facility (PMRF) at Barking Sands and Makaha Ridge and the Service's Kilauea Point National Wildlife Refuge, Hanalei National Wildlife Refuge, and Huleia National Wildlife Refuge. In this final rule, we are designating critical habitat for *Panicum niihauense* at Barking Sands,

as this dune habitat is essential for the conservation of this species. This dune habitat is not essential for the conservation of the other 82 species at issue on Kauai. In this final rule, we are not designating critical habitat for *Wilkesia hobdyi* at Makaha Ridge, as this habitat is not essential for the conservation of this species. This habitat is not essential for the conservation of the other 82 species at issue on Kauai. None of the 83 species at issue on Kauai are known currently or historically from the Service's refuges at Kilauea Point, Hanalei, or Huleia, and these Federal lands are not essential for the conservation of the 83 species at issue on Kauai.

(7) *Comment:* The Service cannot lawfully exclude areas from critical habitat based on a finding that they currently are adequately managed or protected. To do so would violate the mandatory duty to designate critical habitat to the maximum extent prudent and determinable. The commenter urges the Service not to exclude any areas from designation on this basis (already managed or protected), since doing so would violate the mandatory duty to designate critical habitat "to the maximum extent prudent and determinable."

Our Response: We disagree as "special management considerations or protection" is part of the definition of critical habitat and must be given meaning when designating critical habitat. Specifically, we believe that adequate special management consideration or protection could be provided by a legally operative plan or agreement that addresses the maintenance and improvement of the primary constituent elements important to the species and manages for the long-term conservation of the species. However, for this designation we did not identify essential habitat features that already have adequate management and would not be included on that basis.

(8) *Comment:* Several commenters supported the Hawaii Division of Forestry and Wildlife proposal for designating critical habitat on existing managed areas as these areas are where the limiting factors for species conservation can be addressed. Furthermore, one landowner noted that a large portion of his/her lands are managed by the Hawaii Division of Forestry and Wildlife.

Our Response: We agree that the State DOFAW staff have valuable on the ground experience and scientific information that has been essential to our critical habitat decision making process. However, we did not adopt

DOFAW's first proposal (January 11, 2001) as it did not adequately address all of the conservation needs of the species in accordance with the Act. After publication of the January 28, 2002, revised proposed critical habitat rule, we met several times with Kauai DOFAW staff and conducted several site assessment surveys. As a result of the assessment surveys and information provided to us by Kauai DOFAW staff, we were able to better identify areas that did not contain primary constituent elements. In addition, we received important information from Kauai DOFAW staff that enabled us to refine the final critical habitat designations to better meet the conservation needs of the species.

(9) *Comment:* One commenter stated that it is extremely difficult to come up with a biologically sound definition of a population that can be realistically applied to the distribution and abundance of a rare species in the wild. However, the commenter noted that defining separate populations as being more than 1,000 meters apart is both biologically meaningful and operationally useful and serves as the focus of the Army's species stabilization efforts in the Waianae Mountains of Oahu. A commenter noted that the separation distance of 1,000 meters is probably adequate for most small-scale disturbance events, but will be inadequate for large-scale disturbances. The problem of defining populations requires knowledge of gene-flow patterns. The commenter recognizes that the proposed targets for population recovery are initial and not derived from any detailed understanding of genetic architecture. The commenter recommends altering these objectives, but would suggest that the Service state the need for more studies on population genetics. In addition, the targets present a demographic challenge to achieve a population of 100 mature individuals and will require massive plantings to counteract mortality. These practical challenges should be made clear.

Our Response: We agree that the operational definition of 1,000 meters between separate populations is adequate in the absence of information on the specific biological requirements of a population for each species. The need for genetic and demographic studies and the understanding of challenges to reintroduction are addressed in the species' recovery plans.

(10) *Comment:* Many commenters stated that a multi-population approach is essential for the conservation of many of the rare Hawaiian plant species, since the purpose of critical habitat and

recovery in general is to eventually have wild populations that are self-sustaining and no longer in need of protection under the Act. The strongest argument for this strategy is the fact that these populations are subject to many types of catastrophic events, ranging from widespread phenomena such as hurricanes, wildfire, or ungulates, to localized events like landslides, predators, or even disease outbreaks. The multi-population approach offers the opportunity to protect wider latitude of genetic variability for the species as a whole, rather than concentrating on a single or small number of areas with genetically more similar individuals. The Service's use of Hawaii and Pacific Plant Recovery Coordinating Committee (HPPRCC) guidelines for population size and numbers of populations needed to maintain Hawaiian plant taxa are probably the best general guide, since the general tenets of minimum viable population size and numbers are not defined for Hawaiian taxa. The targets (8 to 10 from 100 to 500) used in the critical habitat designations are generally lower than those used by the HPPRCC to identify essential habitat for listed plants and should be considered as the "low end" of what is likely needed for recovery.

Our Response: We agree that the multi-population approach to conservation is necessary for the recovery of Hawaii's endangered plants. We have used the lower end of the HPPRCC guidelines, as that is what the Service believes is essential to the conservation of the species, based on the current conservation literature (see "Criteria Used to Identify Critical Habitat" section).

(11) *Comment:* Two peer reviewers stated that just because a species is found in a certain habitat now does not mean that this habitat is the best place for it to thrive and reproduce. For example, repeated references to steep slopes as being primary constituent elements of critical habitat should not be construed as representing optimum habitat; they are likely remnant populations. The current distribution of a species today may not be a good indication of its optimal habitat, for example dry and mesic forest plants that are historically known only from lowland areas and not high elevation areas (where relatively more complete data are found); areas that were extremely degraded before good records were kept on species distribution and habitat needs.

Our Response: Our regulations state that the Secretary shall designate as critical habitat areas outside the geographical area presently occupied by

a species only when a designation limited to its present range would be inadequate to ensure the conservation of the species. In our designation, we used the best scientific and commercial data available, both historic and current, from a variety of sources (see "Methods" section) to specify any particular area as critical habitat (section 4(b)(2) of the Act) and to determine the physical or biological features essential to the conservation of the species (section 3(5)(A) of the Act). As pointed out by reviewers, biological information is extremely limited for many species, and therefore the only information available may indicate the species is restricted to a particular topography, soil or forest type. No critical habitat was designated for a species outside of its known historic range or known suitable habitat.

(12) *Comment:* Several comments were received in support of the designation of unoccupied habitat. Unoccupied habitat within critical habitat is important for natural dispersal of plant populations beyond their current distribution as well as providing sites for reintroduction of new populations if needed. The biological needs of the species are well enough known to warrant the protection of unoccupied habitat. These unoccupied areas will be especially important to dry and mesic forest species. Protecting unoccupied habitat is essential since currently occupied areas are inadequate for recovery. On the other hand, several comments were also received against the designation of unoccupied habitat. Some felt that at least 70 percent of the proposed critical habitat is not really habitat at all, in that it is not inhabited by any of the species but is unoccupied. Because there is no data to show that excluding these areas will result in the extinction of the species, the Service should omit them from consideration. Several areas do not contain listed species or do not contain records of historic sightings and so do not appear to be warranted as essential for the conservation of any species. The lands that could be excluded from critical habitat without causing the species to go extinct include Unit D1, D2, N, L, and private lands. Other commenters were concerned that it is difficult for the Service to justify its expanded proposed designation if it does not know what physical and biological features are essential to the species' growth, germination or methods of seed dispersal as required by its own rules. The vast majority of the proposed areas are presently unoccupied by the species in question and their successful

introduction to and survival in these areas is speculative. These commenters believe that the first proposed designation was correct.

Our Response: Our recovery plans for these species (Service 1994, 1995, 1996, 1997, 1998a, 1998b, 1998c, 1999) identify the need to expand existing populations and reestablish wild populations within historic range. We have revised the designated critical habitat in the final rule to incorporate new information and/or address comments and new information received during the comment periods, including information on areas of potentially suitable unoccupied habitat for some of these species. Many of the units have been reduced based on this newly available information. However, for most of the species, there are not enough existing populations and most of them are not currently viable. While they may continue to exist at their current low numbers until a catastrophic event causes their extinction, the Service's goal, as stated in section 2(b) of the Act, is to recover the species. Therefore, the protection of additional unoccupied critical habitat is essential to ensure the recovery of these species through reintroduction. We also realize that, although propagation and reintroduction are difficult for some species, both are vitally important to their recovery. Many recovery plans therefore include research into best methods of propagation and reintroduction as important tasks prior to attempting reintroduction.

(13) *Comment:* Some commenters stated that good quality habitat should be designated in lieu of more degraded habitat. However, degraded areas should only be excluded from proposed critical habitat if they lack the ability to become habitat in the future. On the other hand, some commenters said that they see little on-the-ground logic to defend designations of unoccupied habitat and believe the Service must have other strategies rather than just carving out land areas, especially in highly degraded or altered habitats. In some instances, all potential habitats for a species have been degraded to the point that alien species dominate the site. Recovery efforts in these situations need to include both species management, coupled with habitat restoration efforts.

Our Response: We agree that recovery of a species is more likely in higher quality habitat containing the physical or biological features essential to the conservation of the species. To this end, several units have been excluded for some species, as sufficient area is available in less degraded areas. However, for some species, particularly

those only known from low elevation areas, only degraded habitat remains. Therefore, some units still contain degraded habitat, but only if experts agreed that the areas could be restored. Management for the restoration of these habitats is addressed in the species' recovery plans.

(14) *Comment:* The recovery effort in Hawaii will not be effective without a well-developed and implemented management strategy. The designation of critical habitat without adequate management does not necessarily ensure benefit or recovery to a plant species. Some of the critical habitat units cannot sustain the projected recovered populations at current levels of habitat management and investment. Control of key threats such as feral ungulates, alien weeds, and wild fires is crucial to the recovery of listed plants. Alien species are significant problem that need to be addressed in order to be effective in the conservation of Hawaiian plants and animals. However, the land managers have not been able to control some invasive weeds, such as banana poka and lantana. There are workable methodologies for dealing with some of the factors that affect listed species and critical habitat (e.g., fencing and removal of ungulates). For other factors, such as lost pollinators, dispersers, or climate change, effective and appropriate techniques are still being sought. However, from a practical standpoint, if efforts to save threatened and endangered species were dependent on full knowledge of all factors relating to their survival, few if any would have a chance. This lack of knowledge or control tools should not be a reason to give up on recovery efforts for the native species that are affected. Waiting for all factors to be identified and validated would perpetuate current levels of habitat loss and/or management inaction.

Our Response: Critical habitat designation is one of a number of conservation tools established in the Act that can play an important role in the recovery of the species, and the Service is directed to designate critical habitat based on the best available scientific and commercial information. The management of alien species is an important conservation issue that is addressed in the recovery plans for these species. Other, less understood issues are identified in the recovery plans as requiring research to determine appropriate actions. The Service's role in the recovery of these species is to work with other agencies, organizations, and individuals to coordinate the implementation of the recovery plans in a strategic manner.

(15) *Comment:* "Reduced reproductive vigor due to small numbers of extant individuals" or inbreeding depression should not be cited as potential problems unless species-specific information is available. Hawaii's endangered species are biologically incompetent, and totally unable to repopulate the vast areas you are proposing as critical habitat. They should just be grown in a garden setting, since that is the only way they will survive. Extinction is a natural part of evolution.

Our Response: We are required under section 4 of the Act to designate critical habitat based on the best available information we have at the time of designation. In addition, we are directed by the Act to recover the species and the ecosystems on which they depend, not just preserve them in a horticulture facility. We realize that designation of critical habitat alone will not achieve recovery. 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. We also realize that management of the habitat is essential to the species' recovery. All of these issues are addressed in the species' recovery plans. And, while extinction is a natural part of evolution, there are numerous references in the conservation literature that the rate of extinction today is unprecedented.

(16) *Comment:* It should be noted that in many cases disturbance has been shown to contribute to the survival of species when it occurs at an appropriate level and at appropriate intervals.

Our Response: For some species it may be true that disturbance was a natural process that may have benefitted the species in the past. Today, however, many listed species are greatly reduced in numbers and occur in fragmented habitats that have been highly altered by alien species, to the point that the natural disturbance process is no longer present. When disturbances, such as hurricanes, do occur now, the most likely result is an increase in alien species, rather than native habitat. In addition, the small numbers of remaining individuals in greatly reduced ranges are far more vulnerable

to extinction from one disturbance event, whether natural or human-caused.

(17) *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 proposal. The following endangered plant species lack critical habitat on Kauai and/or Niihau: *Caesalpinia kavaiensis*, *Haplostachys haplostachya*, *Hibiscadelphus distans*, *Marsilea villosa*, and *Scaevola coriacea*.

Our Response: These species were not part of the lawsuit and subsequent stipulations, and therefore were not included in this rulemaking. Critical habitat for these species may be considered in the future if warranted and funding and resources are available.

(18) *Comment:* One peer reviewer stated that the Service did consider the entire range of plants found on multiple islands, particularly since they are going through the same process of designation of critical habitat on all of the Hawaiian Islands. On the other hand, some commenters stated that the revised proposal's treatment of "multi-island" plants historically, but not currently, found on Kauai or Niihau makes it impossible to determine whether the Service is complying with its statutory duty to identify adequate habitat for these species' recovery. By proposing critical habitat island-by-island, rather than species-by-species, there is no way for reviewers to know what areas statewide ultimately will be proposed for the multi-island species. The revised proposal's treatment of "multi-island" plants historically, but not currently, found on Kauai or Niihau makes it impossible to determine whether the Service is complying with its statutory duty to identify adequate habitat for these species' recovery.

Our Response: In response to this concern, the Service reopened the comment periods for the proposed designations and nondesignations of critical habitat for plant species on the islands of Kauai, Niihau, Molokai, Maui, Kahoolawe, northwestern Hawaiian Islands, Hawaii, and Oahu after these proposals were published. This comment period, which was open from August 26, 2002 to September 30, 2002, allowed all interested parties to submit written comments on these proposals simultaneously and address issues associated with multi-island species.

(19) *Comment:* The boundaries of critical habitat should follow elevation contours, ridge lines, and other natural

features that naturally delineate the units, rather than long, straight-line segments.

Our Response: The boundaries of the proposed critical habitat designations were generalized for ease of mapping. With this final rule, the new units are separately mapped for each species and are more true to the elevation contours, the distribution of habitat, and other natural features.

(20) *Comment:* The agricultural and grazing lands proposed for designation will never contribute to the conservation of these species, they are certainly not essential, and it is doubtful that listed species still occur on these lands.

Our Response: When delineating critical habitat units, we made an effort to avoid developed areas such as towns, agricultural lands, and other lands with similar features that do not contain the primary constituent elements. Less than one percent of the critical habitat designated in this final rule is within lands districted as agricultural lands, with most of the designated critical habitat in lands districted as conservation lands. However, some species, such as *Ischaemum byrone* and *Sesbania tomentosa*, only occur in low elevation areas where agriculture is most common, and enough habitat necessary for the conservation of the species that contains some of the primary constituent elements and can be restored to have all of the primary constituent elements is not available outside of agriculturally zoned lands.

(21) *Comment:* One commenter asked if "historical" equals post-Polynesian, or post-European, or is it defined by the prevailing climate. The dates of population extirpations should be provided (e.g., *Delissea rhytidosperra*). These dates are important in defining "historical" sightings.

Our Response: The Service's definition of the term "historical" is any plant location information gathered prior to the 1970s. The term does not refer to post-Polynesian or post-European time periods, and is not defined by the prevailing climate. Documented botanical collections in the Hawaiian Islands began in the late 1700s and continued intermittently through the early half of the 20th century. In the early 1970's there was a renaissance in Hawaiian botanical surveys that continues today. This included the establishment of several botanical gardens (e.g. National Tropical Arboretum in the early 1970s), which have served as an important source of information on native plant species status and locations. The passage of the

National Environmental Policy Act in 1969 also encouraged increased surveys of areas as part of the EA/EIS process and thus provided support for private contract botanists whose work entered the public arena as addenda to EAs and EISs. This invigorated effort to document the occurrences of Hawaiian plants was also accompanied by observations on the loss of plant populations from previously known locations due to habitat loss and impacts of free ranging ungulates. These observations lead to a more regular documentation of the causes of decline of Hawaiian plants. Prior to the 1970s, such impacts were rarely recorded even though declines in Hawaiian plant populations were noted. Also at this time there was a growing national recognition that species of plants and animals were being threatened by extinction due to human activities. This concern led to the passage of the U.S. Endangered Species Act in 1973.

(22) *Comment:* *Phlegmariurus nutans* has survived for at least a century without having any habitat on Kauai. If these plants could grow or be cultivated anywhere else, the designated area is not essential. Designating more such areas as critical habitat would not improve that species' chances of survival. Much of the area that would be restricted from human use by the critical habitat designation may be useless to the species that the Service is trying to protect. Four of the plants have not been seen in more than 30 years, and two others were reported as having been seen within the past 30 years on Kauai. Critical habitat should only be designated for areas that host existing populations of the designated species. If a species is gone from an area, it could mean that the designated area is no longer ideally suited to support that species for one reason or another (water table may have changed, ground may have become more saline, animal or insect encroachment, etc.) so no matter what actions are prescribed, the species will most likely not return and successfully thrive in that environment. A critical habitat area should not be designated for a species that does not already live in it if there is no reasonable way for the species to get to that area under its own power. If it has to be artificially transported, then that area should not be designated. On the other hand, two of the plaintiffs supported the Service's inclusion of critical habitat designation for seven species not currently known from Kauai: *Ctenitis squamigera*, *Diellia erecta*, *Diplazium molokaiense*, *Ischaemum byrone*, *Mariscus*

pennatiformis, *Phlegmariurus nutans*, and *Phyllostegia waimeae*.

Our Response: We designated critical habitat for those species not recently seen on Kauai only if historic information was available on the primary constituent elements for those species on Kauai and if such areas still exist with those primary constituent elements or in which the primary constituent elements can be restored. We agree that the species will most likely not disperse to these sites under natural circumstances, because the intervening areas are often not suitable habitat for the species or have become too degraded, or because the pollinator may be lacking in those areas. Therefore, recovery plans include propagation and reintroduction into currently unoccupied but historical habitat. While not all designated critical habitat may contain all the primary constituent elements in their present condition, we believe that they can be restored with management actions.

(23) *Comment:* The Service has undertaken a detailed evaluation of the proposed critical habitat areas on State lands on Kauai to assess how much of the unoccupied habitat is really essential and which lands can be effectively managed for the benefit of the species. The Service should extend its evaluation to private land and land on other islands.

Our Response: We agree, and have met with any landowner who has requested to discuss and visit their lands. Many of those discussions have resulted in changes to some of the critical habitat units, as described in the "Summary of Changes from the Revised Proposed Rule" section.

(24) *Comment:* The hunters, hikers, and local people are the first line resources in protecting these plants, and at no cost to the government. Spend Federal monies to educate and teach the local people, rather than on critical habitat designation.

Our Response: We agree that the local people are an excellent resource to aid in the management of endangered species. For example, the Service has funded for several years a weed control project in the Kokee area of Kauai which operates largely on local volunteer efforts. While these management efforts are extremely beneficial for endangered species protection, section 4 of the Act still requires the Service to designate critical habitat.

(25) *Comment:* The statement that designating critical habitat would not provide significant benefits to the *Pritchardia* species is flawed because critical habitat designation would help them to recover to a non-imperiled

status. The Service did not base its original "not prudent" finding on the likelihood that designation would increase threats, as it now attempts to do. Nor does it explain why designating critical habitat on the privately owned island of Niihau would increase collecting beyond current levels.

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. We have revised critical habitat designations based on additional information received during comment periods. However, 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 these three species of *Pritchardia*.

(26) *Comment:* The revised proposal identifies as critical habitat only the habitat that *Hibiscus clayi* currently occupies, despite the Service biologist's concession that this area alone is inadequate to support the recovery of the species.

Our Response: We agree that the area proposed as critical habitat for *Hibiscus clayi* is inadequate for the recovery of the species. During the public comment period, we received additional information, and have designated five other units of critical habitat for this species within the previously proposed unit M (now Unit 4), based on the presence of primary constituent elements. Habitat has been designated for six populations, however we do not have information on other locations or additional areas that are suitable or essential for this species.

(27) *Comment:* The expansion of the area in the revised proposal raises concerns about the limited data used in the mapping process.

Our Response: When developing the proposal to designate critical habitat for 83 plants from Kauai and Niihau, we used the best scientific and commercial data available, including but not limited to, information from 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; the final listing rules for these species; information received at the three informational open houses held on Kauai at the Waimea Community Center, the Kauai War Memorial Convention Hall in Lihue, and the Kilauea Neighborhood Center, on October 19 to 21, 1999, respectively; recent biological surveys and reports; our recovery plans for these species; information received in response to outreach materials and requests for species and management information we sent to all landowners, land managers, and interested parties on the islands of Kauai and Niihau; discussions with botanical experts; recommendations from the Hawaii Pacific Plant Recovery Coordinating Committee (HPPRCC) (Service 1994, 1995, 1996, 1997, 1998a, 1998b, 1998c, 1999; HPPRCC 1998; HINHP Database 2000; CPC *in litt.* 1999); Geographic Information System (GIS) coverages (e.g. vegetation, soils, annual rainfall, elevation contours, land ownership); new information; completed recovery plans; and information received during the public comment periods and public hearings.

(28) *Comment:* What would make sense is for the Service to develop a plan for human intervention, including the required funding, and then designate selected areas as critical habitat.

Our Response: Recovery plans, in which human intervention actions are recommended for the conservation of all of the 83 plants that are the subject of this critical habitat rulemaking, have already been developed (Service 1994, 1995, 1996, 1997, 1998a, 1998b, 1998c, 1999). In the recovery plans we identified habitat areas deemed essential to the recovery of these plant species and referred to these areas during our development of the critical habitat designations.

(29) *Comment:* The designation of critical habitat in unoccupied habitat is particularly important, since this may be the only mechanism available to ensure that Federal actions do not eliminate the habitat needed for the survival and recovery of extremely endangered species.

Our Response: We agree. Our recovery plans for these species (Service 1994, 1995, 1996, 1997, 1998a, 1998b, 1998c, 1999) identify the need to expand existing populations and reestablish wild populations within historic range.

(30) *Comment:* There cannot be adequate assessment of possible impacts by a proposed Federal action to a species that is not there any more. Such

an assessment is impossible without a total analysis of why a plant species no longer occurs in a region.

Our Response: In cases where a proposed Federal action takes place in unoccupied critical habitat, we will assess whether the proposed action is likely to destroy or adversely modify the primary constituent elements that are needed for the future conservation of the species in question. If we find that the proposed action will appreciably diminish the habitat's value for both survival and recovery of the species, we will recommend reasonable and prudent alternatives.

Issue 2: Site-Specific Biological Comments

(31) *Comment:* The proposed rule could and should have included a more detailed discussion of why the revision included an expansion of critical habitat units in northwestern Kauai (i.e., units O and I).

Our Response: We agree that a more detailed discussion of why areas are included and excluded from each unit would be helpful. Therefore, in "Summary of Changes from the Revised Proposed Rule" section, we have given detailed descriptions for each species of why the units have changed.

(32) *Comment:* Unit D does not contain any listed species and so does not appear to be warranted as essential for the conservation of the species. Areas in units D1, D2, and E that do not contain the primary constituent elements should be remapped in the final rule. The critical habitat area on the beach was proposed to be limited to the dunes on the southern portion of the parcel, to what is commonly known as "Long Beach." The lower slopes of the Haupu range and the Kipu/Kipukai/Hoary Head range in Unit E are covered by *Eucalypts robusta*, *Melaleuca*, *Grevillea*, *Casuarina*, mango, Java plum, catclaw vine, *Rhodomyrtus*, *Ficus benjamina*, and other introduced plants and animals, especially below 1,500 feet elevation. These areas do not contain suitable habitat for listed species and should not be critical habitat.

Our Response: We agree that proposed unit D1 is not essential for the conservation of *Sesbania tomentosa*, and have excluded it from critical habitat designation. We agree that parts of proposed units D2 and E do not contain the physical and biological features essential to the conservation of *Brighamia insignis*, *Delissea rhytidosperma*, *Isodendron longifolium*, *Lipochaeta micrantha*, *Melicope haupuensis*, *Munroidendron racemosum*, *Myrsine linearifolia*, *Peucedanum sandwicense*, *Pteralyxia*

kauaiensis and *Schiedea nuttallii* and have modified these proposed units to exclude areas which are not essential to the conservation of these species.

(33) *Comment*: From the large scale map of the proposed area on Niihau provided in the Department of the Interior correspondence it is impossible to determine the exact boundaries of the proposed critical habitat. The commenter felt that creating this entity on Niihau is somewhat arbitrary.

Our Response: More detailed maps are available on request (see **ADDRESSES** section). We used the best available information to determine these boundaries, and based on new information made available during the comment period, *Cyperus trachysanthos* was removed from the low, wetland area of Niihau. More appropriate habitat to reach our recovery goals was available on other islands in areas that are less degraded and already being managed for conservation. However, *Brighamia insignis* needed more critical habitat than was available on Kauai, the only other island on which it is currently or historically known.

(34) *Comment*: It is unclear why the areas between Wahiawa Bog and Waialeale (unit N) or the central portion of unit J are necessary for either connectivity purposes or as needed unoccupied habitat. While these areas may be in a relatively good condition and may benefit other listed species (such as forest birds), it is not clear what additional value they contribute to listed plants. It is unclear why some critical habitat units (L, J, and N) need to be so large. The portion of this unit between Wahiawa Bog and Waialeale should be re-evaluated to clarify its value to target plant species. Portions of the wet forest in Unit J may potentially be deleted without compromising the recovery of target plant species. The landowner questioned the new information available for designating the entire Wainiha Valley as critical habitat. At minimum, the proposed critical habitat in Wainiha Valley should be restricted to the upper portion of the valley where occupied endangered plant habitat has been identified. This area is not an inconsiderable amount and may be sufficient to provide for any additional unoccupied habitat necessary for the conservation of the affected species.

Our Response: We agree, and have modified the units L, J, and N to exclude areas without primary constituent elements, including the lower reaches of Wainiha Valley. Other more intact areas are being designated on Kauai or proposed on other islands for those species as identified in the "Summary

of Changes from the Revised Proposed Rule" section.

(35) *Comment*: If Wainiha is excluded from critical habitat designation, the entire ecosystem would receive protection. The Nature Conservancy of Hawaii (TNCH) would work with partners from the National Tropical Botanical Garden and the Service concerning the area, including specific endangered species habitat protection. In addition, the landowner may enter into a perpetual conservation easement with TNCH and support species management on a long term basis. On the other hand, designating Wainiha as critical habitat will likely bring about actions detrimental to the preservation of the area and its endangered species. The landowner may react to critical habitat designation by closing up all access to the valleys for survey and data collection, conservation efforts, and management of endangered species.

Our response: We have evaluated the proposed critical habitat for the species in Wainiha Valley and have reduced the area based on the biological needs of the species and their recovery goals (see "Summary of Changes from the Revised Proposed Rule: Kauai J").

(36) *Comment*: No information is available, currently or historically, for the designation of critical habitat in the lower elevation areas of unit M. Because none of these species currently exist on the land, based on a survey by a botanical consultant in 1998, there is seemingly no reason to believe that excluding the area would lead to their extinction. The landowner is unaware of any other reliable scientific data on this area and is unaware of any attempts by the Service to enter the property to gather such data.

Our Response: We have revised the units for the species in unit M to eliminate much of the area in the lower elevations of unit M to exclude areas without primary constituent elements, based on new information received during the public comment period. In addition, other more intact areas are being designated or proposed on Kauai or on other islands for those species as identified in the "Summary of Changes from the Revised Proposed Rule" section.

(37) *Comment*: Some areas of Unit O are overgrown with Java plum, monkeypod or kukui and have no endangered plant species and should not be designated as critical habitat.

Our Response: We agree, and have modified the units to exclude areas without primary constituent elements. Other more intact areas are being designated or proposed on Kauai or on other islands for those species as

identified in the "Summary of Changes from the Revised Proposed Rule" section.

(38) *Comment*: There is no indication that the Navy parcels are, in fact, critical to the survival of these species. The military has numerous structures and activities that are within proposed critical habitat but are unsuitable for listed species. Without confirmation of an actual link between these specific areas and the survival of *Panicum niihauense* or *Wilkesia hobdyi*, designation of these areas as critical habitat would be imprudent. The following should be removed from the critical habitat designation: a 750 buffer area from the center of the runway; which is continually mowed, restrooms, pavilion, and unpaved parking area at Majors Bay Recreation Area; the antennae fields and associated ground radial systems, which are continually mowed; Amphibious Assault Training/RIMPAC Staging Area that disturb the vegetation and substrate; other structures such as buildings, roads, aqueducts, telecommunications equipment, telemetry antennae, radars, missile launch sites, and other manmade features; ground hazard areas established as safety zones around each missile launch site and launch pads; northernmost property line where "Smokey SAMs" are launched; other planned launch sites; Boresighting Tower, which is continually mowed; Borrow Pit site, which is mined; Composting Facility; and the Small Arms Firing Range and Construction Debris Stockpile, which will require the removal of vegetation and sand.

Our Response: We have had numerous discussions with the Navy regarding these areas, and as a result, have removed some sections of the units for these species, based on the lack of primary constituent elements. However, other areas could not be excluded because they do contain the primary constituent elements for these species, as described for each in the "Hawaiian plants—Constituent elements" section. These areas are necessary for the recovery of the species, and not enough other areas are available containing these primary constituent elements outside of the PMRF.

(39) *Comment*: The Navy has recently completed and begun implementing their Integrated Natural Resources Management Plan (INRMP) for the Pacific Missile Range Facility (PMRF). The Service has indicated an apparent willingness to reassess the critical habitat boundaries in light of this INRMP.

Our Response: We have reviewed the existing INRMP for PMRF. It is currently