

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018-AB56

Endangered and Threatened Wildlife and Plants; Determination of Endangered of Threatened Status for 15 Plants From the Island of Maui, HI

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The U.S. Fish and Wildlife Service (Service) determines endangered status pursuant to the Endangered Species Act of 1973, as amended (Act), for 14 plants: *Acaena exigua* (liliwai), *Alectryon macrococcus* (mahoe), *Bidens micrantha* ssp. *kalealaha* (ko'oko'olau), *Clermontia oblongifolia* ssp. *mauiensis* ('oha wai), *Cyanea lobata* (haha), *Cyanea mceldowneyi* (haha), *Cyrtandra munroi* (ha'iwale), *Geranium multiflorum* (nohoanu), *Hedyotis coriacea* (kio'ele), *Huperzia mannii* (wawa'iole), *Lipochaeta kamolensis* (nehe), *Lysimachia lydgatei* (no common name (NCN)), *Melicope mucronulata* (alani), and *Schiedea haleakalensis* (NCN). The Service also determines threatened status for one plant, *Argyroxiphium sandwicense* ssp. *macrocephalum* (Haleakala silversword, 'ahinahina). Fourteen of these taxa are known primarily from the Island of Maui, Hawaii. One of two recognized varieties of *Alectryon macrococcus* is known only from East Maui and the other is known primarily from the island of Oahu, Hawaii. Three of these taxa are also known from one or more sites on the islands of Kauai, Oahu, Molokai, and Hawaii. The 15 plant taxa and their habitats have been variously affected and are threatened by one or more of the following: Trampling and/or predation by feral animals (goats, cattle, deer, pigs, rodents); habitat degradation and competition for space, light, water, and nutrients by naturalized, alien vegetation; and habitat loss from fires. One of these taxa has been subject to overcollection. Because of the depauperate number of extant individuals and their severely restricted distributions, populations of these taxa are subject to an increased likelihood of extinction from stochastic events. This rule implements the protection and recovery provisions provided by the Act for these plants.

EFFECTIVE DATES: June 15, 1992.

ADDRESSES: The complete file for this rule is available for public inspection, by

appointment, during normal business hours at the U.S. Fish and Wildlife Service, 300 Ala Moana Boulevard, room 6307, P.O. Box 50167, Honolulu, Hawaii 96850.

FOR FURTHER INFORMATION CONTACT: Derral R. Herbst, at the above address (808/541-2749 or FTS 551-2749).

SUPPLEMENTARY INFORMATION:

Background

Acaena exigua, *Argyroxiphium sandwicense* ssp. *macrocephalum*, *Bidens micrantha* ssp. *kalealaha*, *Clermontia oblongifolia* ssp. *mauiensis*, *Cyanea lobata*, *Cyanea mceldowneyi*, *Cyrtandra munroi*, *Geranium multiflorum*, *Hedyotis coriacea*, *Huperzia mannii*, *Lipochaeta kamolensis*, *Lysimachia lydgatei*, *Melicope mucronulata*, and *Schiedea haleakalensis* are endemic to, or have their largest or best known population on the island of Maui, Hawaii. Of the two recognized varieties of *Alectryon macrococcus*, one is found solely on East Maui and the other variety is widely spread over four islands: Kauai, the Waianae Mountains of Oahu, Molokai, and West Maui. *Hedyotis coriacea* and *Huperzia mannii* are also known from the island of Hawaii, and *Melicope mucronulata* from Molokai.

The island of Maui is formed from the remnants of two large shield volcanoes, the older West Maui volcano on the west and the larger but much younger Haleakala volcano on the east. These two volcanoes and the connecting isthmus formed by lava flows comprise an island 729 square miles (sq mi) (1,888 sq kilometers (km)) in area. Stream erosion has cut deep valleys and ridges into the originally shield-shaped West Maui volcano. The highest point on West Maui is Puu Kukui at 5,787 feet (ft) (1,764 meters (m)) elevation with an average rainfall of 400 inches (in) (1,020 centimeters (cm)) per year, making it the second wettest spot in Hawaii (Walker 1990) and possibly the world. Having erupted just 200 years ago, East Maui's Haleakala, 10,023 ft (3,055 m) in elevation, has retained its classic shield shape and lacks the diverse vegetation typical of the older and more eroded West Maui mountain. Rainfall on Haleakala is about 350 in (890 cm) per year, with its windward slope receiving the most precipitation. However, Haleakala's crater is a dry cinder desert because it is below the level at which precipitation develops and is sheltered from moisture-laden winds (Gagne and Cuddihy 1990).

The 15 taxa grow in a wide variety of vegetation communities (shrublands, forests, and bogs), elevational zones

(lowland to alpine), and moisture regimes (dry to wet). Four of the 15 taxa (*Alectryon macrococcus*, *Hedyotis coriacea*, *Lipochaeta kamolensis*, and *Melicope mucronulata*) are members of the Lowland Dry Vegetation type that includes several plant communities and occurs on the leeward side of the main Hawaiian Islands at an elevation of 15 to 2,000 ft (5 to 610 m). The climate of this vegetation type is distinctly seasonal with hot dry summers and winter rainfall, usually less than 40 in (100 cm), but ranging up to 80 in (200 cm) annually. These four species grow in forests and shrublands in the wetter parts of this vegetation type, extending into the Lowland Mesic Vegetation type (Gagne and Cuddihy 1990).

Two species, *Cyanea lobata* and *Lysimachia lydgatei*, are found in Lowland Mesic Shrubland and Forest habitats on West Maui and other Hawaiian Islands, occurring mainly between 100 and 5,300 ft (30 and 1,600 m) in elevation in areas topographically unsuitable for agriculture. Annual precipitation ranges from less than 40 to 150 in (100 to 380 cm). The substrate is diverse: Shallow rocky soils on steep slopes to deep soils in gulches and erosional plains (Gagne and Cuddihy 1990, Walker 1990).

The Lowland West Forest habitat of *Cyrtandra munroi* is composed primarily of native vegetation with canopies from 10 to 130 ft (3 to 40 m) high in sheltered, well drained, leeward slopes at elevations between 300 and 3,900 ft (100 and 1,200 m). Annual rainfall is generally between 60 and 200 in (150 and 500 cm). The substrate ranges from clay or organic muck over 'a'a lava to volcanic ash beds or young lava flows (Gagne and Cuddihy 1990).

Four of the plant taxa occur primarily on the windward slopes of Maui and the island of Hawaii in Montane Wet communities. Included in this vegetation type are Wet Montane Bogs and Wet Montane Forest communities. *Acaena exigua* is found in the *Metrosideros* ('ohi'a) Montane Bog Community, characterized by thick peat overlaying an impervious clay substrate with hummocks of sedges and grasses, stunted trees, and shrubs. The Montane Wet Forests to which *Clermontia oblongifolia* ssp. *mauiensis*, *Cyanea mceldowneyi*, and *Huperzia mannii* belong occur on Molokai, Maui, and Hawaii islands at 3,900 to 7,200 ft (1,200 to 2,200 m) in elevation, mainly on steep windward valley walls. This vegetation type is characterized by rich soil development, high rainfall (100 in (250 cm) or more annually), high diversity,

and a rich understory (Gagne and Cuddihy 1990).

Schiedea haleakalensis is found in the Subalpine Dry Vegetation type that occurs on East Maui and the island of Hawaii between 5,600 and 9,800 ft (1,700 and 3,000 m) in elevation. The substrate is of cinder or weathered volcanic ash or bare lava with little or no soil development, partly due to the low annual precipitation of 15 to 40 in (40 to 100 cm). Periodic frost and occasional snow cover characterize the upper limits of this vegetation type (Gagne and Cuddihy 1990).

Argyroxiphium sandwicense ssp. *macrocephalum* is found within the Alpine Dry Shrubland community that occurs above 9,800 ft (3,000 m) elevation. Precipitation is only 30 to 50 in (75 to 125 cm) annually. This community is subject to frequent frosts and arid extremes, limiting vegetation (grasses, mosses, and alpine-adapted shrubs) to near the lower boundary of the community, on bare gravel, debris, and cinders (Gagne and Cuddihy 1990).

The last two plant taxa, *Bidens micrantha* ssp. *kalealaha* and *Geranium multiflorum*, grow in diverse vegetation types. *Bidens micrantha* ssp. *kalealaha* is found in open-canopy Dry Montane Forests to Dry Subalpine Shrublands extending from 1,600 to 9,800 ft (500 to 3,000 m) in elevation. Annual precipitation ranges from 10 to 50 in (25 to 125 cm) in seasonally Dry Montane Forests, to about 60 in (150 cm) in subalpine shrublands. The substrate is comprised mostly of blocky lava flows with little or no soil development. The habitat of *Geranium multiflorum* also spans diverse vegetation types, from montane grasslands to wet forests and swamps, extending into the subalpine zone (1,600 to 8,900 ft (500 to 2,700 m)) with an annual range of precipitation from as low as 15 in (40 cm) to over 100 in (250 cm). Occurring on the windward side of East Maui, this species is found mostly within wet forests. Substrates range from lava flows to rich soils (Gagne and Cuddihy 1990).

The land that supports these 15 plant taxa is owned by the City and County of Honolulu, the State of Hawaii (including State parks, forest reserves, Natural Area Reserves, wilderness reserves, and land leased by the U.S. Army on Makua Military Reservation), the Federal government (Haleakala National Park on East Maui and portions of Schofield Barracks under the jurisdiction of the U.S. Army on Oahu), and private parties (including several with easement agreements with private conservation organizations).

Discussion of the 15 Taxa Included in This Final Rule

Asa Gray (1854) described *Acaena exigua* based on a specimen collected on Kauai in 1840 by personnel of the U.S. Exploring Expedition. He chose the specific epithet in reference to the small size of the plant as compared to other members of the genus. Heinrich Wawra later collected another specimen on Kauai, which was used by F.A. Georg Bitter (1910-1911) as the type specimen for two varieties, *glabriuscula* and *subtusstrigulosa*. Bitter described a third variety, *glaberrima*, from a specimen collected on Maui by Wilhelm Hillebrand. The current taxonomic treatment (Wagner *et al.* 1990) considers Bitter's varieties to represent only populational variation and recognizes no varieties.

Acaena exigua of the rose family (Rosaceae) is a perennial herb with leafy stems 0.4 to 1.6 in (1 to 4 cm) long and flowering stems 2 to 6 in (5 to 15 cm) long. The leaves are about 0.4 to 1 in (1 to 2.5 cm) long, comprising 6 to 17 oval leaflets, each about 0.04 to 0.12 in (1 to 3 millimeters (mm)) long, 0.04 to 0.08 in (1 to 2 mm) wide, glossy above, and whitish beneath. The petalless flowers are in short, dense spikes 0.2 to 0.4 in (5 to 10 mm) long. The receptacle (base of flower) is urn-shaped and encloses the fruit, which is a pale brown, cone-shaped achene (dry, one-seeded fruit) about 0.04 in (1 mm) long. The only member of the genus native to Hawaii, this species is distinguished from other Hawaiian members of the rose family in that it is a small, compact, high-elevation bog species with flowers which lack petals (Hillebrand 1888, Neal 1965, Wagner *et al.* 1990).

Historically, *Acaena exigua* was known from Puu Kukui on West Maui and from Mount Waialeale on Kauai (Hawaii Heritage Program (HHP) 1990a1, 1990a2; Wagner *et al.* 1990). Although this species has not been observed since 1973, it is still believed to be extant on Puu Kukui on privately owned land (HHP 1990a1, Wagner *et al.* 1990). The plants are small, inconspicuous, and easily overlooked among the tussocks of grasses and sedges with which it grows. Because it is likely that future surveys will show that *Acaena exigua* is still extant (Derral Herbst, U.S. Fish and Wildlife Service, pers. comm., 1990), this species is included here to extend to it the protection warranted by the Act if and when it is rediscovered. While Puu Kukui encompasses about 40 acres (ac) (16 hectares (ha)), it contained only a single observed individual in 1973. *Acaena exigua* typically grows in

montane bogs at an elevation of 5,300 to 6,000 ft (1,600 to 1,800 m) (HHP 1990a1, 1990a2, 1990p; Sohmer and Gustafson 1987). Associated species include the native sedges and grasses *Deschampsia nubigena*, *Dichanthelium* spp., and *Oreobolus furcatus*, and the native shrubs *Metrosideros polymorpha* ('ohi'a) and *Vaccinium* ('ohelo) (Sohmer and Gustafson 1987). Habitat degradation by feral pigs is the major threat to all the native vegetation within the historic range of this species.

Hillebrand collected specimens of *Alectryon macrococcus*, which he discussed in his flora (Hillebrand 1888) under the name "*Mahoe*, gen. nov.?" Emmanuel Drake del Castillo (1890) referred to Hillebrand's plant as "*Dodonaea* sp." in a note under his description of *D. viscosa*. Ludwig Adolph Timotheus Radlkofer (1890) published the name *Alectryon macrococcus*, the specific epithet referring to the large fruit, and later added a Latin description (Radlkofer and Rock 1911). Harold St. John and Lafayette Frederick (1949) segregated the Oahu population of the species into *A. mahoe*, based mostly on a difference in the amount of hair on the undersides of the leaves. George Linney (1987), in the currently accepted treatment, considered this difference too trivial to support maintaining the Oahu plants as a distinct taxon; however, he did formally recognize the East Maui plants, with their densely hairy leaf undersurface, as variety *auwahiensis*. Some botanists, retaining Joseph Gaertner's original neuter designation of the genus, have used the specific epithet *macrococum* (St. John and Frederick 1949). However, when monographing *Alectryon*, Radlkofer (1890) treated the genus as masculine. He changed the endings of older epithets to agree and published new ones, including *macrococcus*, as masculine.

Alectryon macrococcus of the soapberry family (Sapindaceae) is a tree up to 36 ft (11 m) tall with reddish brown branches. The leaves are usually 8 to 22 in (20 to 55 cm) long, typically with two to five pairs of egg-shaped, slightly asymmetrical leaflets, each 4 to 11 in (10 to 28 cm) long and 1.6 to 4.7 in (4 to 12 cm) wide. Glossy and smooth above, the leaves have a conspicuous netted pattern of veins. A dense covering of rust-colored hairs persists on the lower surfaces of mature leaves of *A. macrococcus* var. *auwahiensis*, whereas the mature leaves of *A. macrococcus* var. *macrococcus* lack hairs or are only slightly hairy. In both varieties, the flowers, which may be either bisexual or male, are borne in branched clusters up

to 12 in (30 cm) long and lack petals. The hard, spherical fruit, borne singly or sometimes in pairs, encloses a single glossy brown seed with a scarlet aril (fleshy covering over the seed). 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 1 in (2.5 cm) or more in diameter (Degener 1937a, Kimura and Nagata 1980, Lamb 1981, Rock 1913, Wagner *et al.* 1990).

The historical range of *Alectryon macrococcus* var. *auwahiensis* encompasses Auwahi on East Maui, where a single population of nine individuals remains within a 72 ac (29 ha) area on privately owned land (HHP 1990b1 to 1990b4; Medeiros *et al.* 1986). *Alectryon macrococcus* var. *macrococcus* has a much wider distribution. This variety was found historically on four islands: From Kahana Gulch to Olowalu Valley on West Maui; at Kalaupapa, Kamakou Preserve, and Puu Kolekole on East Molokai; in Waimea Canyon and as far south as Makaweli and in Kalalau Valley on Kauai; and widely distributed throughout the Waianae Mountains and more restricted in the Koolau Mountains on Oahu (HHP 1990c1 to 1990c4, 1990c6 to 1990c12, 1990c14, 1990c16, 1990c22 to 1990c24, 1990c26, 1990c27; Hawaii Plant Conservation Center (HPCC) 1990a, 1990b, 1991a, 1991b). *Alectryon macrococcus* var. *macrococcus* still occurs on those four islands, but within a much smaller range. The three existing populations on West Maui are along the Honokowai Ditch Trail and in Launiupoko Valley on privately owned land and total just a few plants. The five extant populations of *A. macrococcus* var. *macrococcus* on Molokai are restricted to Puu Kolekole jeep road, Kaunakakai Gulch, and Kamakou Preserve, with a total of six plants on State and private land. The 6 populations of this taxon on Kauai occur in Waimea Canyon and in Na Pali Coast State Park on State-owned land and number less than 100 plants. The distribution of the plants on Oahu is now spotty, with most recent sightings in the Waianae Mountains, from as far north as Kaluakauila Gulch to as far south as the ridge above Lualualei. These 28 populations are on City and County, State, Federal, and private land, most numbering only 1 or 2 individuals, but 2 populations number between 50 and 200 individuals. The total number of individuals on Oahu is estimated to be about 400. The entire species currently numbers about 500 individuals. Both varieties of *Alectryon macrococcus* typically grow on dry slopes or in

gulches in north-facing, dry to mesic lowland forests at an elevation of 1,200 to 3,500 ft (360 to 1,070 m) (HPP 1990c2; Wagner *et al.* 1990; Steven Perlman, HPCC, pers. comm., 1990). Associated native species include 'ohi'a, *Aleurites moluccana* (kukui), *Diospyros sandwicensis* (lama), *Nestegis sandwicensis* (olopua), and *Psychotria* (kopiko) (HHP 1990c2, 1990c4, 1990c5, 1990c10, 1990c13, 1990c15, 1990c18 to 1990c20; S. Perlman, pers. comm., 1990). The threats to both recognized varieties of *Alectryon macrococcus* are infestations by the black twig borer; habitat degradation by feral pigs; competition for light, space, and water with the alien plants *Melinis minutiflora* (molasses grass), *Pennisetum clandestinum* (kikuyu grass), *Psidium cattleianum* (strawberry guava), and *Schinus terebinthifolius* (Christmasberry); fire; and predation of fruits and flowers by rodents. Predation and habitat degradation by cattle and the small number of remaining individuals are threats specific to *Alectryon macrococcus* var. *auwahiensis*, whereas goat activity and the resultant habitat destruction are immediate threats to *Alectryon macrococcus* var. *macrococcus*.

Charles Pickering, a naturalist on the U.S. Exploring Expedition, first collected *Argyroxiphium sandwicense* ssp. *macrocephalum* on Haleakala, Maui, in 1841. Gray (1852) named that plant *A. macrocephalum*, the specific epithet referring to the large flower heads. Hillebrand (1888) treated the taxon as variety *macrocephalum* of *A. sandwicense*, while David D. Keck (1936a) did not recognize any varieties of *A. sandwicense*, placing the taxon into synonymy. Alain K. Meyrat renamed this taxon subspecies *macrocephalum*, based on quantitative, geographic, and evolutionary differences (Meyrat *et al.* 1983; Gerald Carr, University of Hawaii, pers. comm., 1990). This is the status accepted in the most recent treatment (Carr 1990).

Argyroxiphium sandwicense ssp. *macrocephalum* of the aster family (Asteraceae) usually is a single-stemmed shrub with a rosette of narrowly sword-shaped leaves 5 to 13 in (13 to 33 cm) long and 0.3 to 0.9 in (8 to 23 mm) wide at the midpoint. A dense mat of silky, silvery hairs covers the leaves, which are more or less three-angled in cross section. The narrow, branched flowering stalk is elliptic to lance-shaped in outline, 9 to 31 in (23 to 78 cm) wide, 2.3 to 4.9 ft (0.7 to 1.5 m) long in unbranched plants, and 2.3 to 3.3 ft (0.7 to 1 m) long in branched plants. Each flowering head is about 1 in (2.5

cm) in diameter and has 11 to 42 pinkish petal-like ray florets. Central disk florets, pink to wine-red at the tip and yellowish at the base, number 120 to 600 per head. Fruits are achenes, 0.3 to 0.6 in (7 to 15 mm) long. Plants with a single rosette die after flowering; each rosette of a multi-stemmed plant also dies after flowering. This subspecies is distinguished from *A. sandwicense* ssp. *sandwicense* by having wider leaves, more ray flowers per head, and a broader flowering stalk, less than four times as long as wide. In addition to those characteristics, *A. sandwicense* ssp. *macrocephalum* differs from other members of the genus by the combination of its longer, three-angled leaves; its silvery leaf hairs which completely hide the leaf surface; and its longer achenes (Carr 1985, 1990; Degener 1936a; Degener and Degener 1957; Herbst 1986; Kepler 1983; Kimura and Nagata 1980; Meyrat 1982a, 1982b; Neal 1965; Wilson 1985).

Argyroxiphium sandwicense ssp. *macrocephalum* apparently occupies essentially all of its historical range (Loope and Crivallone 1986). This taxon occurs only in Haleakala National Park on East Maui, mainly within Haleakala Crater. The 7 known populations, which extend over an area of 2,400 ac (970 ha), contain an estimated 50,000 individuals (HHP 1990d1 to 1990d8; Lloyd Loope, Haleakala National Park, pers. comm., 1990). *Argyroxiphium sandwicense* ssp. *macrocephalum* typically grows on barren cinder cones and young 'a'alava flows in dry alpine areas at an elevation of 7,200 to 9,800 ft (2,200 to 3,000 m) (Carr 1990; HHP 1990d1, 1990d2, 1990d8; Loope and Crivallone 1986; Whiteaker 1983). Associated native shrubs include 'ohi'a, *Dubautia menziesii* (na'ena'ena), *Silene struthioloides* and *Styphelia tameiameia* (pukiawe) (HHP 1990d2, 1990d8; Kobayashi 1973b). Historically, *Argyroxiphium sandwicense* ssp. *macrocephalum* has sustained numerous threats to its survival: Overcollection and vandalism by humans, and trampling and predation by goats, cattle, and other feral ungulates. Today, although this taxon receives legal protection within Haleakala National Park, vandalism and illegal collection continue on a small scale. The goats and cattle have been removed from silversword habitat but still pose a potential threat due to the possibility of ingress. Currently, the greatest threat to this taxon is restricted range. One destructive event could possibly extirpate a significant portion of the plants. The predation of silversword pollinators by Argentine ants (*Iridomyrmex humilis*) and yellow

jackets (*Vespula pennsylvanica*) are probable threats to this taxon.

A specimen of *Bidens* collected by Charles Noyes Forbes on Lanai in 1918 was described and named *B. distans* by Earl Edward Sherff in 1930. In 1950 William H. Hatheway and Amy B.H. Greenwell collected a specimen of *Bidens* on Haleakala, Maui, which Sherff (1951b) named *Bidens micrantha* var. *rudimentifera*. Kenneth M. Nagata and Fred R. Ganders determined that the Maui and Lanai populations formed a natural taxon, which they named *B. micrantha* ssp. *kalealaha*, devising an anagram of the word "Haleakala" as the subspecific epithet. Because they believed that Sherff based his variety *rudimentifera* on a plant of this subspecies with abnormal fruits, Ganders and Nagata (1983) did not recognize that name.

Bidens micrantha ssp. *kalealaha* of the aster family (Asteraceae) is an erect perennial herb, slightly woody at the base, and 1.6 to 4.9 ft (0.5 to 1.5 m) tall. Leaves are 2.4 to 7.5 in (6 to 19 cm) long, usually with three to seven and sometimes up to nine lance-shaped leaflets, each 1 to 4 in (2.5 to 10 cm) long and 0.2 to 1.2 in (0.5 to 3 cm) wide. Flower heads are arranged at the top of the plant and on side branches in open clusters of 15 to 50. Each flower head is 1 to 1.8 in (2.5 to 4.5 cm) in diameter and comprises 5 sterile, yellow ray florets, 0.6 to 1.1 in (15 to 27 mm) long and 0.2 to 0.3 in (5 to 7 mm) wide, and 9 to 15 bisexual disk florets in the center of the head. Fruits are black achenes, 0.3 to 0.6 in (8 to 14 mm) long and 0.03 to 0.06 in (0.8 to 1.5 mm) wide, with two awns and no wings. This taxon differs from other subspecies of *B. micrantha* by its larger flower heads and the intermediate number of ray and disk florets in each head. It is distinguished from other species of *Bidens* by its erect habit and the loose arrangement of the relatively large flower heads on both terminal and lateral branches (Degener 1938; Degener and Sherff 1932; Ganders and Nagata 1983, 1990; Hillebrand 1888).

Historically, *Bidens micrantha* ssp. *kalealaha* was known from Lanai, the south slope of Haleakala on East Maui, and from one collection on West Maui (Ganders and Nagata 1990; HHP 1990e3, 1990e4, 1990e6 to 1990e10, 1990e12, 1990e13). This taxon only remains on East Maui, in Kahua, Manawainui to Wailaulau, and in Haleakala National Park, on State and Federal land (HHP 1990e1, 1990e2, 1990e5, 1990e11). The 4 known populations, which extend over a distance of about 9.5 by 2 mi (15.3 by 3.2 km), number no more than 2,000 individuals (Art Medeiros, Haleakala

National Park, pers. comm., 1990). *Bidens micrantha* ssp. *kalealaha* typically grows on sheer rock walls in dry montane forests to subalpine shrubland at an elevation of 5,200 to 7,600 ft (1,600 to 2,300 m) (Ganders and Nagata 1990; HHP 1990e1, 1990e2, 1990e5, 1990e11; Sohmer and Gustafson 1987). Associated native shrubs include pukiawe, *Coprosma* spp. (pilo), *Dodonaea viscosa* ('a'ali'i), and *Dubautia platyphylla* (na'ena'e) (Ganders and Nagata 1990, HHP 1990e2). The major threats to *Bidens micrantha* ssp. *kalealaha* are habitat destruction by feral goats and cattle, predation by goats and possibly cattle, competition from the alien kikuyu grass, and fire.

In 1911 Joseph F. Rock collected the first specimen of *Clermontia oblongifolia* ssp. *mauiensis* on Maui and two years later described and named it *C. oblongifolia* var. *mauiensis* (Rock 1913). However, in his monograph of the Hawaiian members of the bellflower family (Campanulaceae), Rock (1919) no longer recognized the variety. Later Otto Degener (1937b) distinguished the taxon as *C. oblongifolia* f. *mauiensis*. Thomas G. Lammers (1988) raised the taxon to the subspecific level with his publication of the new combination *C. oblongifolia* ssp. *mauiensis*.

Clermontia oblongifolia ssp. *mauiensis* of the bellflower family grows only terrestrially as a shrub or tree, reaching a height of 6.6 to 23 ft (2 to 7 m). Leaves, on petioles (leaf stems) 1 to 4.5 in (2.5 to 11.5 cm) long, are oblong or elliptic; have thickened, rounded teeth; and reach a length of 3 to 7.5 in (8 to 19 cm) and a width of 0.8 to 2 in (2 to 5 cm). Two flowers, or sometimes three, are grouped together on a stalk 0.2 to 1.8 in (0.5 to 4.5 cm) long, each individual flower having a stalk 0.4 to 1.8 in (1 to 4.5 cm) long. The flower is 2.4 to 3.1 in (6 to 7.8 cm) long; the calyx (sepals) and corolla (petals) are similar in size and appearance, each forming an arched tube which is greenish white or purplish on the outside and white or cream-colored on the inside. The nearly spherical, orange fruit is a berry, 0.7 to 1.2 in (17 to 30 mm) long. This subspecies differs from others of the species by its leaf shape; the lengths of its leaf, leaf stalk, and flower stalk; the shapes of the leaf tip and the flower bud; and the purple or magenta color of the fused stamens. This species is distinguished from others in the genus by its calyx and corolla, which are similar in color and are each fused into a curved tube that falls off as the flower ages, as well as by the lengths of the leaf and flower stalks, the flower, and the smooth green basal portion of the

flower (the hypanthium) (Degener 1937b; Lammers 1988, 1990; Rock 1913).

Historically, *Clermontia oblongifolia* ssp. *mauiensis* was known from Mahana and Kaiholena valleys on Lanai and from Honomanu Valley on Haleakala, East Maui (Degener 1937b, Lammers 1990, Rock 1913). Although this taxon was not reported earlier from West Maui, the only currently known individual of *Clermontia oblongifolia* ssp. *mauiensis* grown along a trail to Puu Kukui in the Honokowai section of the West Maui Natural Area Reserve on State land (HHP 1990f1, Lammers 1990). This taxon typically grows on the sides of ridges in 'ohi'a-dominated wet montane forests at an elevation of 2,800 to 3,000 ft (850 to 900 m) (HHP 1989b, 1990f1; Rock 1913). Associated species include pilo, *Clermontia* ('oha wai), *Hedyotis* (manono), and *Melicope* (alani) (Robert Hobdy, Hawaii Division of Forestry and Wildlife, pers. comm., 1990). Because only a single individual of *Clermontia oblongifolia* ssp. *mauiensis* is known to exist, the lack of a genetic pool is likely to result in reduced reproductive vigor, and any collecting (mainly for scientific purposes) also could produce the same results. The rooting activities of feral pigs also pose a serious threat to this taxon.

Based on a specimen collected by Horace Mann, Jr., and William Tufts Brigham on Maui, Mann (1867) described *Cyanea lobata*, the specific epithet referring to the lobed leaves. In 1919 George C. Munro collected a plant on Lanai, named *C. baldwinii* by him and Forbes (Forbes and Munro 1920) and later synonymized under *C. lobata* by Lammers (1990). St. John (1987, St. John and Takeuchi 1987), believing there to be no generic distinctions between *Cyanea* and *Delissea*, transferred both species to the genus *Delissea*, the older name, creating *D. baldwinii* and *D. lobata*. The current treatment does not follow this course (Lammers 1990). *Cyanea lobata* var. *hamakuae*, described by Rock (1919), is currently considered to be *C. grimesiana* ssp. *grimesiana* (Lammers 1988).

Cyanea lobata, a member of the bellflower family, is a shrub with few branches 4.3 to 7.5 ft (1.3 to 2.3 m) tall that may be smooth or occasionally rough due to small projections on the stems and lower leaf surfaces. Leaves are 12 to 20 in (30 to 50 cm) long and 4 to 6 in (10 to 15 cm) wide, with 12 to 25 irregular lobes on each side of the leaf. Flowers, clustered in groups of 5 to 12, have greenish white or purplish petals fused into a curved tube 2.4 to 2.8 in (60 to 70 mm) long and 0.2 to 0.4 in (5 to 11

mm) wide. Berries are yellow and spherical. This species is distinguished from other species of *Cyanea* by the size of the flower and the irregularly lobed leaves with petioles (Degener 1936b, Hillebrand 1888, Lammers 1990, Rock 1919).

Historically, *Cyanea lobata* was known from Lanai and scattered locations throughout West Maui from Honokohau to Wailuku Valley (HHP 1990g3, 1990g4; Lammers 1990). Within the past eight years, this taxon was only found in Waikapu Valley on West Maui on privately owned land (HHP 1990g5). Although that population of one to four individuals was recently destroyed by a landslide following heavy rains (HHP 1990g5, Hobdy *et al.* 1990), the species is still believed to be extant, owing to its wide historical range and the lack of adequate surveys due to the inaccessibility of the area (D. Herbst and R. Hobdy, pers. comm., 1990). *Cyanea lobata* typically grows on steep stream banks in mesic lowland forests at an elevation of 1,800 to 3,000 ft (550 to 900 m) (HHP 1990g1, 1990g2, 1990g5; Hobdy *et al.* 1990; Lammers 1990). Associated species include *Diplazium sandwichianum* (ho'i'o) and *Touchardia latifolia* (olona) (Hobdy *et al.* 1990). Major threats to *Cyanea lobata* are the small number of individuals and habitat degradation by feral pigs.

Rock collected a new species of *Cyanea* in 1954, which he later described and named *Cyanea mceidowneyi* in honor of George McEldowney, a forester on Maui (Rock 1957). St. John (1987) transferred the species to the genus *Delissea*, but the current treatment of these genera (Lammers 1990) does not accept the transfer.

Cyanea mceidowneyi, an unbranched shrub in the bellflower family, has adult leaves which are 8 to 14 in (20 to 35 cm) long by 2 to 3.5 in (5 to 9 cm) wide and have wedge-shaped bases, hardened teeth, and sometimes a few short prickles on the upper surface. Young leaves are the same width as adult leaves but shorter, and have rounded bases, hardened marginal teeth, and a greater number of prickles. Flowers are in clusters of five to seven, each cluster with a stalk 0.6 to 1.2 in (15 to 30 mm) long and each flower with a stalk 0.4 to 0.6 in (10 to 14 mm) long. Petals, white with purple stripes, are fused into a curved tube 1.6 in (40 mm) long and 0.3 in (8 mm) wide and have small prickles on the lobes. Berries have not been observed. This species is distinguished from other species of *Cyanea* by the size of the leaves, the differing morphology of young and mature leaves, the length

of the floral stalks, and the size and proportions of the flowers (Lammers 1990, Rock 1957).

Historically, *Cyanea mceidowneyi* was known from Honomanu on East Maui (HHP 1990h2). This species remains in Waikamoi on East Maui on privately owned land (HHP 1990h1, 1990h2). The 2 known populations, about 0.5 mi (0.8 km) apart and measuring not more than 100 sq ft (9 sq m) in area, total less than 30 individuals (HHP 1990h1; R. Hobdy, pers. comm., 1990). *Cyanea mceidowneyi* typically grows in wet montane forests at an elevation of 3,030 to 4,200 ft (925 to 1,280 m) (HHP 1990h1, 1990h2; Lammers 1990). Associated native vegetation includes alani, manono, and 'ohi'a (R. Hobdy, pers. comm., 1990). The major threats to *Cyanea mceidowneyi* are the same as for *Clermontia oblongifolia* ssp. *mauiensis* and *Cyanea lobata*: Habitat degradation by feral pigs and the small number of remaining individuals.

Cyrtandra munroi was first collected by Forbes on Lanai in 1913 and was named by him (Forbes 1920) in honor of George C. Munro, who had collected other specimens of the species.

Cyrtandra munroi of the gesneria family (Gesneriaceae) is a shrub with opposite, elliptic to almost circular leaves, 3.7 to 8.3 in (9.5 to 21 cm) long and 2.2 to 3.7 in (5.5 to 9.5 cm) wide, which are sparsely to moderately hairy on the upper surface and covered with velvety, rust-colored hairs underneath. The flowers are usually arranged in clusters of three on stalks emerging from the leaf axils. The white petals are fused into a tube, 0.6 to 0.8 in (15 to 20 mm) long, which flares into two upper lobes, 0.1 in (3 mm) long, and three lower lobes, about 0.2 in (5 to 6 mm) long. The white berries, covered with fine hair, are somewhat egg-shaped and 0.7 to 0.9 in (1.8 to 2.3 cm) long. This species is distinguished from other species of the genus by the broad opposite leaves, the length of the flower cluster stalks, the size of the flowers, and the amount of hair on various parts of the plant (Forbes 1920, Wagner *et al.* 1990).

Historically, *Cyrtandra munroi* was known from scattered collections from Lanaihale on Lanai and Makamakaole on West Maui (HHP 1990i1, 1990i2; Wagner *et al.* 1990). This species was considered common in the Makamakaole area on State land in 1971, but has not been sighted there since (HHP 1990i1). The only known existing plant on West Maui is one individual discovered in 1989 in privately owned Honolua Valley (Randy Bartlett, Maui Land and Pineapple Company, pers. comm., 1990). Located

about 5 mi (8 km) from the Makamakaole population, this discovery suggests that the historical distribution of this species was more widespread than previously thought. In 1991, two new populations of the taxon were discovered on Lanai. One population of about 20 individuals was found in the Waiapaa and Kapohaku drainages, and a single plant was seen in the Maunalei drainage in the gulch between Kunoa and Waialala Gulches. *Cyrtandra munroi* typically grows on rich, moist talus slopes in wet lowland forests at an elevation of 1,000 to 3,020 ft (300 to 920 m) (HHP 1990i1; 1990i2; Wagner *et al.* 1990). Associated native species include kukui, lama, 'oha wai, 'ohi'a, and *Hedyotis acuminata* (au) (HHP 1990i1; R. Bartlett, pers. comm., 1990). The major threat to *Cyrtandra munroi* is the small number of existing individuals. On Lanai, strawberry guava is competing with both populations, while the population of about 20 individuals also is being impacted by deer (J. Lau, HP, *in litt.*, 1991).

The first specimens of *Geranium multiflorum* were collected by Pickering in 1841 while the U.S. Exploring Expedition was on Maui. It was later described by Gray (1854), who named it for its many flowers in each flower cluster. Other published names which refer to this taxon are: *G. ovatifolium* (Gray 1854), *G. multiflorum* var. *canum* (Hillebrand 1888), *G. multiflorum* var. *ovatifolium* (Fosberg 1936), and *G. multiflorum* ssp. *ovatifolium* (Carlquist and Bissing 1976). Degener elevated Gray's section *Neurophyllodes* of *Geranium* to the generic level and published the following new varieties and combinations which refer to this taxon: *Neurophyllodes ovatifolium* and *N. multiflorum* (Degener and Greenwell 1952), *N. ovatifolium* var. *forbesii* (Degener and Degener 1967), and *N. ovatifolium* var. *superbum* (Degener and Degener 1967). St. John (1973) rejected Degener's taxonomy and transferred his new taxa back to the genus *Geranium*, resulting in the new combinations *G. multiflorum* var. *forbesii* and *G. multiflorum* var. *superbum*. The current treatment (Wagner *et al.* 1990), however, does not recognize any infraspecific taxa of *G. multiflorum*.

Geranium multiflorum is a 3.3 to 9.8 ft (1 to 3 m) tall, many-branched shrub of the geranium family (Geraniaceae). The leaves, typically oval, 1.8 to 2.8 in (4.5 to 7 cm) long and 0.6 to 1.2 in (1.5 to 3 cm) wide, have 7 to 11 veins, grayish silky hairs, especially on the lower surface, and 7 to 15 teeth on each side. Flowers are in clusters of 25 to 50, and have 5 white petals which are 0.4 to 0.6 in (10 to

15 mm) long with purple veins or bases. One reddish brown seed, about 0.08 in (2 mm) long, is contained in each carpel body (the seed-containing section of the fruit). The carpel body, about 0.1 in (3 mm) long, is topped with an elongated style, 0.6 to 0.8 in (14 to 20 mm) long, which twists to aid dispersal. This species is distinguished from others of the genus by its white, regularly symmetrical flowers and by the shape and pattern of teeth on its leaf margins (Fosberg 1936, Hillebrand 1888, Wagner *et al.* 1990).

Historically, *Geranium multiflorum* was known from Ukulele, Waialeale, and Waianapanapa on East Maui (HHP 1990j3, 1990j5, 1990j13). This species is now known from Haleakala National Park, Hanawi Natural Area Reserve, Koolau Forest Reserve, and Waikamoi Preserve on Federal, State, and private land (HHP 1990j1 to 1990j14). The 11 known populations extend over a distance of about 6.5 by 3.5 mi (10.5 by 5.5 km). Due to the inaccessibility of the populations and the difficulty in determining the number of individuals (due to the plant's multi-branched form), the total number of individuals of this species is not known. However, it probably does not exceed 3,000 plants (HHP 1990j1 to 1990j14; A. Medeiros, pers. comm., 1990). *Geranium multiflorum* grows in a wide variety of habitats between 5,180 and 8,040 ft (1,580 and 2,450 m) in elevation: Montane grasslands, open sedge swamps, fog-swept lava flows, gulch slopes of montane wet forests, and occasionally in subalpine shrublands dominated by *Sophora chrysophylla* (mamane) (HHP 1990j1 to 1990j14, Wagner *et al.* 1990). Associated species in montane wet forests include 'ohelo, 'ohi'a, pilo, pukiaawe, and *Sadleria* ('ama'u) (HHP 1990j1, 1990j2, 1990j10, 1990j14). Species associated with those populations on lava flows are *Dactylis glomerata* (cocksfoot) and *Ranunculus makou* (HHP 1990j6). The major threats to *Geranium multiflorum* are habitat destruction by feral pigs and goats and competition with the encroaching alien plant species, *Rubus argutus* (prickly Florida blackberry).

Based on a specimen collected by Archibald Menzies, Sir James Edward Smith described *Hedyotis coriacea* in 1811, the specific epithet referring to the plant's leathery leaves. Other names by which this taxon has been known, not all validly published, include *H. conostyla* (Gaudichaud-Beaupre 1830), *H. coriacea* f. *conostyla* (Fosberg 1943), *H. menziesiana* (Steudel 1840), *H. smithii* (Walpers 1842-47), *Kadua arnottii* (Don 1834), *K. conostyla* (Hooker

and Arnott 1832), *K. menziesiana* (Chamisso and Schlechtendal 1829), *K. smithii* (Hooker and Arnott 1832), and *Oldenlandia conostyla* (A.P. de Candolle 1830). The current treatment (Wagner *et al.* 1990) recognizes only *H. coriacea*.

Hedyotis coriacea of the coffee family (Rubiaceae) is a small shrub with leathery leaves which are generally elliptic to oblong in shape, 1.2 to 3.1 in (3 to 8 cm) long and usually 0.6 to 1.2 in (1.5 to 3 cm) wide. Flowers are arranged in clusters at the ends of the branches, a few flowers per cluster. The fleshy petals are fused into a tube 0.2 to 0.4 in (5 to 10 mm) long. The capsules, which split open to release dark brown seeds, are cup- to top-shaped, 0.2 to 0.3 in (4 to 7 mm) long and 0.1 to 0.2 in (3 to 4 mm) in diameter. This species is distinguished from others of the genus by its small, triangular calyx lobes, which do not enlarge in fruit, and the combination of capsules which are longer than wide and flower buds which are square in cross section (Fosberg 1943, Hillebrand 1888, Wagner *et al.* 1990).

Historically, *Hedyotis coriacea* was known from the Waianae and Koolau Mountains on Oahu and the U.S. Army's Pohakuloa Training Area on the island of Hawaii (HHP 1990k1 to 1990k3). Considered extinct in recent years, this species was rediscovered in 1990 by Steve Perlman in the State-owned Lihau section of the West Maui Natural Area Reserve (HHP 1990k4, HPCC 1991c); it conceivably could exist elsewhere on Maui. In September, 1991, two individuals of the taxon were rediscovered on the 1859 lava flow in the Pohakuloa Training Area, island of Hawaii (Robert Shaw, Colorado State University, pers. comm., 1991). Currently, only a single individual is known from West Maui and two from Hawaii Island. *Hedyotis coriacea* is found on steep, rocky, slopes in dry to mesic 'a' ali'i-dominated shrublands or forests at an elevation of 1,560 to 7,500 ft (470 to 2,300 m) (HHP 1990k1 to 1990k4; S. Perlman, pers. comm., 1990). Associated species include 'chi'a, pukiaawe, *Alyxia oliviformis* (maile), *Bidens menziesii* (ko'oko'olau), and *Gouania* (HHP 1990k4). The major threats to *Hedyotis coriacea* are the small number of remaining individuals and fire.

Mann (1867-68) first collected *Huperzia mannii* on Maui, referring to it as "*Lycopodium phlegmaria*?" Hillebrand (1888) named the taxon *L. phlegmaria* var. *Mannii* in Mann's honor. Hermann Nessel (1939) later transferred the taxon to the genus

Urostachys. Carl Skottsberg (1942), believing the plant's characters to warrant specific status and retaining the genus *Lycopodium*, published the combination *L. mannii*. Some species of *Lycopodium* have recently been placed in the genus *Huperzia* (Ollgaard 1989); the combination for *H. mannii* was published by Josef Holub (1991) after the proposed rule appeared in the Federal Register. As this new combination has been accepted by most botanists specializing in this plant family, the new name has been incorporated into this final rule.

Huperzia mannii, a member of the clubmoss family (Lycopodiaceae), is a pendent epiphyte (plant not rooted in the ground) with clustered, delicate, red stems which are 1.6 to 3.9 in (4 to 10 cm) long and less than 0.04 in (1 mm) thick. Leaves, arranged in three rows on the stem, are pointed, flat, and lance-shaped and measure 0.2 to 0.5 in (4 to 12 mm) long and 0.04 to 0.08 in (1 to 2 mm) wide. Fruiting spikes branch four to six times and are 4.7 to 8 in (12 to 20 cm) long and 0.4 to 0.8 in (1 to 2 cm) wide. Bracts on the fruiting spiked are arranged in two to four ranks, measure 0.04 in (1 mm) long, and conceal the spore capsules. This species can be distinguished from others of the genus in Hawaii by its epiphytic habit, its delicate red stems, and its forked fruiting spikes (Degener and Degener 1959, Hillebrand 1888, St. John 1981).

Historically, *Huperzia mannii* was known from Haelaau and Hanaula on West Maui, Captain Cook-Kona on the island of Hawaii, and Waiakoali on Kauai (HHP 1990L1, 1990L5, 1990L9, 1990L10). Although not recorded from East Maui before 1982, this species is now known from Kipahulu and Manawainui on East Maui, Lihau and Puu Kukui on West Maui, and Laupahoehoe Natural Area Reserve on the island of Hawaii, on State and private land (HHP 1990L2 to 1990L4, 1990L6 to 1990L8; HPCC 1991d, 1991e). Of the 6 known populations, 5 occupy an area of not more than 30 sq ft (2.8 sq m), while the other is scattered over an area of 650 ac (260 ha); the 6 populations total about 35 individuals (A. Medeiros and L. Loope, *in litt.*, 1989; Linda Cuddihy, Hawaii Volcanoes National Park, and R. Hobdy, pers. comms., 1990; HPCC 1991d, 1991e). *Huperzia mannii* typically grows on plants such as 'ohi'a or *Acacia koa* (koa) in mesic to wet montane 'ohi'a/koa forests on Maui and the island of Hawaii at an elevation of 2,900 to 5,200 ft (900 to 1,600 m) (HHP 1989a, 1990L1 to 1990L10). Other associated species include pilo, *Cheirodendron trigynum* ('olapa), *Ilex anomala* (kawa'u), and

Myrsine (kolea) (HHP 1990L2 to 1990L7). Additional associates on the island of Hawaii are mamane and *Astelia menziesiana* (kaluahā) (Cuddihy *et al.* 1982; HHP 1990L5). The major threats to *Huperzia mannii* are habitat degradation by pigs and cattle, alien plants (prickly Florida blackberry), and the small number of extant individuals. Recently, the Manawainui population has been fenced to protect it from feral animals (Corn 1991, Hawaii Department of Land and Natural Resources 1990).

Lipochaeta kamolensis, first collected in 1948 by Otto Degener, Horace F. Clay, and R. Bertram, was named by Degener and Sherff (Sherff 1951a) after Kamole Gulch, where it was found.

Lipochaeta kamolensis, a perennial herb of the aster family (Asteraceae), has trailing or climbing stems which are woody at the base and reach a length of 1 to 10 ft (0.3 to 3 m). Leaves are variable, ranging from long and narrow to triangular in shape, 1.2 to 2.6 in (3 to 6.5 cm) long and 0.5 to 1.7 in (1.2 to 4.4 cm) wide. Both leaf surfaces are covered with small flat hairs, and the leaf margins are lobed or deeply cut. Flower heads, arranged singly or in pairs, are 0.8 to 1.0 in (2 to 2.5 cm) in diameter, and each comprises 6 yellow, ray florets, about 0.3 in (8.5 to 9 mm) long by less than 0.2 in (3.7 to 4 mm) wide, and approximately 15 disk florets. Fruits are grayish-brown, wingless achenes about 0.08 in (2 mm) long. This species is distinguished from others of the genus by the simple leaves which are pinnately lobed or cut and by the size of the flower heads (Sherff 1951a, Wagner *et al.* 1990).

Historically, *Lipochaeta kamolensis* was known from Kamole Gulch, west of Kepuni Gulch, and 11.8 mi southeast of Ulupalakua Ranch Office (Gardner 1979, Sherff 1951a, Wagner *et al.* 1990). This species still occurs in the Kamole Gulch area, both above and below Highway 31 on State-owned land (Gardner 1979; HPCC 1990c; Wagner *et al.* 1990; R. Hobdy, pers. comm., 1990). The only known population, which extends over an area of about 100 ac (40 ha), contains an estimated several hundred individuals (R. Hobdy, pers. comm., 1990). *Lipochaeta kamolensis* typically grows along the bottom of rock ledges in dry to mesic scrub or dry lowland forests at an elevation of about 820 ft (250 m) (Gardner 1979; Wagner *et al.* 1990; R. Hobdy, pers. comm., 1990). Associated vegetation includes 'a'ali'i, grasses, and *Lantana camara* (lantana) (Gardner 1979). The major threats to *Lipochaeta kamolensis* are habitat destruction by cattle and goats, predation by goats and probably by

cattle, fire, and the small number of populations subject to extinction by stochastic events.

Lysimachia lydgatei was first collected before 1871 and named by Hillebrand in 1888, the specific epithet honoring the Reverend John M. Lydgate. Amos Arthur Heller (1897) created a new genus, *Lysimachiopsis*, into which he placed all endemic Hawaiian species of *Lysimachia*. The current treatment (Wagner *et al.* 1990) recognizes *Lysimachiopsis* as a section of *Lysimachia*.

Lysimachia lydgatei of the primrose family (Primulaceae) is a sprawling, branched shrub with stems from 3 to 4 ft (1 to 1.3 m) long. Older stems are smooth, but young ones have a dense covering of rust-colored hairs. The leathery, elliptic leaves, 1.9 to 2.8 in (49 to 70 mm) long by 0.6 to 0.9 in (14 to 22 mm) wide, are densely covered with rust-colored hairs. Flowers are arranged singly in the leaf axils. Entire flowers have not been seen, and fruits are capsules about 0.2 in (6 mm) long. This species is distinguished from others in the genus by the dense hairs on both the upper and lower surfaces of mature leaves (Hillebrand 1888, Wagner *et al.* 1990).

Lysimachia lydgatei is only known from two West Maui collections: A historical collection from a gulch behind Lahaina and a recent collection from the Lihau section of the West Maui Natural Area Reserve on State-owned land (HHP 1990m1, 1990m2; HPCC 1991f, 1991g; Wagner *et al.* 1990). The Lihau population of one to several individuals measures just a few feet across (R. Hobdy, pers. comm., 1990). *Lysimachia lydgatei* typically grows on the sides of steep ridges in 'ohi'a-dominated lowland mesic shrubland at an elevation of about 3,600 ft (900 m) (HHP 1989b, 1990m2; S. Perlman, pers. comm., 1990). Associated vegetation includes 'a'ali'i, 'ohelo, pukiaawe, and mat ferns such as *Dicranopteris* (uluhe) (HHP 1989b; R. Hobdy, pers. comm., 1990). The greatest threats to *Lysimachia lydgatei* are the small number of extant individuals, subject to extinction by a single destructive human-caused or natural event; competition with the alien plant species, prickly Florida blackberry; and fire.

St. John (1944) based *Pelea mucronulata* on a specimen collected in 1920 by Forbes, the specific epithet referring to the small sharp point at the end of the fruit. Thomas C. Hartley and Benjamin C. Stone (1989) synonymized *Pelea* under *Melicope*, resulting in the current name (Wagner *et al.* 1990).

Melicope mucronulata of the citrus family (Rutaceae) is a small tree up to 13 ft (4 m) tall with oval to elliptic-oval leaves, 3.1 to 6.3 in (8 to 16 cm) long and 1.4 to 2.6 in (3.5 to 6.5 cm) wide. Flower clusters composed of three to nine flowers are arranged in the leaf axils (point between petiole and branch); floral morphology is unknown. The fruit is 0.9 to 1.1 in (2.4 to 2.8 cm) wide and is made up of separate sections, each containing one or two 0.2 in (6 mm) long seeds. This species is distinguished from others in the genus by the growth habit, the number of flowers in each flower cluster, the size and shape of the fruit, and the degree of hairiness of the leaves and fruit walls (Stone *et al.* 1990).

First discovered in 1920 in Kanaio, East Maui, *Melicope mucronulata* was not relocated until 1983. This species was also found 2 years later in Kupaia on Kamakou Preserve on East Molokai (HHP 1990n1, 1990n2; HPCC 1990d; Stone *et al.* 1990). The Maui population occurs on State land and the Molokai population on private land (HHP 1990n1, 1990n2). The two populations, which together extend over an area of 950 ac (380 ha), contain a total of only five plants (HHP 1990n1, 1990n2; A. Medeiros and S. Perlman, pers. comms., 1990). *Melicope mucronulata* typically grows on steep, west- or north-facing, dry to mesic, forested lowland slopes at an elevation of 2,200 to 2,850 ft (670 to 870 m) (HHP 1990n1, 1990n2). Associated native species include 'a'ali'i, 'ohi'a pukiaawe, and *Dubautia linearis* (na'ena'e). The major threat to the continued existence of this species is the small number of extant individuals. Like most of the taxa, each population of *Melicope mucronulata* is susceptible to destruction by a single stochastic event. Habitat degradation by goats and pigs, predation by goats, and competition with alien plants (molasses grass) also pose immediate threats to this species.

Schiedea haleakalensis was discovered by Otto Degener, Emilio Ordonez, and Felix C. Salucop in 1939 and named by Degener and Sherff (Sherff 1942) after the mountain on which it grows.

Schiedea haleakalensis of the pink family (Caryophyllaceae) is a hairless shrub, 1 to 2 ft (30 to 60 cm) tall with slightly fleshy, narrow leaves with a single vein, 1.6 to 3.1 in (4 to 8 cm) long and 0.04 to 0.12 in (1 to 3 mm) wide. Flowers are arranged in clusters 1.2 to 2 in (3 to 5 cm) long at the ends of the branches. The flower has 5 green, oval sepals, which are about 0.1 in (3 mm) long; no petals; 5 nectaries, which are 0.04 to 0.05 in (1 to 1.3 mm) long; and 10 stamens. Capsules are about 0.2 in (4

mm) long and contain grayish to reddish brown seeds which are less than 0.04 in (1 mm) long. This species differs from other species of the genus on East Maui by its crowded, hairless inflorescence composed of bisexual flowers (Degener and Degener 1956, Degener and Greenwell 1956, Sherff 1942, Wagner *et al.* 1990).

Due to the lack of early collections or sightings, the historical range of *Schiedea haleakalensis* is unknown. This species is known only from two areas in Haleakala National Park on East Maui: Holua and on the west side of Kaupo Gap (HHP 1990o1, 1990o2; Wagner *et al.* 1990; L. Loope, pers. comm., 1990). The two populations are estimated to contain a total of 100 to 200 individuals, which together extend over a total area of 28 ac (11 ha) (A. Medeiros and L. Loope, *in litt.*, 1989; A. Medeiros, pers. comm., 1990). *Schiedea haleakalensis* typically grows on sheer, arid subalpine cliffs at an elevation of 6,000 to 7,020 ft (1,830 to 2,140 m) (Wagner *et al.* 1990, Weller *et al.* 1990). Associated vegetation includes *Artemisia mauiensis* ('ahinahina), *Bidens micrantha* (ko'oko'olau), *Dubautia mensiezii* (na'ena'e), and *Viola chamissoniana* (pamakani) (Medeiros *et al.* 1986). The greatest threats to *Schiedea haleakalensis* are fire and the small number and restricted distribution of remaining individuals and populations. Habitat degradation and predation by feral goats are probable threats.

Previous Federal Act

Federal action on these plants began as a result of section 12 of the Act, 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, *Acaena exigua* (as *A. exigua* var. *glaberrima*), *Alectryon macrococcus* (as *A. macrococcus* var. *macrococcum* and *A. mahoe*), *Cyanea lobata* (as *C. baldwinii*), *Cyanea mceldowneyi*, and *Geranium multiflorum* (as *G. multiflorum* var. *ovatifolium* and *G. multiflorum* var. *superbum*) were considered to be endangered. *Acaena exigua* (as *A. exigua* var. *exigua*, *A. exigua* var. *glabriuscula*, and *A. exigua* var. *subtusstrigulosa*), and *Cyrtandra munroi* were considered to be threatened. *Bidens micrantha* ssp. *kalealaha* (as *B. distans*), *Hedyotis coriacea*, *Huperzia mannii* (as *Lycopodium mannii*), and *Melicope mucronulata* (as *Pelea mucronulata*)

were considered to be extinct. On July 1, 1975, the Service published a notice in the **Federal Register** (40 FR 27823) of its 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 giving notice of its intention to review the status of the plant taxa named therein. As a result of that review, on June 16, 1976, the Service published a proposed rule in the **Federal Register** (41 FR 24523) to determine endangered status pursuant to section 4 of the Act for approximately 1,700 vascular plant species, including all of the above taxa considered to be endangered, plus all the above taxa thought to be extinct. *Argyroxiphium sandwicense* ssp. *macrocephalum* (as *A. macrocephalum*) was considered endangered in the proposed rule. 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.

General comments received in response to the 1976 proposal are summarized in an April 26, 1978, **Federal Register** publication (43 FR 17909). In 1978, amendments to the Act required that all 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, the Service published a notice in the **Federal Register** (44 FR 70796) withdrawing the portion of the June 16, 1976, proposal that had not been made final, along with four other proposals that had expired. The Service published an updated notice of review for plants on December 15, 1980 (45 FR 82479), September 27, 1985 (50 FR 39525), and February 20, 1990 (55 FR 6183). In these notices, 10 of the taxa that had been in the proposed rule were treated as Category 1 candidates for Federal listing. Category 1 taxa are those for which the Service has on file substantial information on biological vulnerability and threats to support preparation of listing proposals. The aforementioned taxa that were proposed as endangered in the June 16, 1976, proposed rule were considered Category 1 candidates on all three of the notices of review. *Acaena exigua* and *Lipochaeta kamolensis* were also included as Category 1 species on the 1980 notice and remained so on the 1985 and 1990 notices. *Alectryon macrococcus* appeared as a Category 1 species (as *Alectryon macrococcum*) and a Category 3C species (as *A. mahoe*) on the 1980 and 1985 notices, but as a Category 1 species (as *A. macrococcus*) on the 1990 notice, after

A. mahoe was put into synonymy with *A. macrococcus* in a taxonomic revision (Linney 1987). Category 3C taxa are those which have been found to be more abundant or widespread than previously thought and/or those that are not subject to any identifiable threat. *Argyroxiphium sandwicense* ssp. *macrocephalum* was classified as a Category 1 taxon on all three notices (as *A. sandwicense* on the 1980 notice, as *A. sandwicense* var. *macrocephalum* on the 1985 notice, and as *A. sandwicense* ssp. *macrocephalum* on the 1990 notice). *Bidens micrantha* ssp. *kalealaha* (as *Bidens distans*) was classified as a Category 1 taxon on the 1980 notice, a Category 3B taxon (as *B. distans*) on the 1985 notice, and a Category 1 taxon (as *Bidens micrantha* ssp. *kalealaha*) on both the 1985 and 1990 notices. Category 3B taxa are those which, on the basis of current taxonomic understanding, do not represent distinct taxa meeting the Act's definition of "species." *Cyrtandra munroi* was included as a Category 2 species on the 1980 and 1985 notices but was included as a Category 1 species on the 1990 notice. Category 2 taxa are those for which there is some evidence of vulnerability, but for which there are not enough data to support listing proposals at the time. *Geranium multiflorum* was included as Category 1 (as *G. multiflorum* var. *multiflorum*) and Category 2 (as *G. multiflorum* var. *ovatifolium* and *G. multiflorum* var. *superbum*) taxa on the 1980 and 1985 notices and as a Category 1 species on the 1990 notice (as *G. multiflorum*) after the most recent taxonomic treatment (Wagner *et al.* 1990) recognized no varietal differences. *Schiedea haleakalensis* first appeared on the 1985 notice as a Category 1 species and remained so on the 1990 notice. *Clermontia oblongifolia* ssp. *mauiensis* and *Lysimachia lydgatei* first appeared on the 1990 notice as Category 1 taxa.

Section 4(b)(3)(B) of the Act requires the Secretary to make findings on certain pending petitions within 12 months of their receipt. Section 2(b)(1) of the 1982 amendments further requires all petitions pending on October 13, 1982, be treated as having been newly submitted on that date. On October 13, 1983, the Service found that the petitioned listing of these taxa was warranted, but precluded by other pending listing actions, in accordance with section 4(b)(3)(B)(iii) of the Act; notification of this finding was published on January 20, 1984 (49 FR 2485). Such a finding requires the petition to be recycled, pursuant to section 4(b)(3)(C)(i) of the Act. The finding was reviewed in October of

1984, 1985, 1986, 1987, 1988, 1989, and 1990.

On May 24, 1991, the Service published in the *Federal Register* (56 FR 23842) a proposal to list 14 plant taxa from the island of Maui as endangered and one taxon, the Haleakala silversword ('ahinahina), as threatened. This proposal was based primarily on information supplied by the Hawaii Heritage Program, the Hawaii Plant Conservation Center, and observations of botanists and naturalists, notably Robert Hobdy, Lloyd Loope, and Arthur Medeiros. The Service now determines 14 taxa primarily from the island of Maui to be endangered, and an additional taxon to be threatened, with the publication of this rule.

Summary of Comments and Recommendations

In the May 24, 1991, proposed rule and associated notifications, all interested parties were requested to submit factual reports or information relevant to a final decision on the listing proposal. The

public comment period ended on July 23, 1991. Appropriate State agencies, county and city governments, Federal agencies, scientific organizations, and other interested parties were contacted and requested to comment. Newspaper notices inviting general public comment were published in *The Honolulu Advertiser* on June 1, 1991, and in *The Maui News* on June 2, 1991. Three letters of comment, including one from the Department of the Navy, one from the Governor of Hawaii, and one The Nature Conservancy of Hawaii, were received. Two of the letters had no comments, but one furnished additional information which has been incorporated into this final rule. The third letter had a single comment which is discussed below.

Issue 1: One respondent was concerned that *Acaena exigua* was being listed as the species has not been seen in recent years and may be extinct.

Response: The species is known historically from two islands, and, although it has not been seen for about

19 years, it may still be extant. The species is a small, inconspicuous plant, easily hidden among the other low, tufted bog plants with which it grows. It is restricted to high-elevation bogs comprising rugged, poorly explored terrain, of difficult access. Because there is a good probability that future surveys will show that *Acaena exigua* is still extant (D. Herbst, pers. comm., 1990), the Service has included the taxon in this final rule to extend to it the protection warranted by the Act.

Summary of Factors Affecting the Species

Section 4 of the Endangered Species Act (16 U.S.C. 1533) and regulations (50 CFR part 424) promulgated to implement the listing provisions of the Act set forth the procedures for adding species to the Federal Lists. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). The threats facing these 15 taxa are summarized in Table 1.

TABLE 1.—SUMMARY OF THREATS

Species	Feral animal activity				Alien plants	Fire	Disease/ insects	Rodents	Limited Nos. ¹
	Goats	Cattle	Pigs	Deer					
<i>Acaena exigua</i>			X						X
<i>Alectryon macrococcus</i>	X	X	X		X	X	X	X	
<i>Argyroxiphium sandwicense</i> ssp. <i>macrocephalum</i>	P	P					P		
<i>Bidens micrantha</i> ssp. <i>kalealaha</i>	X	X			X	X			
<i>Clermontia oblongifolia</i> ssp. <i>mauiensis</i>			X						X
<i>Cyanea lobata</i>			X						X
<i>Cyanea mceldowneyi</i>			X						X
<i>Cyrtandra munroi</i>				X	X				X
<i>Geranium multiflorum</i>	X		X		X				X
<i>Hedyotis coracea</i>						X			X
<i>Huperzia mannii</i>		X	X		X				X
<i>Lipochaeta kamolensis</i>	X	X				X			X
<i>Lysimachia lydgatei</i>					X	X			X
<i>Melicope mucronulata</i>	X		X		X				X
<i>Schiedea haleakalensis</i>	P					X			X

X = Immediate and significant threat.
P = Potential threat.

¹ No more than 100 individuals and/or fewer than 5 populations.

These factors and their application to *Acaena exigua* A. Gray (liliwai), *Alectryon macrococcus* Radlk. (mahoe), *Argyroxiphium sandwicense* DC ssp. *macrocephalum* (A. Gray) Meyrat (Haleakala silversword, 'ahináhina), *Bidens micrantha* Gaud. ssp. *kalealaha* Nagata and Ganders (ko'oko'olau), *Clermontia oblongifolia* Gaud. ssp. *mauiensis* (Rock) Lammers ('oha wai), *Cyanea lobata* H. Mann (haha), *Cyanea mceldowneyi* Rock (haha), *Cyrtandra munroi* C. Forbes (ha'iwale), *Geranium multiflorum* A. Gray (nohoanu), *Hedyotis coriacea* Sm. (kio'e), *Huperzia mannii* (Hillebr.) Holub (wawae'iole), *Lipochaeta kamolensis* Degener and Sherff (nehe), *Lysimachia lydgatei* Hillebr. (NCN), *Melicope mucronulata* (St. John) T. Hartley and B. Stone (alani), and *Schiedea haleakalensis* Degener and Sherff (NCN) are as follows:

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

The native vegetation of Maui and other Hawaiian Islands has undergone extreme alterations because of past and present land management practices, including deliberate alien plant and animal introductions, agricultural development, and military use (Cuddihy and Stone 1990, Frierson 1973, Wagner *et al.* 1985). Degradation of habitat by feral animals and competition with alien plants are considered the greatest present threats to the 15 taxa.

First introduced to Maui in 1793 (Stone and Loope 1987), goats (*Capra hircus*) became established on other Hawaiian islands by the 1820s (Cuddihy and Stone 1990, Culliney 1988). Far from controlling their numbers, the era of trade in goatskins (mid-1800s) saw the feral goat population increase into the millions (Culliney 1988). As a result of their agility, they were able to reach more remote areas than other ungulates (Culliney 1988). Feral goats now occupy a wide variety of habitats, from dry lowland forests to alpine grasslands, where they consume native vegetation, trample roots and seedlings, accelerate erosion, and promote the invasion of alien plants (Scott *et al.* 1986, Stone 1985, Stone and Loope 1987, Yocom 1967).

Currently, goats contribute to the substantial decline of the habitat of all four populations of *Alectryon macrococcus* var. *macrococcus* in Waimea Canyon on Kauai, due to ongoing management of goats by the State for recreational hunting (Daehler 1973, Tomich 1986). In the Waianae Mountains of Oahu, encroaching urbanization and hunting pressure tend

to restrict goats to the drier upper slopes (Tomich 1986). Over half of the Oahu populations of *Alectryon macrococcus* var. *macrococcus* are affected by increasing numbers of goats in scattered locations along the Waianae Mountains, especially in Makua and Makaleha (J. Lau, pers. comm., 1990). On Molokai, five populations of *Alectryon macrococcus* var. *macrococcus* and the population of *Melicope mucronulata* are immediately threatened by habitat degradation by goats (Medeiros *et al.* 1986). The populations of both taxa are restricted to a 3 sq mi (7.5 sq km) area that goats are known to frequent. Feral goats had nearly extirpated the populations of *Argyroxiphium sandwicense* ssp. *macrocephalum*, *Bidens micrantha* ssp. *kalealaha*, *Geranium multiflorum*, and *Schiedea haleakalensis* within Haleakala National Park by the 1930s. However, an active management program eradicated all but 100 feral goats from the Park by 1988. While they are no longer an immediate threat to plants within the park, the potential for the ingress and reestablishment of goats is still a possibility (L. Loope, pers. comm., 1990). The effects of past feral goat activity have taken their toll on *Schiedea haleakalensis*, which is now restricted to vertical cliff faces inaccessible to goats. Even after the removal of these feral ungulates, there has thus far been no evidence that *S. haleakalensis* is spreading (Bryan Harry, National Park Service, *in litt.*, 1990; A. Medeiros and L. Loope, *in litt.*, 1989).

Of the four taxa just mentioned, *Argyroxiphium sandwicense* ssp. *macrocephalum* has undergone the most extreme population fluctuation due to goats and cattle (*Bos taurus*). Until the 1920s, these animals grazed in what is now Haleakala National Park (Medeiros *et al.* 1986). As a result of the park's eradication program, numbers of *Argyroxiphium sandwicense* ssp. *macrocephalum* have increased significantly: from a low of between 100 and 1,500 to the present estimate of 50,000 plants (Degener 1948, Loope and Crivellone 1986). However, goats and cattle still threaten plants outside the park's managed areas. Until recently, goats were among the most pervasive threats to the adjacent Waikamoi Preserve (Holt 1983), where 5 of the 11 populations of *Geranium multiflorum* are located (HHP 1990j6, 1990j8 to 1990j10, 1990j12). Management practices initiated by The Nature Conservancy of Hawaii in that preserve within the past 3 years have reduced the number of goats from a high of several thousand to the current estimate of less than 50.

Although the reduction is substantial, there is still a possibility of ingress from adjacent parkland areas (Mark White, The Nature Conservancy of Hawaii, pers. comm., 1990). The remaining goats continue to degrade the habitat of *Geranium multiflorum*. Also found along much of the southern slope of Haleakala, goats are known to frequent the area where the only remaining population of *Lipochaeta kamolensis* persists in small depressions and along cattle trails (Medeiros *et al.* 1986).

The impact of cattle on the native vegetation is similar to that described for goats (Scott *et al.* 1986). These two ungulate species are considered the most damaging alien vertebrates to Hawaii's native ecosystems (Culliney 1988). Introduced to Maui in the early 1800s (Tomich 1986) and permitted to range freely, cattle became so abundant that by the 1840s, the northwestern slopes of Haleakala above Makawao were described as "endless bullock paths" (Culliney 1988). On the southern slope of Haleakala, cattle ranching dates from before 1910 (Rock 1913) and still continues in the vicinity of four of the taxa: *Bidens micrantha* ssp. *kalealaha*, *Huperzia mannii*, and the last known populations of *Alectryon macrococcus* var. *auwahiensis* and *Lipochaeta kamolensis* (R. Hobdy, pers. comm., 1990). The long history of cattle grazing has so altered this area that only pockets of native vegetation remain. As mentioned above, cattle also played a significant role in the decline of *Argyroxiphium sandwicense* ssp. *macrocephalum* in Haleakala National Park. Decades of uncontrolled grazing had devastating effects on native vegetation in Kula and Kahikinui forest reserves on Haleakala's southern and southwestern slopes (Medeiros *et al.* 1986). Although most cattle have been eradicated from these reserves through incentive permits, some were encountered there as recently as 1983 (Medeiros *et al.* 1986). Populations of the taxa occurring outside Maui are also threatened by cattle. Two of the six known populations of *Huperzia mannii* in Laupahoehoe Natural Area Reserve on the island of Hawaii occupy sites frequented by cattle that stray from adjacent State-leased ranches (L. Cuddihy, pers. comm., 1990). An additional effect of cattle is that their trails provide new routes for feral pigs (*Sus scrofa*) to expand their range (Paul Higashino, The Nature Conservancy of Hawaii, pers. comm., 1981).

On the island of Lanai, axis deer have caused extensive habitat degradation similar to that of goats and cattle. The axis deer is now considered to be the

major threat to the forests of Lanai (Culliney 1988). Deer browse on native vegetation, destroying or damaging the habitat. Also, their trampling removes vegetation and litter important to soil-water relations, compacts the soil, promotes erosion, and opens areas, allowing exotic plants to invade. Deer are common throughout Lanai; however, very few patches of forest are untouched by them. Ridge tops in particular are being invaded, but so are gulches (R. Hobdy, pers. comm., 1990). The largest known population of *Cyrtandra munroi* (and the only population with more than a single individual) is being impacted by deer (J. Lau, in litt., 1991). If hunting pressure decreases, deer could potentially destroy both Lanai's populations of this species (J. Lau, pers. comm., 1992).

In contrast to goats, cattle, and deer, pigs occupy the wetter regions of Hawaii's forests and are one of the major current modifiers of wet forest habitats (Stone 1985). Pigs damage the native vegetation by rooting and trampling the forest floor, and encourage the expansion of alien plants that are better able to exploit the newly tilled soil than are native species (Stone 1985). Pigs also disseminate alien species through their feces and on their bodies, accelerating the spread of alien plants within the native forest. Of the 15 plant taxa, *Acaena exigua*, both varieties of *Alectryon macrococcus*, *Clermontia oblongifolia* ssp. *mauiensis*, *Cyanea lobata*, *Cyanea mceldowneyi*, *Geranium multiflorum*, *Huperzia mannii*, and *Melicope mucronulata* are threatened by or have already sustained loss of individual plants or habitat as the result of feral pig activity (HHP 1990c17; HHP and Hawaii Division of Forestry and Wildlife (DOFAW) 1989; Sohmer and Gustafson 1987; L. Cuddihy, R. Hobdy, J. Lau, and A. Medeiros, pers. comms., 1990). Present throughout the Waianae Mountains of Oahu in low numbers, feral pigs pose a significant threat to the scattered populations of *Alectryon macrococcus* var. *macrococcus* (J. Lau, pers. comm., 1990). At the time of the last sighting of *Acaena exigua* on Puu Kukui on West Maui (1973), there was no sign of pigs on that plateau. Since then, the montane bog habitat of *A. exigua* has become threatened by the ingress of feral pigs from adjacent areas (Betsy Gagne, Haleakala National Park, pers. comm., 1990). On West Maui, *Clermontia oblongifolia* ssp. *mauiensis*, *Cyanea lobata*, and *Cyanea mceldowneyi* are also threatened by feral pigs (HHP and DOFAW 1989; R. Hobdy, pers. comm., 1990). Pigs are considered one of the most pervasive threats to the wet forests of Waikamoi

Preserve on East Maui, an area where *Geranium multiflorum* populations are susceptible to rooting and trampling by pigs (Holt 1983).

Since 1989, flocks of escaped or released domestic European rabbits (*Oryctolagus cuniculus*) have invaded Hosmer's Grove in Haleakala National Park. These animals are extremely prolific and, like feral goats and pigs, can deplete vast areas of vegetation (Tanji 1990a, 1990c). Although the rabbits are currently restricted to Hosmer's Grove, their range is increasing and has the potential of reaching five populations *Geranium multiflorum*, the closest of which is only 0.7 mi (1.2 km) away.

Six of the 15 taxa are threatened by competition with 1 or more alien plant species (see Table 1). *Schinus terebinthifolius* (Christmasberry), introduced to Hawaii before 1911, has had particularly detrimental impacts (Cuddihy and Stone 1990). This fast-growing tree is able to form dense thickets that displace other plants (Cuddihy and Stone 1990, Smith 1985). It is now replacing the native vegetation of much of the southern Waianae Mountains and threatens to occupy the range of all Oahu populations of *Alectryon macrococcus* var. *macrococcus* (HHP 1990c13, 1990c15, 1990c17, 1990c19, 1990c21; J. Lau, pers. comm., 1990).

Psidium cattleianum (strawberry guava) is a pervasive alien tree in the southern Waianae Mountains of Oahu and the wet forests of Maui. It is also found on the other Hawaiian Islands. Like Christmasberry, strawberry guava is capable of forming dense stands that exclude other plant species (Cuddihy and Stone 1990) and is distributed mainly by feral pigs and fruit-eating birds (Smith 1985). The Maui populations of *Alectryon macrococcus* var. *macrococcus* are immediately threatened by competition with this alien plant as are Lanai's populations of *Cyrtandra munroi* (J. Lau, pers. comms., 1990 and 1992).

With the introduction of cattle and goats and the development of organized ranching, the native forests in many parts of the State were converted to vast pastures of alien grasses. Such species as *Melinis minutiflora* (molasses grass) and *Pennisetum clandestinum* (kikuyu grass) were introduced as fodder (Cuddihy and Stone 1990) and quickly spread to areas previously disturbed by ungulates. Today, these alien species have infested many dry to mesic forests on most of the Hawaiian Islands (Cuddihy and Stone 1990). Native vegetation on dry mountain ridges of

Kauai, Oahu, Maui, Lanai, and Molokai is being replaced by molasses grass. This species and Christmasberry are considered the two most serious alien plant problems in the Waianae Mountains of Oahu (J. Lau, pers. comm., 1990). Molasses grass produces a dense mat capable of smothering plants, provides fuel for fire, and carries fire into areas with woody plants (Cuddihy and Stone 1990). Most populations of *Alectryon macrococcus* var. *macrococcus* on Oahu and Molokai as well as the sole population of *Melicope mucronulata* on Molokai are immediately threatened by this alien plant (HHP 1990n1; J. Lau, pers. comm., 1990). Kikuyu grass is invading dry to mesic habitats as well as disturbed wet forests on all of the Hawaiian Islands. Like molasses grass, kikuyu grass forms a thick mat that prevents the reproduction of native plant taxa, such as *Alectryon macrococcus* var. *auwahiensis* at Auwahi (Cuddihy and Stone 1990; Medeiros et al. 1986; S. Perlman, pers. comm., 1990) and populations of *Bidens micrantha* ssp. *kalealaha* on East Maui (L. Loope, pers. comm., 1990).

Rubus argutus (prickly Florida blackberry), recognized as a noxious weed by the Hawaii State Department of Agriculture, is adapted to open disturbed areas, where it forms impenetrable thickets (Smith 1985). This invasive alien plant poses a serious threat to the habitat of *Geranium multiflorum* and *Lysimachia lydgatei* on Maui (Berger et al. 1975, HHP and DOFAW 1989) and, to a lesser degree, threatens *Huperzia mannii* on Hawaii Island (HHP 1989a; L. Cuddihy, pers. comm., 1990).

Fire threatens six plant taxa growing in dry to mesic grassland, shrubland, and forests on the leeward slopes of West Maui, Haleakala on East Maui, and the Waianae Mountains of Oahu (Center for Plant Conservation (CPC) 1990; HHP and DOFAW 1989; R. Hobdy, pers. comm., 1990) (see Table 1). Human-set fires and wildfires are known to destroy native Hawaiian vegetation and usually favor fire-resistant alien plants (Cuddihy and Stone 1990). A dump located near the Lihau Section of the West Maui Natural Area Reserve regularly burns and starts wildfires, immediately threatening the only known plant of *Hedyotis coriacea* on Maui (HHP and DOFAW 1989; S. Perlman, pers. comm., 1990). A single fire could also extirpate the only known population of *Alectryon macrococcus* var. *auwahiensis*, *Lipochaeta kamolensis*, or *Lysimachia lydgatei* (CPC 1990; R. Hobdy, pers. comm., 1990).

or affect a significant portion of the population of *Bidens micrantha* ssp. *kalealaha* and *Schiedea haleakalensis* (A. Medeiros, pers. comm., 1990). Unintentionally ignited fires have resulted from ordnance training practices in Makua Military Reservation on Oahu. Although most fires have been contained within 0.02 ac (0.01 ha), a single 300 ac (120 ha) fire in July 1989 spread upslope and came to within 0.2 mi (0.3 km) of a population of *Alectryon macrococcus* var. *macrococcus*, also threatening seven other populations in the area (Colonel William Chastain, U.S. Army, Fort Shafter, Hawaii, *in litt.*, 1989a, 1989b, 1990a, 1990b).

Natural fires and fires accidentally set by hunters or military ordnance or personnel within Pohakuloa Training Area (PTA) on the island of Hawaii threaten native vegetation on the leeward side of Mauna Kea (Herbst and Fay 1979), including the habitat of the largest population of *Hedyotis coriacea*. Habitat disturbance caused by military exercises at PTA on the island of Hawaii may have threatened *Hedyotis coriacea* in the past. Planned military maneuvers are now being reevaluated in light of the recent discovery of several endangered plants on PTA.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Illegal collecting for scientific or horticultural purposes or excessive visits by individuals interested in seeing rare plants could result from increased publicity, and would seriously threaten six of these taxa (*Acaena exigua*, *Clermontia oblongifolia* ssp. *mauiensis*, *Cyanea lobata*, *Hedyotis coriacea*, *Lysimachia lydgatei*, and *Melicope mucronulata*). Because for each of these taxa fewer than 10 individuals exist, any collection of whole plants or reproductive parts would adversely impact the gene pool and threaten their survival.

Argyroxiphium sandwicense ssp. *macrocephalum* is of horticultural, ornamental, and scientific interest, and, in the past, collection of seed for propagation or of entire plants for ornamental purposes, combined with habitat degradation by ungulates, nearly extirpated this taxon (Degener 1948, Keck 1936b, Kepler 1983, Kimura and Nagata 1980). Illegal silversword collecting and vandalism continues to this day (Tanji 1990b); however, these activities are now minimal and represent only a potential threat. Propagation of *A. sandwicense* ssp. *macrocephalum* is difficult, since both seed production and germination are quite low (Kobayashi 1974). According

to Kobayashi (1973a), trampling by humans and subsequent erosion of the loose cinder substrate, now mainly confined to the western rim of Haleakala Crater, may become a more serious threat as the number of visitors to the national park increases. Such disturbance to the substrate causes serious mechanical damage to *A. sandwicense* ssp. *macrocephalum* by injuring or exposing the shallow root system (Doria 1979, Kobayashi 1973c).

The montane bog habitat of *Acaena exigua* is extremely sensitive to excessive visitation. Habitat degradation may result from trampling, which destroys vegetation and creates pools of mud and standing water (Sohmer and Gustafson 1987).

C. Disease or Predation

Xylosandrus compactus (black twig borer) has been cited as an immediate threat to the extant populations of both varieties of *Alectryon macrococcus* (CPC 1990; Hara and Beardsley 1979; HHP 1990c25; J. Lau and S. Perlman, pers. comms., 1990). The black twig borer burrows into the branches and introduces a pathogenic fungus, pruning the host severely, often killing branches or whole plants (Hara and Beardsley 1979, Howarth 1985). The Waimea Canyon populations of *Alectryon macrococcus* var. *macrococcus*, most populations on Oahu, and the single population of *Alectryon macrococcus* var. *auwahiensis* suffer severe defoliation and reduced vigor due to infestations of this alien insect (J. Lau, pers. comm., 1990). Most populations of this species probably sustain some damage from the borer (J. Lau, pers. comm., 1990).

The three remaining individuals of *Melicope mucronulata* on Molokai have been browsed by goats (HHP 1990n2, Medeiros *et al.* 1986). Although the plants appeared vigorous when last seen (HHP 1990n2), continued predation would severely threaten the population. *Bidens micrantha* ssp. *kalealaha* is apparently highly palatable to goats (HHP 1990e2). Predation and habitat degradation have destroyed all plants in areas accessible to goats, restricting this taxon to sheer cliffs (HHP 1990e1, 1990e2). It is likely that browsing reduced *Argyroxiphium sandwicense* ssp. *macrocephalum* numbers in Haleakala Crater. Although probably not a preferred food item, goats, cattle, and horses will browse the plant if it is available (Bryan 1948, Kimura and Nagata 1980, Kobayashi 1973a to 1973c, Loope and Crivellone 1986).

Cattle ranching continues on private and leased State land in Auwahi and on the southern slope of Haleakala, where

the only known remaining populations of *Alectryon macrococcus* var. *auwahiensis* and *Lipochoeta kamolensis* exist. Not only do cattle threaten the mature plants by their browsing activities (Medeiros *et al.* 1986), but they also trample seedlings. While there is no direct evidence of predation of the other taxa, none are known to be unpalatable to goats or cattle. Predation is therefore a probable threat at sites where those animals have been reported, potentially affecting *Geranium multiflorum*, *Huperzia mannii*, and *Schiedea haleakalensis*.

Of four rodent species that have been introduced to the Hawaiian Islands, the arboreal black rat (*Rattus rattus*) has probably had the greatest impact on the native flora and fauna (Stone and Loope 1987). Rodents (the arboreal black rat and, to a lesser degree, the Polynesian rat (*Rattus exulans*) and the house mouse (*Mus musculus*)) feed on the fleshy fruits and flowers of Hawaiian plants and/or girdle and strip tender branches (Cuddihy and Stone 1990). Evidence of such predation has been seen on both varieties of *Alectryon macrococcus* (CPC 1990, HPCC 1990, Wagner *et al.* 1990). The combined effect of the black twig borer and predation by goats and rats has inhibited germination and reproduction of this plant for many years (Medeiros *et al.* 1986).

Argyroxiphium sandwicense ssp. *macrocephalum* is predated by the larvae of a phycitid moth (*Rhynchephestia rhabdotis*) and tephritid fly (*Tephritis cratericola*), which were found to have damaged 60% of the seeds produced on average (Kobayashi 1974, Loope and Crivellone 1986). Since these are native insects which evolved with the silversword, they may not pose a threat to the plant, at least under normal conditions (Kobayashi 1973a). Two alien insects, the Argentine ant (*Iridomyrmex humilis*) and yellow jacket (*Vespa pennsylvanica*) are potential threats to the pollinators of *A. sandwicense* ssp. *macrocephalum* (Beardsley 1980, Stone and Loope 1987) and are moving into the silversword habitat (Loope and Crivellone 1986). In 1985, the highly aggressive Argentine ant had become established within the elevational limits of silversword distribution. Although not currently within Haleakala Crater (Loope and Crivellone 1986), the ant is found in similar habitat (Stone and Loope 1987). The rapid increase in the yellow jacket population following its introduction in the late 1970s is also of concern. The decline in native invertebrates as the yellow jacket population has increased suggests that

this species may become a more serious threat in the future (Howarth 1985; L. Loope, pers. comm., 1990).

D. The Inadequacy of Existing Regulatory Mechanisms

Of the 15 taxa, a total of 7 have populations located on private land, 1 on City and County land, 10 on State land, and 5 on Federal land. While six of the taxa occur in more than one of those three ownership categories, the other nine are restricted to a single category: Three taxa are found only on private land, four only on State land, and two only on Federal land. There are no State laws or existing regulatory mechanisms at the present time to protect or prevent further decline of these plants on private land. However, Federal listing would automatically invoke listing under Hawaii State law, which prohibits taking and encourages conservation by State government agencies. State regulations prohibit the removal, destruction, or damage of plants found on State lands. However, the regulations are difficult to enforce because of limited personnel. Hawaii's Endangered Species Act (HRS, Sect. 195D-4(a)) states, "Any species of aquatic life, wildlife, or land plant that has been determined to be an endangered species pursuant to the Endangered Species Act (of 1973) shall be deemed to be an endangered species under the provisions of this chapter and any indigenous species of aquatic life, wildlife, or land plant that has been determined to be a threatened species pursuant to the Endangered Species Act shall be deemed to be a threatened species under the provision of this chapter." Further, the State may enter into agreements with Federal agencies to administer and manage any area required for the conservation, management, enhancement, or protection of endangered species (HRS, Sect. 195D-5(c)). Funds for these activities could be made available under section 6 of the Federal Act (State Cooperative Agreements). Listing of these 15 plant taxa therefore reinforces and supplements the protection available under State law. The Act also offers additional protection because it is a violation of the Act for any person to remove, cut, dig up, damage, or destroy any endangered plant in an area not under Federal jurisdiction in knowing violation of State law or regulation or in the course of any violation of a State criminal trespass law.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

The small number of populations and of individual plants of all of these taxa

increases the potential for extinction from stochastic events. The limited gene pool may depress reproductive vigor, or a single man-caused or natural environmental disturbance could destroy a significant percentage of the individuals (or the only known extent population of these taxa. For example, *Acaena exigua* and *Clermontia oblongifolia* ssp. *mauiensis* are known from a single individual and *Cyanea lobata*, *Hedyotis coriacea*, *Lysimachia lydgatei*, and *Melicope mucronulata* from less than 10 individuals. Eleven of the 15 taxa are known from fewer than 5 populations, and 10 of the taxa are estimated to number no more than 100 individuals (see Table 1).

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by these 15 taxa in determining to make this rule final. Based on this evaluation, the preferred action is to list 14 taxa, *Acaena exigua*, *Alectryon macrococcus*, *Bidens micrantha* ssp. *kalealaha*, *Clermontia oblongifolia* ssp. *mauiensis*, *Cyanea lobata*, *Cyanea mcelandowneyi*, *Cyrtandra munroi*, *Geranium multiflorum*, *Hedyotis coriacea*, *Huperzia mannii*, *Lipochaeta kamolensis*, *Lysimachia lydgatei*, *Melicope mucronulata*, and *Schiedea haleakalensis*, as endangered and one taxon, *Argyroxiphium sandwicense* ssp. *macrocephalum*, as threatened. Eleven of the 14 taxa determined to be endangered either number no more than about 100 individuals or are known from fewer than 5 populations. The 14 taxa are threatened by 1 or more of the following: Habitat degradation and/or predation by feral goats, cattle, deer, and pigs; competition from alien plants; military training exercises; and fire. Small population size makes these taxa particularly vulnerable to extinction from stochastic events. Because these 14 taxa are in danger of extinction throughout all or a significant portion of their ranges, they fit the definition of endangered as defined in the Act. Therefore, the determination of endangered status for these 14 taxa appears warranted.

All populations of *Argyroxiphium sandwicense* ssp. *macrocephalum* are located within Haleakala National Park. Since ongoing management practices have eradicated goats and cattle from the park, those animals no longer pose an immediate threat to this taxon. However, these populations are vulnerable to a variety of alien insects and animals that have the potential of invading the habitat of *A. sandwicense* ssp. *macrocephalum*. As recreation use

of the park increases, vandalism or unintentional damage to the plants may become a more serious threat. Although the relatively large number of existing plants provides greater flexibility in recovery and reduces the likelihood that the taxon will go extinct in the immediate future, all populations are threatened to some degree. Because of the limited threats facing *A. sandwicense* ssp. *macrocephalum*, this taxon is not now in immediate danger of extinction throughout all or a significant portion of its range. However, *A. sandwicense* ssp. *macrocephalum* is likely to become endangered in the foreseeable future. As a result, *Argyroxiphium sandwicense* ssp. *macrocephalum* fits the definition of threatened species as defined by the Act. Critical habitat is not being designated for these taxa for reasons discussed in the "Critical Habitat" section of this rule.

Critical Habitat

Section 4(a)(3) of the Act, as amended, requires that to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time a species is determined to be endangered or threatened. The Service finds that designation of critical habitat is not presently prudent for these taxa. Such a determination would result in no known benefit to the taxa. As discussed under Factor B in the "Summary of Factors Affecting the Species," the taxa face numerous anthropogenic threats. The publication of precise maps and descriptions of critical habitat in the Federal Register and local newspapers as required when critical habitat is designated would increase the degree of threat to these plants from take or vandalism and, therefore, could contribute to their decline and increase enforcement problems. The listing of these taxa as either endangered or threatened publicizes the rarity of the plants and, thus, can make these plants attractive to researchers, curiosity seekers, or collectors of rare plants. All involved parties and the major landowners have been notified of the location and importance of protecting the habitat of these taxa. Protection of the habitat of the taxa will be addressed through the recovery process and, in some cases, through the section 7 consultation process.

There are only three known Federal activities within the currently known habitats of these plants. Four taxa are found in Haleakala National Park, where laws protect all plants from damage or removal. One taxon is located on Federal property under

control of the military, on State property leased to the Federal government for use by the military, and on nearby State lands. Although military and ordnance training takes place on Schofield Barracks, which is Federal property, and Makua Military Reservation, which is leased from the State of Hawaii, the impact areas and buffer zones for these activities are outside the area where the taxon occurs, so it is unlikely that the activities would directly affect the continued existence of these plants. Another taxon is located on PTA, on land owned by the Department of the Army. Planned military maneuvers are now being reevaluated in light of the recent discovery of several endangered plants on PTA. Therefore, the Service finds that designation of critical habitat for these taxa is not prudent at this time, because such designation would increase the degree of threat from vandalism, collecting, or other human activities and because it is unlikely to aid in the conservation of these taxa.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Endangered Species Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain activities. Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies, groups, and individuals. The Endangered Species Act provides for possible land acquisition and cooperation with the State and requires that recovery actions be carried out for all listed species. The protection required of Federal agencies and the prohibitions against certain activities involving listed plants are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(2) of the Act requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of such a species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service. Two of these taxa, *Argyroxiphium sandwicense* ssp. *macrocephalum* and *Schiedea*

haleakalensis, are located only in Haleakala National Park. Some populations of two other taxa, *Bidens micrantha* ssp. *kalealaha* and *Geranium multiflorum*, also are found in this park. Laws relating to national parks prohibit damage or removal of any plants growing in the parks. Two populations of *Alectryon macrococcus* are located on Federal property, one population on Schofield Barracks and the other on Lualualei Naval Reservation. Eight populations of *A. macrococcus* are located on State land, three in areas leased to the Federal government as part of Makua Military Reservation and five in a nearby State Conservation District. Makua Military Reservation and Schofield Barracks are controlled by the U.S. Army, and portions are used by them and other branches of the military for ordnance training of their troops, including a buffer zone adjacent to impact areas. These plants are not located inside impact or buffer zones and thus are not directly affected by military activities. The Army has constructed firebreaks on the Makua Military Reservation to minimize damage from unintentional fires that occasionally result from stray bullets (Herve Messier, U.S. Army, Ft. Shafter, pers. comm., 1990). The largest known population of *Hedyotis coriacea* is located on the Pohakuloa Training Area on the island of Hawaii. Fires accidentally set by military ordnance or personnel and habitat disturbance caused by military exercises in the Pohakuloa Training Area on the island of Hawaii may have adversely impacted *Hedyotis coriacea* in the past, however planned military maneuvers are now being reevaluated in light of the recent discovery of several endangered plants on PTA. There are no other known Federal activities that occur within the present known habitat of these 15 plant taxa.

The Act and its implementing regulations found at 50 CFR 17.61, 17.62, and 17.63 for endangered species and 17.71 and 17.72 for threatened species set forth a series of general prohibitions and exceptions that apply to all endangered and threatened plant species. With respect to the 14 plant taxa listed as endangered in this rule, all trade prohibitions of section 9(a)(2) of the Act, implemented by 50 CFR 17.61 apply. These prohibitions, in part, make it illegal with respect to any endangered plant for any person subject to the jurisdiction of the United States to import or export; transport in interstate or foreign commerce in the course of a commercial activity; sell or offer for sale these species in interstate or foreign

commerce; or to remove and reduce to possession any such species from areas under Federal jurisdiction; maliciously damage or destroy any such species on any area under Federal jurisdiction; or remove, cut, dig up, damage or destroy any such species on any other area in knowing violation of any State law or regulation or in the course of any violation of a State criminal trespass law. The Haleakala silversword, listed as threatened, is subject to similar prohibitions (16 U.S.C. 1538(a)(2)(E), 50 CFR 17.71). Seeds from cultivated specimens of threatened plant species are exempt from these prohibitions provided that a statement of "cultivated origin" appears on their containers. Certain exceptions apply to agents of the Service and State conservation agencies. The Act and 50 CFR 17.62, 17.63, and 17.72 also provide for the issuance of permits to carry out otherwise prohibited activities involving endangered and threatened plant species under certain circumstances. It is anticipated that few trade permits would ever be sought or issued because the species are not common in cultivation nor in the wild.

Requests for copies of the regulations on plants and inquiries regarding them may be addressed to the Office of Management Authority, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, room 432, Arlington, Virginia 22203-3507 (703/358-2093 or FTS 921-2093; FAX 703/358-2281).

National Environmental Policy Act

The Fish and Wildlife Service has determined that an Environmental Assessment or Environmental Impact Statement, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act of 1973, as amended. A notice outlining the Service's reasons for this determination was published in the *Federal Register* on October 25, 1983 (48 FR 49244).

References Cited

A complete list of all references cited herein is available upon request from the Pacific Islands Office. (See **ADDRESSES** above.)

Author

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List of Subjects in 50 CFR Part 17

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

Regulations Promulgation

Accordingly, part 17, subchapter B of chapter I, title 50 of the Code of Federal

Regulations, is amended as set forth below:

PART 17—[AMENDED]

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

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

2. Amend § 17.12(h) by adding the following, in alphabetical order under

the families indicated, and by adding three new families, "Gesneriaceae—Gesneria family," "Lycopodiaceae—lubbmoss family," and "Sapinaceae—Soapberry family," in alphabetical order, to the List of Endangered and Threatened Plants:

§ 17.12 Endangered and threatened plants.

* * * * *
(h) * * *

Species		Historic range	Status	When listed	Critical habitat	Special rules
Scientific name	Common name					
Asteraceae—Aster family:						
<i>Argyroxiphium sandwicense</i> ssp. <i>macrocephalum</i>	Haleakala silversword, 'ahinahina	U.S.A. (HI)	T	467	NA	NA
<i>Bidens micrantha</i> ssp. <i>kalealaha</i>	ko'oko'olau	U.S.A. (HI)	E	467	NA	NA
<i>Lipochaeta kamolensis</i>	nehe	U.S.A. (HI)	E	467	NA	NA
Campanulaceae—Bellflower family:						
<i>Clermontia oblongifolia</i> ssp. <i>mauiensis</i>	'oha wai	U.S.A. (HI)	E	467	NA	NA
<i>Cyanea lobata</i>	haha	U.S.A. (HI)	E	467	NA	NA
<i>Cyanea mceldowneyi</i>	haha	U.S.A. (HI)	E	467	NA	NA
Caryophyllaceae—Pink family:						
<i>Schiedea haleakalensis</i>	none	U.S.A. (HI)	E	467	NA	NA
Gesneriaceae—Gesneria family:						
Geraniaceae—Geranium family:						
<i>Geranium multiflorum</i>	nohoanu	U.S.A. (HI)	E	467	NA	NA
<i>Cyrtandra munroi</i>	ha'iwale	U.S.A. (HI)	E	467	NA	NA
Lycopodiaceae—Clubmoss family:						
<i>Huperzia manni</i>	wawae'iole	U.S.A. (HI)	E	467	NA	NA
Primulaceae—Primrose family:						
<i>Lysimachia lydgatei</i>	none	U.S.A. (HI)	E	467	NA	NA
Rosaceae—Rose family:						
<i>Acaena exigua</i>	li'iwai	U.S.A. (HI)	E	467	NA	NA
Rubiaceae—Coffee family:						
<i>Hedyotis coriacea</i>	ku'eie	U.S.A. (HI)	E	467	NA	NA
Rutaceae—Citrus family:						
<i>Melicope mucronulata</i>	alani	U.S.A. (HI)	E	467	NA	NA
Sapindaceae—Soapberry family:						
<i>Alectryon macrococcus</i>	mahoe	U.S.A. (HI)	E	467	NA	NA

Dated: May 1, 1992.

Bruce Blanchard,

Director, Fish and Wildlife Service.

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