fern taxa. However, the vegetation now covering the Koolau Mountain Range is mostly alien. The majority of the remaining native vegetation is restricted to steep valley head walls and inaccessible summit ridges. The windswept ridges are very steep and are characterized by grasses, ferns, and low-growing, stunted shrubs (Gagne and Cuddihy 1990).

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

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

The known habitat of these 25 plant taxa is owned by the City and County of Honolulu, the State of Hawaii (including land classified as Department of Hawaiian Homelands, Natural Area Reserve (NAR) System, Forest Reserve, and land leased by the Federal government (Department of Defense

(DOD)) for military use), the Federal government, and private parties. Plants on land owned or leased by the Federal government are located on portions of Dillingham, Kaena Point, Makua, and Schofield Barracks Military Reservations; Kawailoa and Kahuku Training Areas; Lualualei Naval Reservation; and the Omega U.S. Coast Guard Station. Private lands include Honouliuli Preserve, leased from a major landowner by TNCH.

Discussion of the 25 Plant Taxa Proposed for Listing

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

Chamaesyce herbstii, a member of the spurge family (Euphorbiaceae), is a small tree ranging from 3 to 8 m (10 to 26 ft) tall. The thin, leathery leaves, normally 8 to 19.5 cm (3.1 to 7.7 in) long and 1.8 to 3.8 cm (0.7 to 1.5 in) wide, are narrowly oblong or sometimes more lance-shaped or elliptic. The leaves are arranged in pairs on the same plane. The small, petalless flower clusters (cyathia or compact flowering stalks with small individual flowers, the whole simulating a single flower) occur in groups of 3 to 15 in branched, open flowering stalks. The individual flower stalks are 8 to 20 mm (0.3 to 0.8 in) long. The hairy inflorescence bracts (specialized leaves) are broadly bellshaped and contain five to six yellowish green glands. The green or sometimes reddish purple-tinged, angular capsules (dry fruit that open at maturity) scarcely protrude from the bracts. This species is distinguished from others in the genus by the length of the flowering stalk and the color of the angular fruits (Koutnik 1990).

Historically *Chamaesyce herbstii* was known from scattered populations in the northern and central Waianae Mountains on the island of Oahu (Hawaii Heritage Program (HHP) 1994c1 to 1994c5). Currently this species is known from four populations in the central and northern Waianae Mountains—South Ekahanui Gulch, Pahole (Kukuiula) Gulch, Kapuna Gulch, and West Makaleha-Central Makaleha. These populations are found on private land in TNCH's Honouliuli Preserve and State land, including Pahole NAR (HHP 1994c1 to 1994c5). The total number of plants is estimated

to be fewer than 200. *Chamaesyce herbstii* typically grows in mesic koa'ohi'a lowland forests, *Pisonia* sp.
(papala kepau)-*Charpentiera* sp.
(papala) lowland forests, or diverse mesic forests at elevations between 530 and 700 m (1,750 to 2,300 ft).

Associated plant taxa include the federally endangered *Alectryon macrococcus* var. *macrococcus* (mahoe), as well as *Hibiscus arnottianus* var. *arnottianus* (koki'o ke'oke'o), *Melicope* sp. (alani), *Pouteria* sp. ('ala'a), and *Urera glabra* (opuhe) (HHP 1994c1 to 1994c5).

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

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

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