

Conservation Needs and Ongoing Conservation Actions for the Critical Habitat in the Action Area Conservation needs for *Euphorbia haeleeleana* critical habitat include control of fire threat. The conservation actions that include Army fencing and control of non-native plants and rats, described in the Makua Biological Opinion, remain valid. *Euphorbia haeleeleana* critical habitat unit A is located almost entirely within the Kaluakauila Management Unit, where Army fencing, ungulate exclusion, weed control, and fire protection minimize the impact of major threats. **Other than interagency efforts to protect this area from fire, no ongoing conservation actions benefit *E. haeleeleana* critical habitat in the Puulu to Alaiheihe fuelbreak portion of the action area.**

Status of the Species and Critical Habitat – *Hibiscus brackenridgei* (Mao hau hele)

Species Description *Hibiscus brackenridgei* is a short-lived perennial shrub in the Malvaceae (mallow) family. It is a sprawling to erect shrub or small tree with lobed, heart-shaped leaves 5 to 15 cm (2 to 6 in) long. The yellow flowers, borne singly or in small clusters, have petals 3.5 to 8 cm (1.4 to 3.2 in) long. The fruits are round or oval capsules 1.1 to 2 cm (0.4 to 0.8 in) long (Wagner *et al* 1999).

The stature, branching pattern, and morphology of leaves, stems, and flowers of *H. brackenridgei* ssp. *mokuleianus* differ in the three areas on Oahu where the species is currently known. Three *H. brackenridgei* ssp. *mokuleianus* phenotypes: tall, medium, and short are recognized (Lau 2008a). Morphological differences among these types are attributed to underlying genetic differences (Makua Implementation Team 2003). The Waialua type (which includes plants at Kihakapu, Palikea, Puulu to Alaiheihe, and Kaumoku Nui population units) represents typical *H. brackenridgei* ssp. *mokuleianus* plants, which are single-trunked trees 4 to 7 m (13 to 23 ft) tall with stems densely covered with spines. The Kealia type south of Dillingham Airfield (including the Haili to Kawaii population unit) is shorter (2 to 6 m (6.5 to 20 ft) tall), branches near the ground to form a multi-trunked tree, and has moderately spiny to spineless stems (medium type). The recently discovered Makua, or short type morphologically resembles *H. brackenridgei* ssp. *molokaiana*, which historically occurred in West Molokai (Caum 1930). This short Makua type is a rambling shrub with branches that spread outward, rather than upward (as the two other types do), and these short-type plants have smaller leaves and no spines. *Hibiscus brackenridgei* ssp. *brackenridgei* is a sprawling to erect shrub or small tree with calyx 1.5 to 2.5 cm (0.6 to 1 in) long and petals with or without basal maroon spotting, 3.5 to 6 cm (1.4 to 2.4 in) long, occurring in dry forest and shrubland, near sea level up to 370 m (1214 ft), on Molokai, Lanai, Maui, and Hawaii.

Listing Status *Hibiscus brackenridgei* was federally listed as endangered on November 10, 1994 (59 FR 56333), and was State listed as endangered at the same time. This species is included in a recovery plan for multi-island plants (Service 1999a). Critical habitat for this species was designated for Oahu on June 17, 2003 (68 FR 35950); for Hawaii on July 2, 2003 (68 FR 39624); for Maui on May 14, 2003 (68 FR 25934); and for Molokai on March 18, 2003 (68 FR 12982). Three subspecies of *H. brackenridgei* are now recognized: *brackenridgei*, *mokuleianus*, and *molokaiana* (68 FR 35950). The taxonomic change that recognizes three subspecies is cited in the “Supplement to the Manual of the Flowering Plants of Hawaii” (Wagner and Herbst 1999). Although project impacts to the species, as it is listed, are

addressed in this Amendment, particular consideration is given to *H. brackenridgei* ssp. *mokuleianus* because it occurs naturally within the action area.

Historic and Current Distribution *Hibiscus brackenridgei* is endemic to the Hawaiian Islands. Historic data indicate it was known from all main Hawaiian Islands (Wagner *et al* 1999) (Figure 15 and Table 2). As of February, 2008, a total of 319 to 363 total *H. brackenridgei* are currently known to occur in the wild (see Table 2 and Table 3). Approximately 163 individuals (45 to 50 percent) are currently classified as belonging to the subspecies *Hibiscus brackenridgei* ssp. *mokuleianus* and occur on Oahu, the others are classified as *Hibiscus brackenridgei* ssp. *brackenridgei* and occur on Lanai, Maui, and the Island of Hawaii, and none are classified as *H. brackenridgei* ssp. *molokaiana*.

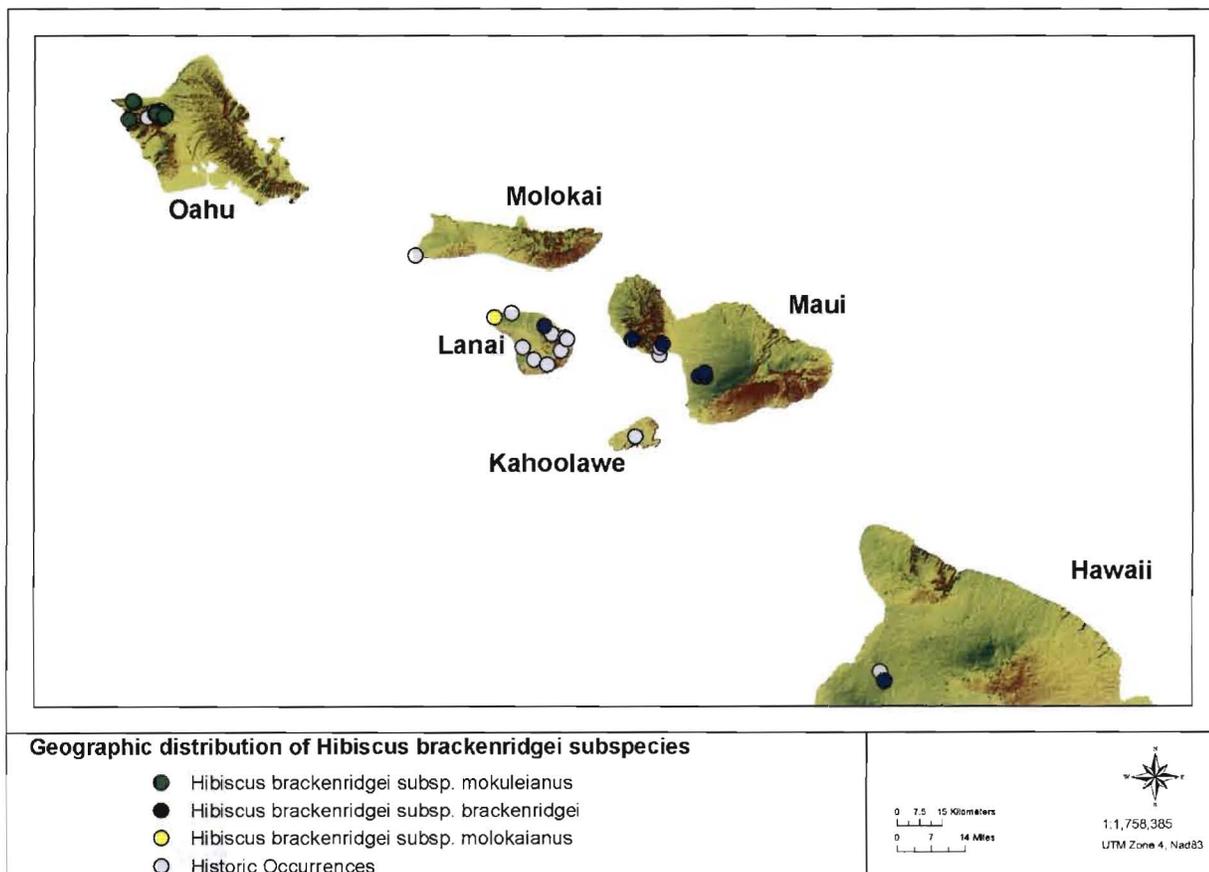


Figure 15. Range-wide geographic distribution of subspecies of *Hibiscus brackenridgei*.

Table 2. Estimated number of known *Hibiscus brackenridgei* ssp. *brackenridgei* and *H. molokaiana* individuals

Island	1989 - 1991	2007 **
Lanai	4 *	5 ^^
West Maui	9/13 #	11/few
East Maui	17 ##	11
Island of Hawaii	3 ^	129 - 173
Total Individuals	33/13	156 - 200

* Perlman 1991 Sheet 915230; # Lau, 1992 data compiled in 1994; ## 1989 Hawaii Natural Heritage Program Survey Data; ^ Perlman 1991 Sheet 915467; ** Service 2008 (Unpublished Recovery Database); ^^ Perlman 2007

Plant numbers have increased substantially on the island of Hawaii as a result of successful out-planting and increased efforts to exclude ungulates from areas occupied by *Hibiscus brackenridgei* ssp. *brackenridgei*. Plants on Lanai are in poor health (Plant Extinction Program 2007 Annual Report).

The subspecies *Hibiscus brackenridgei* ssp. *mokuleianus* was historically known from scattered locations in the Waianae Mountains of Oahu and West Molokai (Makua Implementation Team 2003). In 1950, *H. brackenridgei* was observed in gulches in the Waialua area as “a large tree, occurring in pure stands or in association with *Erythrina* [wiliwili]” (Hatheway 1952). The species was not known to occur on the leeward side of the Waianae Mountains until it was discovered at Makua in the early 1990s (Makua Implementation Team 2003). When the species was listed in 1994, only six to eight total individuals were known from five Oahu locations. The number of adult plants of this subspecies in recent years has ranged from between 49 and 82 individuals. Currently, this subspecies occurs in five naturally occurring population units (excluding inter situ, ex situ, and experimentally reintroduced sites): two population units (Makua and Keaau) are proposed for Army management within the Makua action area and two (Puulu to Alaiheihe and Haili to Kawaiu) occur on private lands (Figure 16). A portion of the Kaumoku Nui *Hibiscus brackenridgei* ssp. *mokuleianus* population unit, not slated for Army management, occurred on State land, and although all known individuals were killed in the Waialua Fire in August 2007, (U.S. Army Garrison 2008, p.29), seedlings currently grow at this site. No population units for this taxon meet minimum numeric criteria for stabilization (defined as 50 mature, reproducing individuals per population unit for short-lived perennials).

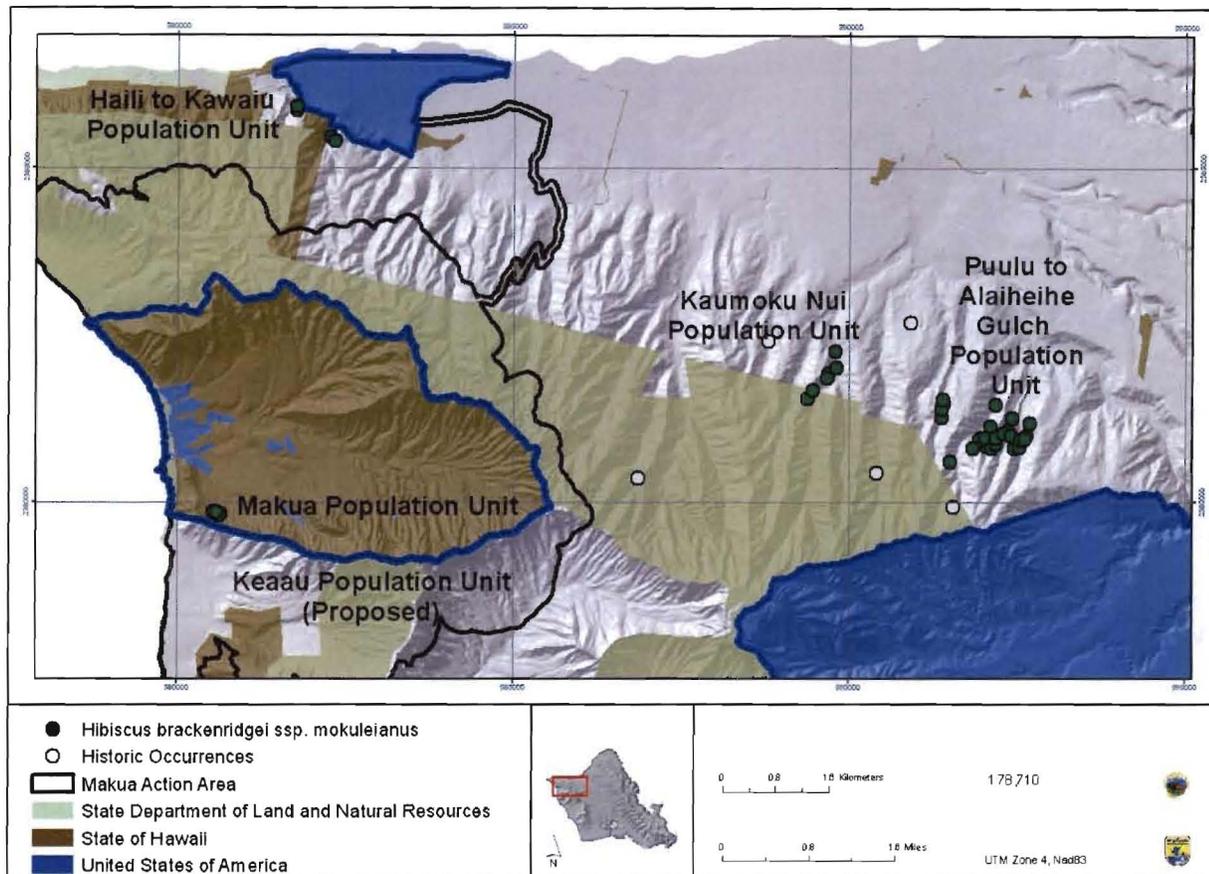


Figure 16. Current and historic distribution of *Hibiscus brackenridgei* ssp. *mokuleianus* in the Waianae Mountains.

The two historically large Waialua area population units dramatically declined in the past two years. The number of seedlings found at the Kaumoku Nui population unit increased to 750 in 2004, but no seedlings or immature plants were found in this area in 2006. Prior to the 2007 Waialua fire, there were a total of 59 mature plants and 648 immature and seedling individuals in the Kaumoku Nui and Puulu to Alaiheihe population units. All but one of the 28 adult *Hibiscus brackenridgei* ssp. *mokuleianus* (four percent), and eight out of the 611 immature plants (one percent) growing in the fire area were killed by this fire (see Table 3) (U.S. Army Garrison 2008). As of February, 2008, seventy percent of known adult *Hibiscus brackenridgei* ssp. *mokuleianus* were a result of out-planting efforts by the Army. In 2007, Army Natural Resources Staff out-planted 26 mature and two immature *H. brackenridgei* ssp. *mokuleianus* to the Haili to Kawaiu population unit. In February 2008, 23 adult *H. brackenridgei* ssp. *mokuleianus* were out-planted in the Makua population unit, which at that time, contained 11 mature plants, two immature shrubs, and 68 seedlings (Ching 2008a). Seedlings in the Waialua Fire area have not been censused but informal observations suggest they are abundant (Ching 2008b).

Table 3. Range-wide Distribution of *Hibiscus brackenridgei* ssp. *mokuleianus*

Population Units (phenotype)	Number of Known <i>Hibiscus brackenridgei</i> ssp. <i>mokuleianus</i> Individuals						
	'94 (1)	1999 (2)	2003 (3)	2004 (4)	2005 (5)	2006 (6)	2007-February 2008 (7, 8, 9)
Makua* (short)	--	--	4/3 [‡]	18/8	18/19	16/4	2007:10/22 2008 ⁽¹⁰⁾ : 34/70
Keaau* (short)	--	--	--	--	--	--	--
Haili to Kawaiu* (medium)	--	--	3/1	1/22	3/10	5/6	34/15
Puulu to Alaiheihe* (tall)	--	--	3/5	7/230	7/238	7/238	Pre-fire: 14/611 After Fire: 1/8
Kaumoku Nui (tall)	--	--	0/2	2/750	2/750	14/0	Pre-fire: 14/0 After Fire: 0/0
Kihakapu (tall)	--	--	1/2	6/316	6/373	6/373	1/0
Total Individuals	6-8	153-203	62 (49/13) [†]	1398 (72/1326)	1472 (82/1390)	669 (48/621)	Pre-fire: 707 (59/648) After Fire: 91 (46/45) As of Feb 2008: 163 (70/93)

Shaded population units are inside the action area; *Stabilization population units; †Total mature/immature individuals

(1) Listing rule (59 FR 56333); (2) Recovery plan (Service 1999a); (3) Makua Implementation Plan (Makua Implementation Team 2003), 2004 status report (U.S. Army Garrison 2004a); (4) MIP Addendum and 2004 status report (U.S. Army Garrison 2005a, 2004); (5) 2005 status update (U.S. Army Garrison 2005b); (6) 2006 status update (U.S. Army Garrison 2006c); (7) Waialua Fire Report (U.S. Army Garrison 2007); (8) 2007 status update (U.S. Army Garrison 2007b); (9) Reinitiation Request Letter (U.S. Army Garrison 2008); (10) Ching (2008b).

Inter situ sites have been out-planted on Oahu at Kaiser High School, Kaala Learning Center, and Waimea Botanical Garden; ex situ sites have been out-planted at Koko Crater Botanical Garden and Leeward Community College; and experimental reintroductions have been out-planted at Kaluakauila Management Unit on Makua. All population units within and outside the Makua action area, including experimental reintroductions and those in the Makua population unit, have low plant numbers and are located in areas of high fire risk. Population units outside the Makua action area are heavily impacted by ungulates, fire, and competition from invasive weeds.

Ecology *Hibiscus brackenridgei* ssp. *mokuleianus* on Oahu occurs on slopes, cliffs, and arid ledges in lowland dry forest and shrubland at elevations of 24 to 490 m (79 to 1,607 ft) (68 FR 35950). The Waialua type occurs in dry gulches, gulch bottoms, and lower to middle gulch slopes in mixed and native dry forest, and the Kealia type occurs on open ledges and bluffs in mixed native and alien grasses, shrubs, and trees (Makua Implementation Team 2003). The

Makua type occurs in sites similar to the West Molokai site, on rocky slopes in areas that are drier and more open than any of the other Oahu sites, and in vegetation consisting of mixed native and alien shrubs and grasses. Wild *H. brackenridgei* ssp. *mokuleianus* plants of all types lose their leaves at the beginning of the summer dry season, usually by June, and remain dormant until new growth appears with the wet season, usually by October. The three Oahu types vary in growth rates and age at which cultivated plants begin to flower. Most of the cultivated Makua stock flowers at younger than 6 months; cultivated stock of the other types begin to flower at ages ranging from 6 months to 4 years. Flowering occurs from December through June. Flowers open in the afternoon and early evening and remain open until early the next morning, and are pollinated by sphinx or hawk moths. Mature seed capsules are present from February through June, and seeds of cultivated plants may remain viable in garden soil for up to 15 years. In the wild, seedlings are often found at locations where no mature plants have been seen for many years. The longevity of *H. brackenridgei* ssp. *mokuleianus* plants in the wild is undocumented, but it is considered a short-lived species because wild populations appear to undergo large fluctuations in numbers (Makua Implementation Team 2003). Other demographic information for *H. brackenridgei* ssp. *mokuleianus* in the wild is unknown, including longevity, number of seeds produced, survivorship to sexual maturity, pollination and seed dispersal, vegetative reproduction, and specific environmental requirements.

Threats to the Species *Hibiscus brackenridgei* was listed as endangered because of major, ecosystem-level threats to its survival and recovery. Populations are exposed to fire, browsing by cattle and goats, rooting by pigs, leaf damage by the Chinese rose beetle and other insects, competition with invasive non-native plants. In addition, *H. brackenridgei* plants are short-lived, and seedling survival varies dramatically with seasonal rainfall abundance (Makua Implementation Team 2003; U.S. Army Garrison 2005b). In addition, *H. brackenridgei* ssp. *mokuleianus* in areas near human habitation is threatened by hybridization and genetic contamination from the related, cultivated taxon *H. brackenridgei* ssp. *brackenridgei*, which is sold in commercial nurseries and does not occur naturally on Oahu or Molokai (Makua Implementation Team 2003). This taxon experiences large population fluctuations related to rainfall and its natural recruitment is severely reduced by feral ungulates and invasive weeds. Occurrences also are vulnerable to extirpation from naturally occurring events such as windstorms and/or reduced reproductive vigor due to small population size and limited distribution (59 FR 56333; 68 FR 35950; Service 1999a). The science of conservation biology has documented a general pattern of population collapse for a wide range of plant and animal species (Dennis *et al* 1991; Schemske *et al* 1994; Morris *et al* 1999; Menges 2000). According to this pattern, *H. brackenridgei* in the wild already is in a phase of “quasi-extinction” with numbers that have declined to the point where demographic stochasticity alone can result in extirpation. Thus, *H. brackenridgei* has a very high background risk of species extinction and any additional threats could eliminate expectation of its long-term persistence.

Conservation Needs of the Species Although recovery objectives may be refined as population viability analyses are conducted, the recovery plan for this species identifies interim objectives, downlisting objectives, and delisting objectives. Interim recovery objectives call for the stabilization of all existing populations of *H. brackenridgei*. To be considered stable, threats must be controlled, genetic storage must be maintained, and each of the populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population. The Army’s plant demography data will enable population

viability analyses to be conducted and the results may require a modification to the current stabilization targets. Species subject to common, large fluctuations in numbers may require a stabilization target of at least 100 mature individuals for each population unit, but because *H. brackenridgei* ssp. *mokuleianus* seeds are persistent in the soil seed bank, increasing the numerical criterion for stabilization is likely to be necessary to ensure the persistence of this species' population units.

Hibiscus brackenridgei downlisting criteria call for the establishment of five to seven populations containing a minimum of 300 mature, reproducing individuals, protected from threats. Delisting objectives currently call for the management of eight to ten populations of *H. brackenridgei* containing a minimum of 300 mature, reproducing individuals (Service 1999a). To achieve downlisting and delisting, locations of historical occurrences should be surveyed for new regeneration from seed (Makua Implementation Team 2003) and ungulate exclusion, fuelbreak establishment, weed control, and population augmentation should be completed at selected multi-island sites.

Ongoing Conservation Actions The Makua Implementation Team (2003) has developed stabilization protocols for *Hibiscus brackenridgei* ssp. *mokuleianus*, which are incorporated in the Makua Implementation Plan Addendum (U.S. Army Garrison 2005a). One population unit for each of the three morphological types is being managed for stabilization (U.S. Army Garrison 2005b). An additional population unit, Keaau, will be established for the short, Makua phenotype to further ensure persistence of this unique type. The management units are Haili to Kealia (subunits I and II), which is not fenced, and Lower Ohikilolo, which is fenced. Stock from three of the five wild population units has been established in inter situ and ex situ sites around Oahu. *Hibiscus brackenridgei* ssp. *mokuleianus* grows easily from cuttings, produces many flowers and seeds in a season, and there is good recruitment at the inter situ sites. Much of the seed collected, however, is not viable (U.S. Army Garrison 2005b).

In 2005, additional current State-wide ex situ collections for the species *Hibiscus brackenridgei* included 10 vegetative buds in micropropagation (Harold L. Lyon Arboretum), 23 cuttings in nurseries (Army Environmental Division, Oahu, and Harold L. Lyon Arboretum), 83 plants in nurseries (Harold L. Lyon Arboretum and Volcano Rare Plant Facility), 229 plants in botanical gardens (Amy Greenwell Ethnobotanical Garden, Maui Nui Botanical Garden, and Waimea Valley Audubon Center), two un-germinated seeds in a nursery (Harold L. Lyon Arboretum), 17,895 seeds in seed storage (Lyon Arboretum Seed Storage Facility and Maui Nui Botanical Garden), and three seedlings in a nursery (Harold L. Lyon Arboretum) (Service 2005b).

Critical Habitat Description A total of 1,814 ha (4,482 ac) of critical habitat, in seven separate units, was designated for *Hibiscus brackenridgei* on four islands. However, only Oahu critical habitat units provide habitat for the taxon *H. brackenridgei*. On Oahu, 661 ha (1,634 ac) of critical habitat was designated in three units on State (including Mokuleia Forest Reserve) and private lands. The three Oahu units provide habitat for three populations. To meet recovery goals, a population should be represented by at least 300 mature, reproducing individuals of *H. brackenridgei* (68 FR 35950).

The primary constituent elements for two of the critical habitat units on Oahu include slopes, cliffs, or arid ledges in lowland dry forest or shrubland at elevations of 32 to 490 m (105 to 1,607 ft). In addition, these units contain one or more of the following associated native plant species: *Bidens amplexans*, *Chamaesyce* sp., *Diospyros hillebrandii*, *Dodonaea viscosa*, *Doryopteris* sp., *Erythrina sandwicensis*, *Heteropogon contortus*, *Lepidium bidentatum*, *Melanthera remyi*, *Pleomele halapepe*, *Psydrax odorata*, *Reynoldsia sandwicensis*, *Sida fallax*, or *Waltheria indica*. The primary constituent elements for the other unit on Oahu, for the Makua type, include dry shrublands at elevations of 32 to 490 m (105 to 1,607 ft) and containing one or more of the following associated native plant species: *Doryopteris* sp., *Dodonaea viscosa*, *Heteropogon contortus*, *Sida fallax*, or *Waltheria indica*. The plant community, associated species, and elevations are indicative of important features such as soil moisture, nutrient cycling and availability, temperature ranges, and light levels which are primary constituent elements of the habitat required for the species' conservation (68 FR 35950).

Threats to the Critical Habitat *Hibiscus brackenridgei* critical habitat units are exposed to impacts from fire, grazing, pigs, non-native insects and pathogens, human disturbance, non-native invasive plants, natural disturbances, and human activity (Makua Implementation Team 2003; U.S. Army Garrison 2005b). In 2007 the Waialua Fire burned 360 ha (888 ac) (64 percent) of *H. brackenridgei* critical habitat unit C, accounting for an impact to 20 percent of the total area on all islands designated as critical habitat for this species.

Environmental Baseline of the Species and Critical Habitat - *Hibiscus brackenridgei*

Status of the Species in the Action Area As a result of the Waialua Fire and recent Army out-planting efforts, the Makua population unit in the training portion of the action area contains 48 percent of the total remaining mature, in situ individuals of *Hibiscus brackenridgei* ssp. *mokuleianus*. The 104 individuals account for 63 percent of all known individuals of this subspecies. These 104 Makua plants account for between 28 and 32 percent of all in situ individuals of the *Hibiscus brackenridgei* multi-island species as a whole (excluding inter situ, ex situ, and experimental out-plantings). The Makua population unit has been monitored since 2003, and has increased from 7 to 104 total individuals. With 34 mature individuals, the Makua population unit is not meeting minimum numerical criteria for stabilization (defined as 50 mature, reproducing individuals). Although the area occupied by this population unit historically burned in fires ignited by the military and the public, recent germination suggests the seed bank is still viable if the alien guinea grass is removed and controlled (U.S. Army Garrison 2005b).

The Makua population unit is located within the Lower Ohikilolo Management Unit at the seaward end of Ohikilolo ridge, in sparse, lowland dry cliff vegetation adjacent to non-native grassland. The Makua population unit's 104 total individuals are located in a high risk fire zone from military training. Since 2002, the Army has experimentally reintroduced 46 individuals into the Kaluakauila population unit; these plants are not counted as naturally occurring (in situ) individuals. The 2003 prescribed burn damaged three of these plants and killed one (U.S. Army Garrison 2004a). The Army will not continue to maintain the Kaluakauila ex situ population because of the high risk of fire at that location (U.S. Army Garrison 2005b). Additional ex situ individuals include 34 mature individuals out-planted in

the vicinity of the Makua Range Control office. Thus, *H. brackenridgei* ssp. *mokuleianus* in the action area is currently characterized by one population unit that does not currently meet numeric, threat control, or genetic storage minimum criterion for stabilization located within the high fire risk zone. Keaau, a second population unit which currently contains no plants is located in an area designated as low risk of training-related wildland fire (Figure 17).

Status of the Critical Habitat in the Action Area In total, the two portions of the action area contains two percent of all range-wide critical habitat designated for *Hibiscus brackenridgei*. Originally land was proposed as critical habitat for *H. brackenridgei* on the Makua Military Reservation; however, pursuant to 3(5)(A) and 4(b)(2) of the Act, proposed critical habitat was not designated on Army lands (68 FR 36001). Unit C is a 0.04-ha (0.1-ac) residual portion of that larger piece of proposed critical habitat and it is located along the southern edge of the installation on State and private lands. It is considered to have minimal existing conservation value for the species at this time because of heavy impacts from grazing and non-native grass. The Puulu to Alaihehe fuelbreak portion of the action area contains six percent (35 ha (86 ac)) of *H. brackenridgei* critical habitat unit B. With the exception of a small sliver along its eastern edge, the entire fuelbreak action area is designated critical habitat for *H. brackenridgei*. Like the *H. brackenridgei* critical habitat found in the training portion of the action area, due to grazing and recent fires, the site is dominated by invasive, exotic grasses (Hawaii Gap Analysis Program, 2005 and Keir 2008).

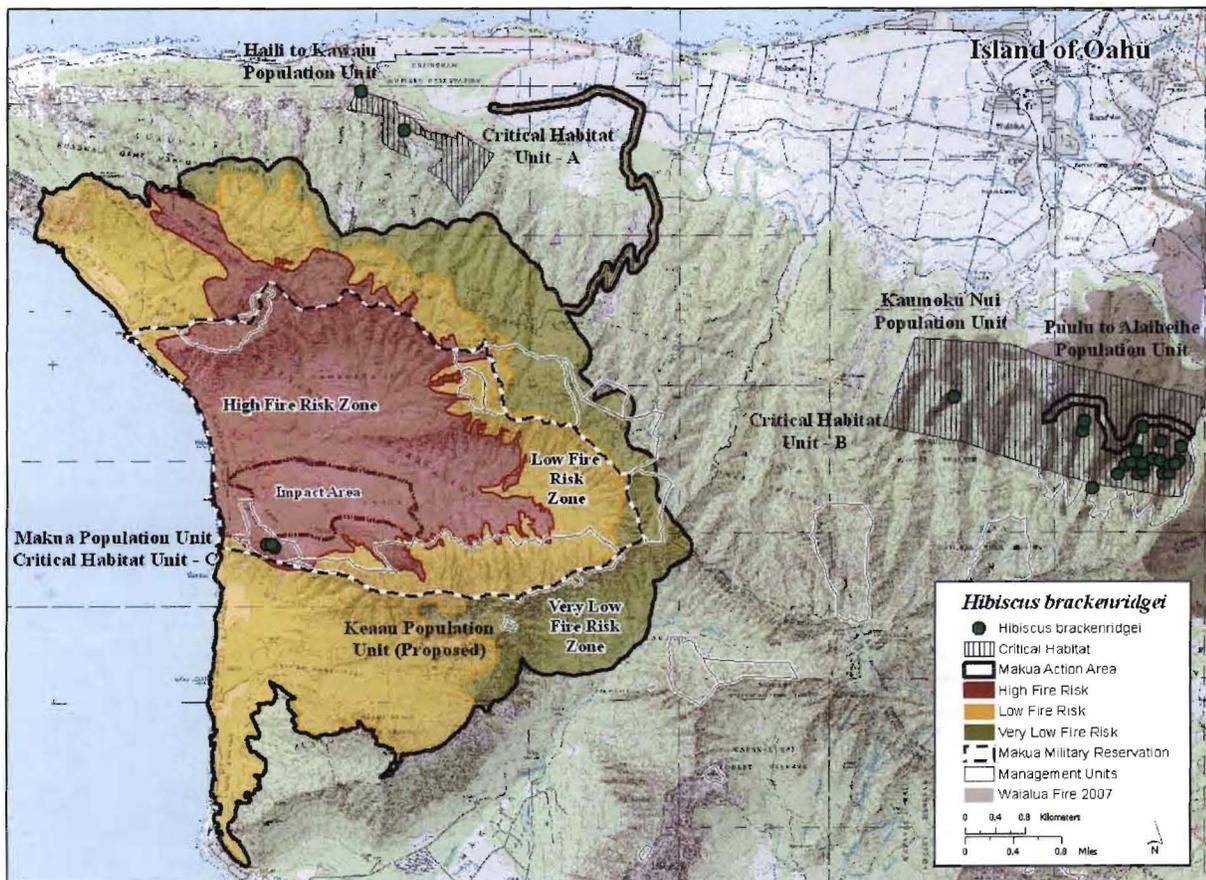


Figure 17. *Hibiscus brackenridgei* population units and critical habitat in the vicinity of the Makua Action Area.

Threats to the Species and Critical Habitat in the Action Area *Hibiscus brackenridgei* populations and critical habitat units within the action area are threatened by wildland fire, rodents, Chinese rose beetle, non-native invasive plants, natural disasters, and human activity. Within the training portion of the action area, *H. brackenridgei* ssp. *mokuleianus* are particularly vulnerable to wildland fires associated with both military training activities and local activities of the public, as well as competition from non-native grasses. Guinea grass requires significant control effort and is a major fire risk (U.S. Army Garrison 2005b). The *H. brackenridgei* ssp. *mokuleianus* in the action area have a very high background risk of extinction and any additional uncontrolled threats could eliminate the expectation of the population's long-term persistence. All but eight percent of the fuelbreak portion of the action area burned in the Waialua Fire. The three-ha (7-ac) area mapped as unburned appears to be in the vicinity of an area that was heavily impacted by grazing (Cherry 2008).

Conservation Needs of the Species and Critical Habitat in the Action Area Stabilization goals to improve the status of *H. brackenridgei* ssp. *mokuleianus* include management to attain four population units, each with a minimum of 50 mature, reproducing individuals. Two population units have been identified for stabilization within the training portion of the action area; Makua and Keaau. Because of its low numbers, this species is considered particularly at risk from project-related impacts and is included in Army plans for expedited stabilization.

The Army also proposes to reintroduce individuals from the Makua population unit into the Keaau population unit because *Hibiscus brackenridgei* ssp. *mokuleianus* occurs in a high fire risk zone within the training portion of the action area. The Keaau site has a lower risk of burning because it is farther from Farrington Highway and from the training area, and because the slopes below the management unit are intermittently grazed. In the future, it may be possible to establish a grazed fuelbreak to protect the site (Lau 2008b). Keaau will be fenced and weeded as a fourth population unit to manage for *H. brackenridgei* ssp. *mokuleianus* stabilization. In addition, a post-fire revegetation plan and site-specific fuel modification are needed where this species occurs in the action area, and herbicide treatment and mowing along the firebreak roads should be maintained consistently (U.S. Army Garrison 2005b). The non-native insect *Niesthrea louisianica* (Rhopalidae) was recently observed on *H. brackenridgei* ssp. *mokuleianus* out-planted at Makua Range Control. This insect was introduced for study as a biocontrol agent for the non-native weed *Abutilon theophrasti* and reduces its seed viability by 98 percent. Research is needed to determine if this insect is a source of seed predation on *H. brackenridgei* ssp. *mokuleianus*, and if so, to develop control techniques (U.S. Army Garrison 2005b). Past fires at Makua, including the August 2005 white phosphorus fire, have jumped the firebreak road in the vicinity of the Makua population unit. Therefore removal of shrubs, trees, and heavy grass fuels along the inside edge of the firebreak road is identified as a high priority. In addition, fire-fighting and helicopter support are vital to protect this population unit from burning in fires ignited by the public and the Army (U.S. Army Garrison 2005b). Other general conservation needs of the species in the action area are the same as those described in the introduction to the "Status and Environmental Baseline of the Species and Critical Habitat" section of the Makua Biological Opinion.

Ongoing Conservation Actions for the Species and Critical Habitat in the Action Area The Makua population unit is being managed for stabilization as specified in the Makua

Implementation Plan Addendum (U.S. Army Garrison 2005b). The Makua population unit in the Lower Ohikilolo Management Unit is protected by a fence, goats have been virtually eradicated from Makua, and weeds are controlled around plant sites. A 30-m (98-ft) chemically controlled fuelbreak is maintained inside the firebreak road, a 10-m (33-ft) fuelbreak is maintained outside the firebreak road, and a 30-m (98-ft) wide, 1.4-ha (3.5-ac) fuelbreak is maintained directly around the *Hibiscus brackenridgei* ssp. *mokuleianus* population unit (U.S. Army Garrison 2005b). As of 2007, genetic storage goals for this population unit were approximately 70 percent complete, with 20 plants meeting the goals of the Makua Implementation Plan (U.S. Army Garrison 2005b).

The Keaau population unit is slated to be established, prior to implementation of weapons restrictions listed in Table PD 2, Column D of the Biological Opinion, by propagating and out-planting plant material from plants in the Makua population unit. The Army is developing a fuelbreak to protect the Keaau area from fires ignited by training and the public.

Status of the Critical Habitat – *Nototrichium humile*

The Makua Biological Opinion's description of *Nototrichium humile* critical habitat and that document's characterization of threats to this critical habitat remain valid. In summary, a total of 900 ha (2,224 ac) of critical habitat, in five separate units, was designated for *N. humile* on Oahu and Maui. On Oahu, 502 ha (1,241 ac) of critical habitat was designated in four units on State and private lands to provide habitat to support six populations of *N. humile*. On Maui, one unit on State and private lands was designated to provide habitat for one population. To meet recovery goals, each population would contain a minimum of 300 mature, reproducing individuals of *N. humile* (68 FR 35950).

The primary constituent elements of critical units on Oahu include cliff faces, gulches, stream banks, or steep slopes in dry or mesic forests often dominated by *Diospyros sandwicensis* or *Sapindus oahuensis*, at elevations between 185 and 806 m (607 and 2,644 ft). In addition, all Oahu units contain one or more of the following associated native plant species: *Abutilon sandwicense*, *Alyxia oliviformis*, *Antidesma pulvinatum*, *Artemisia australis*, *Bidens cervicata*, *Canavalia* sp., *Carex wahuensis*, *Charpentiera* sp., *Dodonaea viscosa*, *Elaeocarpus bifidus*, *Erythrina sandwicensis*, *Eugenia reinwardtiana*, *Hibiscus* sp., *Melanthera tenuis*, *Metrosideros polymorpha*, *Myoporum sandwicense*, *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Peperomia* sp., *Pisonia umbellifera*, *Pleomele* sp., *Pouteria sandwicensis*, *Psydrax odorata*, *Rauwolfia sandwicensis*, *Reynoldsia sandwicensis*, *Sicyos* sp., *Stenogyne* sp., *Streblus pendulinus*, or *Syzygium sandwicensis*. The plant community, associated species, and elevations are indicative of important features such as soil moisture, nutrient cycling and availability, temperature ranges, and light levels, which are primary constituent elements of the habitat required for the species' conservation (68 FR 35950).

Environmental Baseline of the Critical Habitat

Status of the Critical Habitat in the Action Area The action area contains slightly more than one percent of the total critical habitat for *Nototrichium humile* on Oahu, including 6 ha (16 ac) within the training portion of the action area and 7 ha (17 ac) within the proposed Puulu to Alaiheihe fuelbreak. Originally land was proposed as critical habitat for *H. brackenridgei* on

the Makua Military Reservation; however, pursuant to 3(5)(A) and 4(b)(2) of the Act, proposed critical habitat was not designated on Army lands (68 FR 36001). Unit A is a 5-ha (13-ac) residual portion of that larger piece of proposed critical habitat and it is located along the northern edge of the installation on State land, almost entirely within Kaluakauila Management Unit at Makua where it is exposed to high risk of training-related fire. Less than one percent (1 ha (3 ac)) of the 229-ha (567 ac) critical habitat unit B, designated to provide habitat for two *N. humile* populations is located within the very low fire risk zone on the east edge of the training action area. Three percent (7 ha (17 ac)) of the 237-ha (586-ac) *N. humile* critical habitat unit C, designated to provide habitat for two *N. humile* populations, is located within the proposed Puulu to Alaiheihe fuelbreak (Figure 18). Vegetation within the fuelbreak portion of the action area is dominated by invasive, exotic guinea grass, as described in the general effects section of this Amendment.

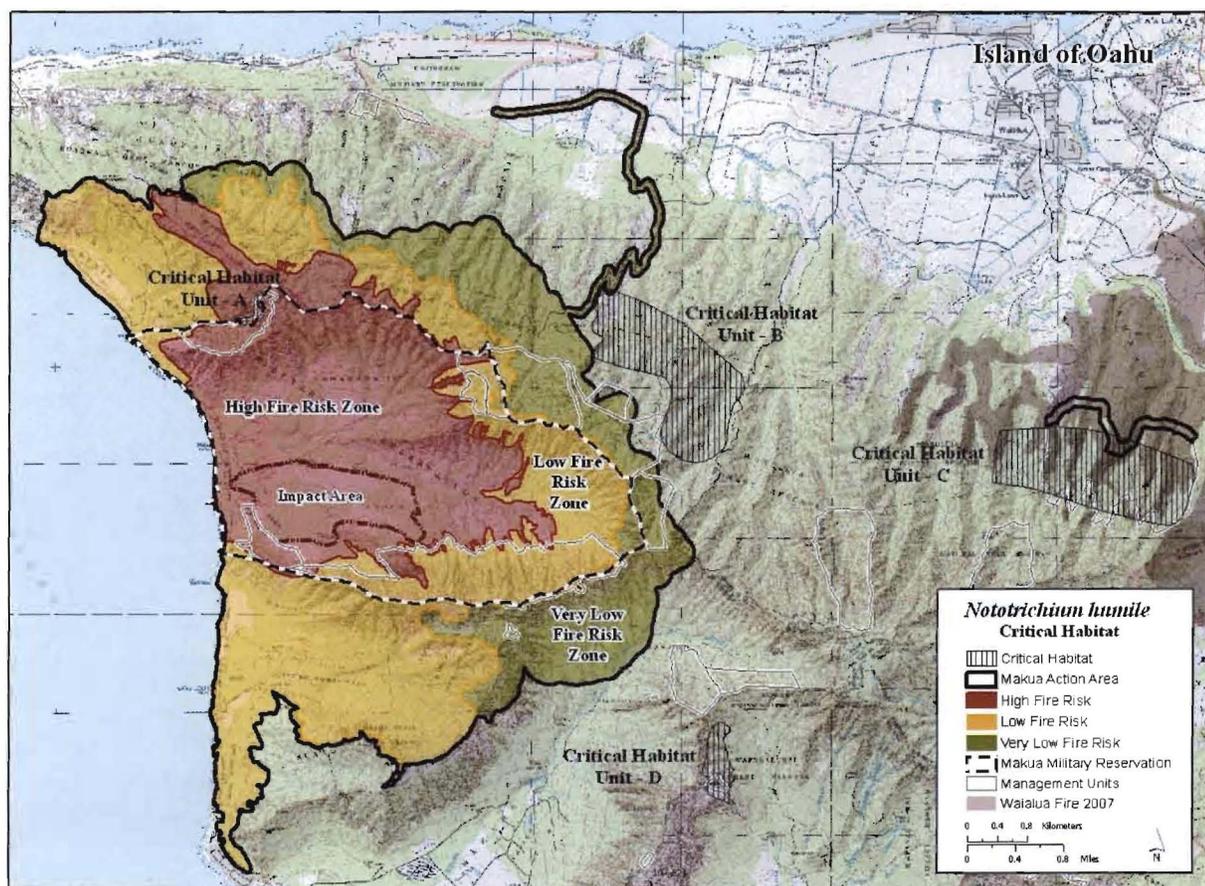


Figure 18. *Nototrichium humile* critical habitat in the vicinity of the Makua Action Area.

Threats to the Critical Habitat in the Action Area Threats to *Nototrichium humile* critical habitat in the training portion of the action area include fires ignited by the public and military training and invasion of alien vegetation are described in the Makua Biological Opinion. Based on historic fire perimeter maps, Unit A was within the perimeter of 1970 and 1984 fires ignited by the military at Makua (Costales 2006). Approximately 30 percent of critical habitat unit A was impacted by the 2003 escaped prescribed burn at Makua (Enriques 2003). Threats to *N. humile* critical habitat in the Puulu to Alaiheihe fuelbreak portion of the action area are identical to those in the training portion of the action area (detailed in the Makua Biological